Background values in European soils and sewage sludges

Results of a JRC-coordinated study on background values

Edited by
B. M. GAWLIK and G. BIDOGLIO



PART II

Contents of trace elements and organic matter in European soils

J. Utermann, O. Düwel, I. Nagel

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

2006

EUR 22265 EN

Background values in European soils and sewage sludges

Results of a JRC-coordinated study on background values

Edited by
B. M. GAWLIK and G. BIDOGLIO

PART II

Contents of trace elements and organic matter in European soils

J. Utermann, O. Düwel, I. Nagel

Institute for Environment and Sustainability

2006

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

EUR 22265 EN

The mission of the Institute for Environment and Sustainability is to provide scientific and technical support to the European Union's policies for protecting the environment and the EU Strategy for Sustainable Development.

European Commission
Directorate-General Joint Research Centre
Institute for Environment and Sustainability

Contact information
Address: Via Enrico Fermi, 21020 Ispra (Va), Italy
E-mail: bernd.gawlik@jrc.it
Tel.: +39 0332 78 9487
Fax: +39 0332 78 9158

http://ies.jrc.cec.eu.int
http://www.jrc.ec.europa.eu/

EUR 22265 EN
Luxembourg: Office for Official Publications of the European Communities

ISBN 92-79-02121-6
ISSN 1018-5593

Acknowledgement

The report is based on data material provided by the following persons, whose support to the study is gratefully acknowledge by the European Commission DG JRC:

Austria
A. Freudenschuß, Federal Environment Agency, Vienna

Belgium
E. van Ranst, Ghent University, Department of Geology and Soil Science, Ghent
J. Defoux, Direction générale des ressources naturelles et de l'environnement, Jambes

Czech Republic
M. Sáňka, P. Němec, Central Institute for Supervising and Testing in Agriculture (CISTA), Brno

Denmark
H. Breuning Madsen, University of Copenhagen, Institute of Geography, Copenhagen

Estonia
V. Petersell, Geological Survey of Estonia, Tallinn

Finland
T. Tarvainen, Geological Survey of Finland (GTK), Espoo

France
D. King, Institut National de la Recheche Agronomique (INRA), Olivet Cedex

Germany
I. Nagel, O. Düwel, J. Utermann, Federal Institute for Geosciences and Natural Resources (BGR), Hannover

Ireland
D. McGrath, Irish Agriculture and Food Development Authority (TEAGASC), Johnstown

Italy
P. Giandon, Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto (ARPAV), Castelfranco Veneto
D. Magaldi, Dipartimento di Scienze dell'Ambiente e del Territorio (DISAT), Milano

Lithuania
V. Gregorauskiene, Geological Survey of Lithuania, Vilnius

The Netherlands
D. J. Brus, Alterra, Green World Research, Wageningen

Norway
A. Arnoldussen, Norwegian Institute of Land Inventory (NIJOS), Aas

Portugal
R. Mano, Laboratory for Agricultural Chemistry Rebelo da Silva (LQARS) Lisboa

Romania
A. Manea, Research Institute for Soil Science & Agrochemistry (RISSA), Bucharest

Slovakia
J. Čurlík, Soil Science and Conservation Research Institute, Bratislava

Sweden
J. Eriksson, Swedish University of Agricultural Sciences, Uppsala

United Kingdom
R.J.A. Jones, European Commission, DG JRC IES, Ispra
P.J. Loveland, National Soil Resources Institute, Cranfield University, Silsoe
Macaulay Land Use Research Centre (MLURI), Aberdeen

Affiliation of the authors

Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)
[Federal Institute for Geosciences and Natural Resources]
Geozentrum Hannover
Stilleweg 2
D-30655 Hannover

Table of Contents

List of abbreviations

Throughout this report the following abbreviations and symbols are used.

AMA	Advanced Mercury Analyser
AR	*aqua regia* contents
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe
CEN	European Committee for Standardization
CLC	CORINE land cover
CORINE	Co-ordination of Information on the Environment
DC	direct charge
DG ENV	Directorate-General Environment
dm	dry mass (dry matter)
EN	European norm
ESB	European Soil Bureau
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
ICP-Forest	International Co-operative Programme on Assessment and Monitoring on Air Pollution Effects on Forests
IES	Institute for Environment and Sustainability
ISO	International Standardization Organization
JRC	Joint Research Centre
LOI	loss on ignition
LU	legend unit
n	number of samples
OM	organic matter
R	correlation coefficient
RT	real total contents
STU	soil typological unit
US	United States of America

1 Common introduction to the reports Part I, II and II

The European Commission has realized that since the "*Sewage Sludge Directive*" 1986 (EEC) was set into force, a rapid development in the field of the agricultural use of sewage sludge has taken place. On the one hand, the Directive confirmed that those European countries, which had set up legal regulations earlier, were on the right way and, on the other hand, it gave the frame for recycling secondary raw materials with a remarkable content of nutrients and soil improving properties for all EU countries.

Although the Directive set up only guide/limit values for heavy metals, the question whether there might be also harmful effects caused by organic micropollutants has been discussed from this time until now, being initiated and promoted by the COST 681 Action of the European Commission (Quaghebeur, D. et al (Eds.) 1989, Hall, J.E. *et al.* (Eds.), 1992) and follow-up activities. The results are revisions of existing national regulations in some countries thus setting up more stringent limit values for heavy metals and introducing new limitations for some organic micropollutants. However, there was no uniform way in handling these problems. Subsequently, in autumn 1999 the European Commission started discussions with governmental representatives of the EU countries as well as with experts/delegates from European economic, technical and scientific organizations. This led to the so-called "*3rd Draft-Working Document on Sludge*" of April 2000, in which general aspects of a long-time improvement of the agricultural use of sludges were laid down.

The document covering proposals for future action contains several Annexes, of which Annex IV includes a table referring to limit values for concentrations of organic compounds and dioxins in sludge for use on land. Since the publication of the 3rd Draft these data have been subject of intensive discussions in the EU and at national conferences (e.g. DG Environment and UKWIR, 2001 and KTBL, Darmstadt, 2002).

The following series of reports give some basic information about selected organic micropollutants in sludges as well as about the establishment of background values for some trace elements in soils, susceptible to receive sewage sludge.

2 Extended Summary of Part II

In the context of the JRC's support to various soil-related activities of DG ENV such as the revision of the Sewage Sludge Directive 86/279/EEC it was attempted to compile a Europe-wide evaluation of heavy metal and organic matter contents of European top soils. The evaluation programme was accomplished thereby in several steps.

This report outlines the current situation of available data in Europe (status October 2004), whereby the main focus is set on the latest data request campaign (the so-called Phase II, 2nd part). The participating countries were asked to evaluate available data according to previously established criteria. Evaluated data were provided together with the corresponding meta-information. The evaluation was carried out in relation to three different bases of reference:

(i) soil parent material (MAT 11 level) and land use,

(ii) (ii) soil pH,

(iii) (iii) soil texture.

A detailed description of the available data is given. Furthermore, a comparative evaluation of the provided data was carried out under consideration of harmonisation aspects. The available data of the participating countries vary, both in quality and quantity. A differentiated overview of trace element and organic matter contents in European soils is possible to a certain extent. The degree of spatial coverage in the mapped countries differs, depending on the considered element and statistical parameter. However, the study also show that even after repeated data requests it remained impossible to obtain a complete and exhaustive database for the whole of Europe. Major data gaps still exist. This has three main reasons:

(i) Relevant data are not collected yet,

(ii) data exist in fact, but could not be provided, or

(iii) data are not comparable due to methodological or analytical reasons.

The comparability of data is one of the key issues on the way to obtain a Europe-wide database on heavy metal and organic matter contents. In the course of the evaluation essential aspects of data harmonisation were attempted to take into consideration. Options and limits became obvious:

- Provided **heavy metal** data were harmonised to *aqua regia* basis by using conversion algorithms. Despite of relating restrictions and inaccuracies this procedure seems a passable way and is put up for discussion.
- For **soil pH** a reference method was proposed (ISO 10390). Not all of the available data are based on that procedure. The transformation of data determined by different measurement procedures was renounced, as no original data were available. For further investigations the appliance of one measurement procedure exclusively is proposed. Already existing data could be transformed by one of the available conversion algorithm, which should be determined in advance.
- **Soil organic carbon** data are comparable up to a certain extent. Organic matter contents were calculated from measured organic carbon contents by using the factor 1.72. It should be discussed, if thereby a sufficient accuracy at European scale can be obtained. Otherwise more suitable conversion factor(s) should be stipulated.
- Due to missing criteria to compare / convert different **sampling strategies** the influence of this aspect could not be taken into account yet.
- According to the given information many of the evaluated data do not or no longer contain samples from **contaminated sites**. With regard of this harmonisation aspect data comparability was improved. Nevertheless upon a common procedure to eliminate pertinent data should be agreed.
- The national evaluations are based on different sample sizes. The comparability and spatial **representation** of the obtained results has to be checked. The need of criteria to ensure a minimum level of spatial coverage of the legend unit persists.

In summary, it can be concluded that some small progress towards a Europe-wide data harmonisation was achieved, which allows some conclusions for the legislative purpose.

Problems to be solved include particularly standardisation aspects. Thus, the significance of the chosen bases of reference has to be valued differently. It seems little target-orientated to draw conclusions about usual contents of heavy metals by means of pH or texture solely, although this might be the easier way from a sheer regulatory point of view. Whereas the evaluation approach regarding parent material and land use points the right way. Questionable remains the reference level (MAT 11). For organic matter contents it seems more suitable to refer the values according to STUs and land use.

3 Background

Soils play an important role in the environment. They are a finite, increasingly scarce and non-renewable resource. Therefore, the protection and preservation of soils and their ecological functions (e.g. filter and buffer system against chemical degradation) should be of utmost importance. The development of an adequate soil protection strategy should be based on the best available information. In the 6th Community Environment Action Programme of the European Commission soil protection becomes a main issue. The strengthened political interest in soil is demonstrated in the formulation of the communication *Towards a Thematic Strategy for Soil Protection* by the Commission of the European Communities (2002).

In 1999, the DG ENV of the European Union and the German Federal Environment Agency commissioned a feasibility study on trace element and organic matter contents of European soils. Background of the request was amongst others the imminent revision of the Sewage Sludge Directive 86/279/EEC. Initiated by the Scientific Committee of the European Soil Bureau (ESB), the working group *Heavy metals in European Soils* was formed from the 15 EU-Countries. A questionnaire-based study was undertaken to elicit the available information and relevant data in the European countries (European Soil Bureau 1999a). The appraisal turned out to be complex and difficult. Hence, a specific working programme at different time scales was proposed. The purpose of the programme is to provide both, meta-information on available data and evaluation approaches for compiling background values of heavy metal and organic matter contents.

The proposed working programme is divided into two main evaluation steps:

Step 1: Short Term Action

- Evaluation and harmonisation (to a certain extent) of the currently available database;
- Ascertainment of needs for data and standardisation in Europe.

For this purpose national experts assess the data according to previously established criteria, followed by a final comparison of the results provided by the participating countries. This procedure accommodates the obvious complexity of available data as well as a tight time schedule.

Step 2: Long Term Action

- Reduction of data gaps;
- Improved understanding of the inevitable disparities within the data gaps;

- Standardisation of future data collection (in terms of sampling, analysis and data management).

This follow-up investigation programme should be part of a European Soil Monitoring Programme. The time frame is appraised for about three years.

Figure 1 gives a brief overview of the different evaluation steps and the corresponding documentation.

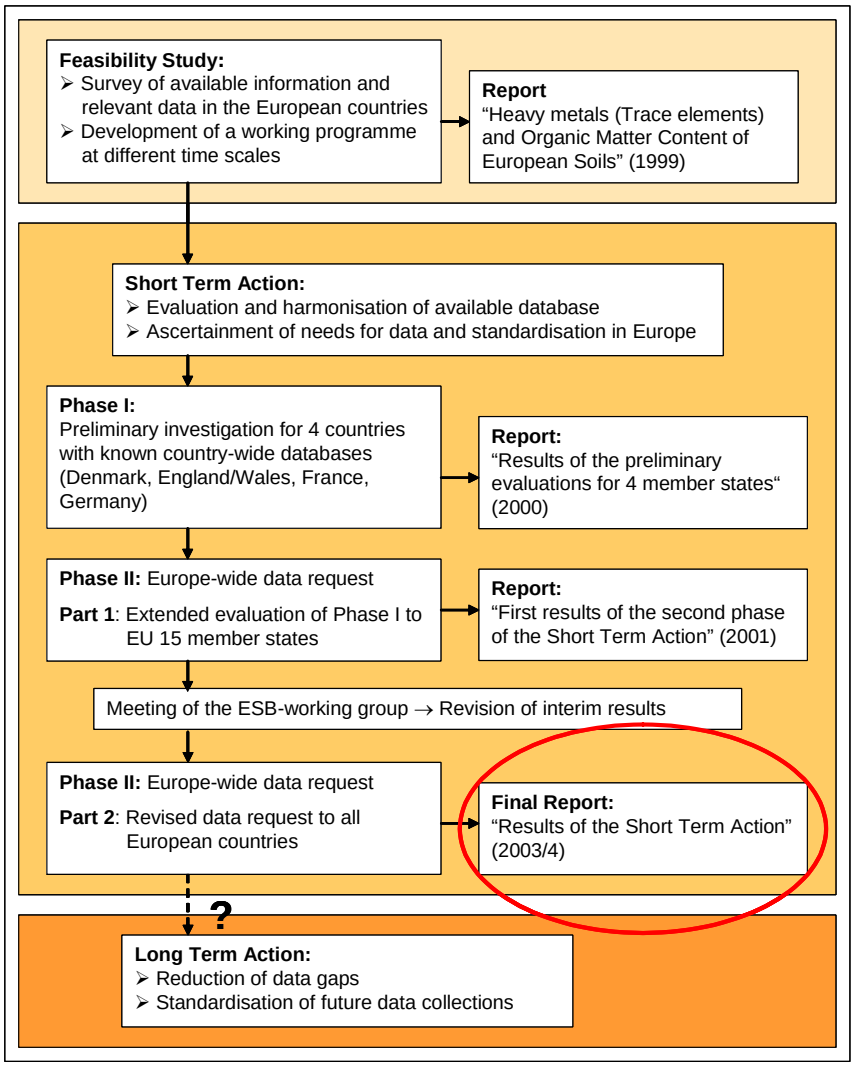


Figure 1 - Evaluation steps and the respective reports

With regard to the time schedule given and other constraints, the working group, in collaboration with the Joint Research Centre (JRC), split the "Short Term Action" into two phases (see Fig. 1). In the preliminary investigation only four countries with known country-wide databases were considered (Denmark, France, Germany, England and Wales). The report of the first phase was accomplished in May 2000 (European Soil Bureau, 2000). It could be shown that country-specific evaluations related to different bases of reference were possible to a certain extent.

Based on the experience of the preceding phase, the Europe-wide data request started in July 2000 for all 15 Member States (Phase II). Subsequently, the following aspects and problems were highlighted (Joint Research Centre 2001):

- The level of detail of information differed strongly;
- The given information related to different geographical references (administrative boundaries, soil units, parent material units, no geographical reference);
- Neither harmonisation aspects nor different sampling strategies or analytical procedures could be considered till then;
- The spatial coverage varied widely depending on the used reference value (median, 90. percentile).

As could be seen from the report, the quality and quantity of the provided information varied considerably. So far, a major step towards a Europe-wide harmonised database was still missing. In view of the further development of the survey it was proposed to make an effort on both, the enlargement and improvement of the database. For this, an extension of the existing ESB-working group on Member State representatives, who could provide country-wide databases, was recommended. Moreover, in the course of a workshop a discussion about a more suitable way to obtain adequate data was initiated.

In October 2001, an ESB-Working Group meeting was held in Ispra. In order to stay abreast of changes, the members agreed to a revised data request. Furthermore, the group of participating countries was broadened. Consequently, a more detailed questionnaire was developed. The modified version was distributed in March 2002 by the JRC.

A final report was compiled and delivered to JRC in July 2003. At the beginning of the year 2004 the documents were distributed among the ESB-Working group and the co-operating institutions in order to comment about the results. Additionally the results of the project were presented and discussed during the workshop *Background Values in Sludges and Soils* taken place in ISPRA on 15/16th April 2004. Proposed changes and ideas were gathered and included in the present report as far as possible.

The revised final report comprises a summary of the evaluation of the entire “Short Term Study”, whereas the main emphasis is put on the results of the revised questionnaire (Phase II, 2nd part). The report provides an overview on the current situation of available data (status October 2004) concerning heavy metal and organic matter contents in European soils. A detailed description of the gathered information is given. Evaluated data are presented in tables and maps.

4 Objectives and criteria of the survey

The main **objectives** of the Short Term Action were postulated as follows:

- to compile spatial information about trace element[1] and organic matter contents in European top soils;
- to identify areas / regions with data gaps and
- to elaborate recommendations for further actions in terms of additional sampling and analyses.

Concerning the revised questionnaire (2nd part, phase II) the working group agreed on the following **criteria and definitions**:

- The usual content is described as "the concentration of a substance in soils resulting from both the natural pedo-geochemical content and moderate diffuse source input into the soil" (ISO / CD 19258).
- Accordingly, data from sites for which contamination is well known (= contaminated sites) should be eliminated.
- The evaluation is restricted to the top soil, defined as the first mineral A-horizon below any existing litter layer (Ap in arable land, Ah in grassland or forest).
- Four land use types are regarded: arable land, grassland, forest, other land use (e.g. permanent crops), whereas the main focus lies on the first two land use types.
- The evaluation is focussed on the trace elements cadmium, copper, chromium, lead, mercury, nickel and zinc plus the organic matter content. Regarding the analytical procedures, a comparative evaluation between the countries is only possible, if the data can be transformed to a common analytical reference. Following reference methods were determined:
    - Heavy metal contents: *Aqua regia* (acc. to ISO 11466)
    - pH: 0.01 M $CaCl_2$ (acc. to ISO 10390)
    - Organic matter: elemental analyser or wet oxidation.

The chosen methods to determine heavy metal contents (ISO 11466) and soil pH (ISO 10390) are internationally widely accepted and are proposed as reference method in the currently revised Sewage Sludge Directive 86/279/EEC. If any other procedures are applied, a clear indication of the methods should be given. If possible, the data should be converted to the respective reference method stating the rules of conversion (heavy metals, pH).

The evaluation relates to three different **bases of reference**:

1. Heavy metal and organic matter contents in European soils according to soil parent material (MAT 11 level[2]) and land use.

---

[1] *Note that the terms "Heavy metal" and "Trace element" are used synonymous in this report.*

2. Heavy metal contents according to soil pH. Four pH-classes are determined: pH ≤ 5, pH > 5 - 6, pH > 6 - 7, pH > 7.
3. Heavy metal contents according to soil texture classes. The proposed texture classes refer to the European Soil Data Base (Coarse, Medium, Medium Fine, Fine, Very Fine, No texture – peat soils).

In the first stratification approach the known influence of soil parent material on the geogenetic baseline content (ISO / CD 19258) as well as the land use–related effects on element distribution in soils will be investigated. The second and third stratification approach has to be seen against the background of the upcoming revision of the Sewage Sludge Directive 86/279/EEC and the determination of more differentiated limit values. Further information on the stratification approaches is given in the respective chapters.

The following statistical parameters should be indicated: number of samples (n), minimum and maximum value, median, 25. / 75. / 90. percentile. The data sets accompany a 'documentation sheet', where the underlying survey(s) or sampling exercises should be specified.

---

[2] *The classification of the MAT 11 units bases on the 1 : 1 000 000 European Soil Data Base, Version 1.0 (European Soil Bureau 1999b).*

5 Available data at the end of the “Short Term Action”

One principal task of this report is to outline the general situation of available data in Europe. This chapter comprises a detailed description of the current status of the survey (see also Fig. 2). Firstly, the returned information relating to the revised data request (Phase II, 2nd part) is recorded, followed by a brief review of the database of the former inquiries and a short summary. Some countries answered to both data requests. The new questionnaire obtains priority, but additional information relating to the former data sets was given if relevant.

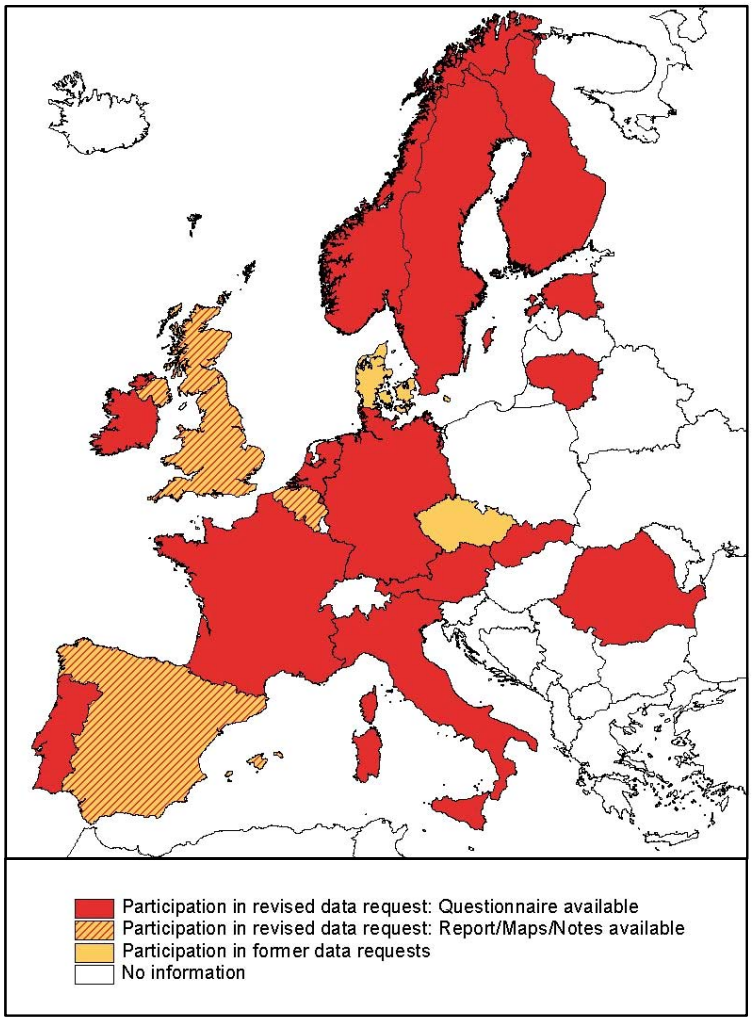


Figure 2 - Short Term Action – Current state

5.1 Phase II – Current data request (2nd part)

Until October 2004, BGR, being charged by the JRC with the data collection, received information from seventeen European countries, whereof fourteen replies were returned questionnaires and three other reports or (at least) notes. Besides the contribution of fifteen countries of the meanwhile enlarged European Union, other European countries like Romania and Norway have provided information as well. Table 1 gives a comparative overview of the available data. The table was conceived according to the requested information in the documentation sheet. The complete questionnaires are attached in annex II. The following country-wise description is mainly restricted to information concerning sampling strategy, analytical methods and existing statistical parameters[3].

5.1.1 Austria

The Federal Environment Agency of Austria provided data that derive from soil surveys carried out by the Federal Provinces of Austria and the Federal Forest Research Centre. The sites of the investigations were selected in grid systems of different densities (forest 8.7 · 8.7 km, arable land, grassland 4 · 4 km). Samples were taken on horizon basis. Given values refer to a soil depth of 0 - 10 cm on forest sites and grassland and to 0 - 20 cm on arable land. Weighted mean values were calculated when necessary. The extraction methods to determine total amounts of heavy metals in soils vary according to the investigation. Most frequently, the *aqua regia* extraction ($HCl:HNO_3$ 3:1, Austrian Standard L 1085) was used. Forest soil samples were mainly extracted with a mixture of HNO_3 and $HClO_4$ (Austrian Standard L 1085). The analytical methods to determine the organic carbon content differ likewise. Wet and dry combustion were accomplished (Austrian Standards L 1081, L 1080, L 1084). Organic carbon values were transposed to organic matter using the factor 1.72. The soil pH-values are based on 0.01 M $CaCl_2$ (Austrian Standard L 1083).

The evaluation was done for all three bases of reference and for each element. Results are given for arable land, grassland and forest. All statistical parameters are stated. If the number of samples is low, only the minimum and maximum value and the median are recorded. The data set does not include samples from contaminated sites.

5.1.2 Belgium (Walloon region)

In the course of the revised data request the 'Direction générale des ressources naturelles et de l'environnement' of the 'Ministère de la Région Wallonne' sent a report *Inventaire de la qualité des sols en Région wallonne* (2001). The data are restricted to the Walloon region. Soil associations according to the Belgian soil classification and agricultural regions were selected as geographical references. The given data do not allow the direct transfer of the results to the pre-set bases of reference. However, it can be concluded that a large database exists and that an equivalent evaluation could be done supposedly. The Flemish part provided data within the scope of the previous data request (see chapter 5.2.1.1).

---

[3] *The information were taken from the documentation sheets and covering notes. Accordingly, the level of detail of the country-wise descriptions depends on the accuracy of the transmitted information.*

5.1.3 Estonia

The Geological Survey of Estonia sent the questionnaire and two publications: *Bulletin of the Geochemical Monitoring of Soil 1992-1994* (Petersell *et al.* 1996) and G*eochemical Atlas of the Humus Horizon of Estonian Soils* (Petersell *et al.* 1997). The Estonian data were collected in a grid system with the density of 1 sample per 30 – 50 km². Samples were taken on horizon basis and as single core. The heavy metal contents were determined by different methods: HF / HNO_3 / $HClO_4$ (Cd, Cu, Zn), X-ray-fluorescence (Pb), gas analyser (Hg) and spectral analysis (Cr, Ni). Soil pH was measured in water. The organic matter content was obtained by calculating the difference in weight between the dry (105°C) and ashed (450°C) sample.

The evaluation was done for all three bases of reference and for each element. Results are given for arable land, grassland and forest. All statistical parameter are recorded. The dataset does not include samples from contaminated sites.

5.1.4 Finland

The Finnish data derive from the Baltic Soil Survey. The survey is based on a regular grid sampling strategy of 50 · 50 km. Samples were taken as depth increment (0 – 25 cm) and mixed core. The heavy metals were digested by *aqua regia*. Hg was not analysed. The organic matter content was determined by the Loss-On-Ignition method (LOI). pH-related data were not available.

The evaluation was done in relation to soil parent material (MAT 11 level) and land use as well as to texture classes. In the former case, data for arable land was analysed. In the latter, information for peat soils were given. The evaluation includes 55 sites. All statistical parameters are stated. If the number of samples is low the 90 percentile is not recorded. The data set do not include samples from contaminated sites.

5.1.5 France

The 'Institut National de la Recherche Agronomique' provided two different data sets, one on *aqua regia* and one on HF / $HClO_4$ data. All data refer to a random based sampling strategy. Samples were collected on horizon basis (topsoil only) and as mixed core. Except for Hg, heavy metals were determined by one of the two digestion procedures: *aqua regia* or HF / $HClO_4$ (NF X 31-147). The used digestion method for Hg was not specified. Soil pH was measured in water. Organic carbon was analysed by wet chromic acid digestion.

The respective evaluations (*aqua regia*, HF / $HClO_4$) were done for all three bases of reference and all elements. Results are given for arable land. The data sets include few profiles of permanent grassland and presumably a number of samples from contaminated sites, which were not eliminated. All statistical parameter are stated.

5.1.6 Germany

The Federal Institute for Geosciences and Natural Resources (BGR) provided data from several programmes of the Federal States as well as from nationwide surveys. The sampling strategy of most of the investigations was random sampling. Only the data of the Federal State of Saxony derive from a grid system 4 · 4 km. Samples were collected on horizon base as single core. In the research programmes different analytical methods to determine heavy metal contents were used: *Aqua regia*, X-ray-fluorescence or HF acid digestion. 'Real total contents' obtained through the latter two mentioned methods were

transferred to *aqua regia* basis using regression functions (Utermann *et al.* 2000). The analytical methods to determine organic carbon varies respectively. Wet oxidation by $K_2Cr_2O_7$ as well as elemental analyser (DIN ISO 10694) was in use. Organic matter contents were calculated by using the factor 1.72. The soil pH was measured in 0.01M $CaCl_2$ (ISO 10390).

The evaluation was done for all three bases of reference and for each element. All statistical parameters are stated. If the number of samples is below 20, the minimum, median and maximum values are indicated only. The original data set includes samples from contaminated sites which were eliminated before data evaluation.

5.1.7 Ireland

The Irish data were collected in a 7 · 7 km grid system. The samples were taken as depth increments (0 – 10 cm) and mixed core. Most elements were extracted by using a HF mixture (HF / HNO_3 / HCl / H_2O, microwave assisted). A transformation to *aqua regia* basis was not conducted. Organic carbon was analysed by wet oxidation (Walkley-Black method). Organic matter values were obtained by using the factor 1.16. Soil pH was determined in water. The values were corrected to $CaCl_2$ values by subtracting 0.6 from water values.

The evaluation was done for all three bases of reference and for each element. The data set is restricted to a limited number of sampling plots (n = 295). Most information is available for grassland. Arable and forest soils are less well represented. As there was no evidence of significant anthropogenic contamination no values were eliminated. All statistical parameters are stated.

5.1.8 Italy

The evaluated Italian data refer to a random based sampling strategy. Samples were taken on horizon basis and as single core. Heavy metals were extracted by *aqua regia*. Organic carbon was determined (Walkley-Black method) but not evaluated. Soil pH was measured in water. The evaluation was done for all elements in relation to soil pH and texture classes. All statistical parameters are indicated. The dataset do not include samples from contaminated sites. In connection with the former inquiries additional data are available (see chapter 5.2.1.3).

5.1.9 Lithuania

The evaluated Lithuanian data refer to a grid based sampling strategy with a grid distance of 10 · 10 km. Samples were collected on horizon basis and as mixed core. The trace element contents were determined by DC-Arc Emission Spectrometry after burning at a temperature of 450°C. Hg was not analysed. The data were not transferred to *aqua regia* basis. Organic matter content was determined by LOI. The soil-pH values are quoted as pH (H_2O).

The evaluation was done for all three bases of reference, whereas the Cd values were below the detection limits and thus not stated. Otherwise all statistical parameters are available. In the evaluation relating to soil texture classes only three classes were given. Texture classes 2 and 3 as well as 4 and 5 were subsumed respectively. The datasets do not include samples from contaminated sites.

5.1.10 The Netherlands

The Dutch data are based on different national and provincial soil quality monitoring networks. The datasets consist of both purposively selected sampling points and probability samples. Samples of the heavy metal datasets were mainly collected as depth increment and mixed core. Samples for organic carbon contents were taken horizon-wise and as single core. The extraction methods to determine trace element contents in soils vary according to the investigation. They can be subsumed as 'hot acid destruction'. The soil-pH values are quoted as pH (KCl). Organic matter contents were determined by LOI.

The evaluation was done for all elements in relation to soil parent material (MAT 11 level) and land use as well as to pH classes. Statistics for trace element contents per soil texture class were not available. All statistical parameters are stated. If the number of samples is low, only the minimum and maximum value and the median are recorded. Locations in recent floodplains of Rhine and Meuse as well as roadsides were excluded.

5.1.11 Norway

The Norwegian Institute of Land Inventory provided data about organic carbon contents in agricultural and forest soils as well as Zinc values in forest soils only. The forest soils were sampled in a grid system of 9 · 9 km for coniferous forest and 18 · 18 km for birch forest. In agricultural areas a selective sampling strategy was conducted. The samples were taken either as depth increment or horizon-wise. The Zn contents were extracted by 1 M NH_4NO_3, but not transformed to *aqua regia*. The organic carbon content was determined using an elemental analyser. Soil pH was measured in $CaCl_2$.

For Zn the evaluation was done for all three bases of reference. The organic carbon content was quoted in relation to soil parent material (MAT 11 level) and land use. All statistical parameters are indicated. The dataset do not include samples from contaminated sites.

5.1.12 Portugal

Portugal participated in the ICP-Forest project 'Forest soil condition in Europe'. The evaluation is based on these data. Recently, a project started on heavy metals in agricultural soils but results are not available yet. The samples were taken in a 16 · 16 km grid and as depth increment (0 – 5 cm) and mixed core. As digestion method to determine trace elements a mixture of HCl / HNO_3 / H_2O_2 (3:1:2) was applied. Organic carbon was analysed by wet oxidation (dichromate oxidation). The values were not converted to organic matter contents. The soil pH was measured in 0.01M $CaCl_2$ (1:5).

The evaluation was done for all three bases of reference and all elements except Hg. The survey involved 148 observation plots. The number of samples for the reference bases differs notable. Accordingly not all statistical parameters were continuously stated. The data set include presumably a very small number of samples from contaminated sites. They were not eliminated.

5.1.13 Romania

The Romanian data refer to a grid based sampling strategy with a grid distance of 16 · 16 km. The samples were taken as depth increment or horizon-wise and as single core. Heavy metal contents were extracted by a mixture of HNO_3 / $HClO_4$ / H_2SO_4 (2:1:0.2). Organic carbon content was obtained through wet oxidation (Walkley-Black method). pH-values were recorded as pH (H_2O).

The evaluation was done for all three bases of reference and all elements except Hg. All statistical parameters are stated. If the number of samples is low, only the minimum and maximum values were quoted. The data set includes sample(s) from one contaminated site that remain in the evaluation.

5.1.14 Slovak Republic

The Soil Science and Conservation Research Centre in Bratislava provided a national report *Heavy metals and organic matter in Slovakian soils* (Čurlík & Šefčik, 2001). Appertaining data derive from the project "Geochemical Atlas of Slovakia". Samples were taken in a 10 km² grid, on horizon basis and as mixed core. Trace elements were extracted by a mixture of HF / HNO_3 (Cd, Cu, Ni, Pb, Zn) or Na_2O_2 (Cr) or by AMA (Hg). Soil pH was determined in water. There is no information about the used analytical method for organic matter.

The evaluation was done for all three bases of reference and all elements. Results are given for arable land and forest. The organic matter values are quoted in relation to soil types. All statistical parameters are recorded. The data set include presumably a number of samples from contaminated sites.

5.1.15 Spain

According to our knowledge, Spain does not have a national database about heavy metal contents on its disposal. In fact, there exist different regional programmes but the data are usually not available. At present, it is not possible to deliver any relevant data for the questionnaire.

5.1.16 Sweden

The Swedish data refer to a soil database of the Swedish University of Agricultural Sciences. The data originate from a systematic mapping of arable soils during the period 1988 – 1997. The sites were evenly distributed over the total arable land. On farm and field level the sites were selected randomly and were stratified partly on crop types. Samples of the plough layer (0 – 20 cm) were collected as mixed core. The trace element contents were digested in 7 M HNO_3 at 120°C in an autoclave (Swedish Standard SS 028311). The data were not transformed to *aqua regia* basis as a comparative study indicates no significant difference between the two methods. Organic carbon content was determined by an elemental analyser and recalculated to organic matter by using the factor 1.72. Soil pH was measured in water (ISO 10390). Data were additionally transformed to pH ($CaCl_2$) by subtracting 0.5 pH-units from pH (H_2O)-values.

The evaluations according to soil pH were done for all elements, according to texture classes for all except for Ni. All statistical parameters are indicated. The data set does not include samples from contaminated sites.

5.1.17 United Kingdom (England and Wales)

There exist heavy metal data for England and Wales that derive from the National Soil Inventory made between 1979 and 1984 (McGrath & Loveland 1992). The survey is based on a 5 · 5 km grid.

Evaluations for Cd, Cr, Cu, Ni, Pb and Zn according to soil parent material as stratification level (MAT 11) were solely provided as maps. Stratification according to land use was not carried out as the land use recorded at the time of sampling may not

accord with the land use identified in CORINE. No data are available for Hg. The pertinent tables and the documentation sheet of the questionnaire were not submitted so far. For the evaluation according to soil pH and soil texture the data of the preliminary evaluation (European Soil Bureau 2000) were comprised (see chapter 5.2.2.2).

Table 1 - Overview of the current data request

Country	Kind of information			Information on geographical locations			Sampling strategy		Land use
	Questionnaire (y/n)	Others	Source	Co-ordinates deliverable	Co-ordinate system	Accuracy	Kind of sampling	Sample unit	
EU Member States									
Austria	Yes	-	Federal Environment Agency: Data derive from Soil Surveys carried out by the Federal Provinces of Austria and the Federal Forest Research Centre	No information	No information	No information	Grid system: 8.7 x 8.7 km (forest); 4 x 4 km (arable land, grassland)	Soil horizon	Arable land, grassland, forest
Belgium (Wallonia only)	No	Report: Inventaire de la qualité des sols en Région wallone	Direction générale des ressources naturelles et de l'environnement	No information	Lambert belge 72	No information	No information	Depth increment: 0-25 cm	Agricultural soils
Estonia	Yes	Geochemical Atlas of the Humus Horizon of Estonian Soils (with explanations); Bulletin of the Geochemical Monitoring of Soil 1992-94	Geological Survey of Estonia	Yes	Pulkovo 1942	50 m	Grid system 1 sample per 30-70 km²	Soil horizon, Single core	Arable land, grassland, forest
Finland	Yes	-	Geological Survey of Finland (GTK): Data derive from the Baltic Soil Survey	Yes	UTM and National grid	20 m	Grid system: 50 x 50 km	Depth increment: 0 - 25 cm; Mixed core	Arable land
France	Yes	-	Institut National de la Recherche Agronomique (INRA): 2 data sets delivered: one on aqua regia data and one on HF / $HClO_4$ data	No	No information	No information	Random sampling; Area sample about 200m²	Soil horizon (topsoil only), Mixed core	Arable land (incl. few samples of permanent grassland)
Germany	Yes	-	Federal Institute for Geosciences and Natural Resources (BGR); Data derive from programmes of the Federal States as well as from national surveys	Yes	Gauss-Krüger	1 - 1000 m	Random sampling (mainly); Grid system: 4 x 4 km (Saxony)	Soil horizon, Single core	Arable land, grassland, forest, other land use
Republic of Ireland	Yes	-	Irish Agriculture and Food Development Authority (TEAGASC)	Yes	National grid	50 m	Grid system: 7 x 7 km	Depth increment: 0- 10 cm; Mixed core	Arable land, grassland, forest
Italy	Yes	-	ARPAV - Centro Agroambientale di Castelfranco Veneto	Yes	UTM	1 m	Random sampling	Soil horizon, Single core	-
Lithuania	Yes	-	Geological Survey of Lithuania	Yes	National LKS 94	No information	Grid system: 10 x 10 km	Soil horizon, Mixed core	Arable land, grassland, forest
The Netherlands	Yes	-	Alterra, Green World Research: Data derive from different national and provincial soil quality monitoring network	Yes	No information	1 m (Corg); 1 m - 1 km (HM)	Purposive sampling (Corg, HM); Stratified simple random sampling (Corg)	Soil horizon, Single core (Corg); Depth increment, Mixed core (HM)	Arable land, grassland, forest, other land use
Portugal	Yes	-	Laboratory for Agricultural Chemistry Rebelo da Silva (LQARS) : Data derive from ICP-Forest project	Yes	European Datum (1950)	No information	Grid system: 16 x 16 km	Depth increment: 0-5 cm; Mixed core	Forest
Slovak Republic	(Yes)	Report: Heavy metals and organic matter in Slovakian Soils	Soil Science and Conservation Research Institute, Bratislava	Yes	No information	No information	Grid system (10 km²)	Soil horizon, Mixed core	Arable land, forest
Spain	Currently no national data about heavy metal contents available								
Sweden	Yes	-	Swedish University of Agricultural Sciences: Data derive from a systematic mapping of arable soils during the period 1988-1997	Yes	National grid	1 km	Random sampling on farm and field level, partly stratified sampling on crop type	Soil horizon: Plough layer (0-20 cm), Mixed core	Arable land
UK	No	Information added by R.J.A. Jones in the provisional report; The Soil Geochemical Atlas of England and Wales	National Soil Resource Institute, Cranfield University: Data derive from the National Soil Inventory made between 1979-1984	No information	No information	No information	Grid system: 5 x 5 km	Depth increment: 0-15 cm; Mixed core	No information
Other European Countries									
Norway	Yes	-	Norwegian Institute of Land Inventory (NIJOS)	Yes	UTM and NGO	No information	Grid system: 9 x 9 km (coniferous forest); 18 x 18 km (birch forest)	Soil horizon, Single core; Depth increment, Mixed core	Arable land (Corg), forest (Corg, Zn)
Romania	Yes	-	Research Institute for Soil Science & Agrochemistry (RISSA)	Yes	Geographical	400 m	Grid system: 16 x 16 km	Soil horizon (A-horizon), Depth increment (5-10 cm forest, 20-25 cm others),	Arable land, grassland, forest, other land use

Table 1 - Overview of the current data request (cont'd)

Country	Soil parameter					Trace elements			Harmonisation of data sets		Geografical reference	
	pH	method	Corg / OM	method	Texture	Analysed elements	Digestion methods	Transfer to Aqua regia	Contaminated sites	Elimination of contaminated samples	Parent material (MAT 11)	Others
EU Member States												
Austria	Yes	0.01 M $CaCl_2$ (Austrian Standard L1083)	Yes	Wet or dry combustion (Austrian Standard L 1080, L 1081, L 1084)	Yes	Cd, Cr, Cu, Hg, Ni, Pb, Zn	Arable land: Aqua regia (Austrian standard L1085); $HCLO_4$ (Hg); Forest: HNO_3 / $HClO_4$ 5:1 (Austrian standard L1085)	-	No	-	Yes	-
Belgium (Wallonia only)	Yes	H_2O	No	-	No	Cd, Cr, Cu, Hg, Ni, Pb, Zn	No information	No information	No information	No information	No	Soil associations acc. to Belgium soil classification
Estonia	Yes	H_2O	Yes	Difference in weight between dry (105°C) and ashed (450°C) sample	Yes	Cd, Cr, Cu, Hg, Ni, Pb, Zn	HNO_3 / HF / $HClO_4$ (Cd, Cu, Zn); X-ray-fluorescence (Pb); gas analyser (Hg); semiquantitative spectral analysis (Cr, Ni)	Yes	No	-	Yes	-
Finland	No	-	Yes	LOI (Loss on ignition)	Yes (peat soils)	Cd, Cr, Cu, Ni, Pb, Zn	Aqua regia	-	No	-	Yes	-
France	Yes	H_2O	Yes	Wet chromic acid digestion	Yes	Cd, Cr, Cu, Hg, Ni, Pb, Zn	Aqua regia; HF / $HClO_4$ (NF X 31-147) (all elements except of Hg: method unknown)	-	Yes	No	Yes	-
Germany	Yes	$CaCl_2$ (DIN ISO 10390)	Yes	Elemental analyser (DIN ISO 10694, Wösthoff), Wet oxidation ($K_2Cr_2O_7$)		Cd, Cr, Cu, Hg, Ni, Pb, Zn	Aqua regia, Hydrofluoric acid digestion, X-ray-fluorescence	Yes	Yes	Yes	Yes	-
Republic of Ireland	Yes	H_2O; Corrected to $CaCl_2$ values by substracting 0.6 from water values	Yes	Wet oxidation (Walkley-Black)	Yes	Cd, Cr, Cu, Hg, Ni, Pb, Zn	HF / HNO_3 / HCl / H_2O microwave assisted	No	No	-	Yes	Alternative: parent material (Soil Map of Ireland)
Italy	Yes	H_2O	No	-	Yes	Cd, Cr, Cu, Hg, Ni, Pb, Zn	Aqua regia	-	No	-	No	-
Lithuania	Yes	H_2O	Yes	LOI	Yes	Cd, Cr, Cu, Ni, Pb, Zn	DC - Arc Emission Spectrometry (after burning at 450°C)	No	No	-	Yes	-
The Netherlands	Yes	KCl	Yes	LOI	No	Cd, Cr, Cu, Hg, Ni, Pb, Zn	Hot acid digestion (different acids)	No information	Yes	Yes	Yes	-
Portugal	Yes	0.01 M $CaCl_2$ 1:5 mixture	Yes	Wet oxidation (dichromate oxidation)	Yes	Cd, Cr, Cu, Ni, Pb, Zn	HCl / HNO_3 / H_2O_2 (3:1:2)	No information	Yes	No	Yes	-
Slovak Republic	Yes	H_2O (1:2.5)	Yes	No information	Yes	Cd, Cr, Cu, Hg, Ni, Pb, Zn	HF / HNO_3 (Cd, Cu, Ni, Pb, Zn), Na_2O_2 (Cr), AMA (Hg)	No information	Yes	No	Yes (HM)	Alternative (HM): parent material (acc. Slovakian classification); FAO Soil type (OM)
Spain												
Sweden	Yes	H_2O (ISO 10390)	Yes	Elemental analyser (LECO CNS 700)	Yes	Cd, Cr, Cu, Hg, Ni, Pb, Zn	7 M HNO_3 at 120°C autoclave (Swedish Standard SS 028311)	No	No	-	No	-
UK	see Table 2					Cd, Cr, Cu, Ni, Pb, Zn	Aqua regia	-	No information	No information	Yes (but no stratification acc. to land use)	
Other European Countries												
Norway	Yes	$CaCl_2$	Yes	Elemental analyser	Yes	Zn	NH_4NO_3	No	No	-	Yes	-
Romania	Yes	H_2O	Yes	Wet oxidation (Walkley-Black);	Yes	Cd, Cr, Cu, Ni, Pb, Zn	HNO_3 / $HCLO_4$ / H_2SO_4 (2:1:0.2)	No information	Yes	No	Yes	

Table 2 - Additional data from former inquiries

Country	Data		Sampling strategy		Land use	Soil parameter					Trace elements		Harmonisation of data sets		Geografical reference
	Source	Statistical parameters	Kind of sampling	Sample unit		pH	method	OM	method	Texture	Analysed elements	Digestion methods	Contaminated sites	Elimination of contaminated samples	
First data request (Phase II)															
Belgium (Flanders only)	Ghent University, Department of Geology and Soil Science: Data derive from 3 soil surveys in the provinces of Antwerp, East- and West Flanders	Min, Max, Median, Mean, 25. / 75. / 90. P.	2 Grid systems: 3,8 x 3,8 km; 4 x 4 km	Depth increment: 0-20 cm; Mixed core	Land use classes were recorded but not considered in the evalua-tion			Yes	Walkley-Black		Cd, Cr, Cu, Hg, Ni, Pb, Zn	Aqua regia; Cold vapour atomic adsorption (Hg)	Yes	Yes	SMU units (European Soil Database)
Italy	DISAT: Dataset of some provinces (mainly northern Italy)	Min, Max, Median, Mean			Arable land	Yes	?				Cd, Cr, Cu, Ni, Pb, Zn	Hot acid digestion (presumably aqua regia)			Administrative boundaries
Scotland	MLURI: Data relating for Scottish soils at a whole	Median, (25. / 75. P.)	Grid system: 10 km²		Agricultural soils						Cd, Ni, Pb, Zn	Aqua regia			No
Spain	List of publications and site descriptions of sampling locations														
Czech Republic	CISTA: Evaluated data derive from different databases: Basal soil monitoring scheme (1) + Register of contaminated soils (2); Report 'Contents of risk elements in agricultural soils of the Czech Republic' (based on 2)	Median, 90. P. (1) Min, Max, Median, Mean, 25. / 75. / 90. / 95. P. (2)	Purposive sampling (1); 1 sample on arable land and grassland represents the area of 7-10 ha (2)	No information (1); Depth increment: 0-30 cm arable land, 0-15 cm grassland; Mixed core (2)	Agricultural soils					Sandy soils, other soils (2)	Cd, Cr, Ni, Pb, Zn (1+2), Cu (1)	Aqua regia (1); 2 M HNO_3 (except of Hg: total content - method unknown) (2)			Geological substrates (1+2),
Preliminary evaluation for 4 member states (Phase I)															
Denmark	Only evaluated data available (ESB 2000)	Median, (25. / 75. P.)	2 Grid systems: 7 km², 22 km²	0-25 cm, Mixed core	Cultivated soil, forest	Yes	$CaCl_2$ (1:2.5)			Sand (< 10 mass-% clay), Clay (> 10 mass-% clay)	Cd, Cr, Cu, Hg, Ni, Pb, Zn	50% HNO_3 (microwave oven)	Yes	No	No
England / Wales	Only evaluated data available (ESB 2000)	Min, Max, Median, 25. / 75. P.	Grid system: 5 x 5 km	Mixed core		Yes	H_2O (1:2.5)			7 texture classes	Cd, Cr, Cu, Ni, Pb, Zn	Aqua regia	Yes	No	No

5.2 Former inquiries

The results of the preceding evaluation steps of the "Short Term Action" are documented in the reports *Progress report - First results of the second phase of the Short Term Action* (Joint Research Centre 2001) and *Results of the Preliminary Evaluations for 4 Member States* (European Soil Bureau 2000). The following chapter comprises a brief description of data provided in the context of the former inquiries (see also Tab. 2).

5.2.1 Phase II - First data request

5.2.1.1 Belgium (Flanders)

From the Flemish part only data from this data collection are available. The data derived from surveys conducted in the districts of Antwerp, East-Flanders and West-Flanders. The samples were collected in different grid systems (3.8 · 3.8 km, 4 · 4 km) as depth increment and mixed core. The heavy metals were extracted by *aqua regia*, Hg by cold vapour atomic adsorption. Organic carbon was determined by the Walkley-Black method. The evaluation (heavy metals and C_{org}) was done relating to soil mapping units (SMU's) of the European Soil Data Base. All required statistical parameters are stated. Samples from contaminated sites were eliminated before the data evaluation.

5.2.1.2 Czech Republic

The Czech Republic made available the document *Contents of risk elements in agricultural soils of the Czech Republic* (Trávník *et al.* 2000) as well as a position paper for the *ISO / TC 190 / SC 7 / WG 7 – Background values* – (Sáňka & Němec 2001). The evaluated data derive from two national databases, the 'Register of contaminated sites' and the 'Basal soil monitoring scheme'. In the 'Register of contaminated sites' one sample on arable land and grassland represent the area of 7 – 10 ha. They were taken as depth increment and composite core. Heavy metals were extracted by 2M HNO_3. The document *Contents of risk elements in agricultural soils of the Czech Republic* (Trávník *et al.*, 2000) contains outputs from that database. Therein, among other things contents of selected trace elements in relation to soil texture[4] are presented. Furthermore, an exemplary evaluation for Cd according to geological substrate and soil texture is available (Sáňka & Němec 2001). The general statistical parameters are provided for both above mentioned evaluations.

The 'Basal soil monitoring scheme' is based on a network of 217 permanent plots on agricultural soils. The sampling sites consider existing soil types, land uses and climatic conditions. Contents of trace elements were analysed by *aqua regia*. Evaluated data in relation to main groups of geological substrates are given (Sáňka & Němec 2001). The results could be aligned to the MAT 11 units. They refer to agricultural soils. A differentiation between land uses was not made. The medians and 90 percentiles of all required elements are stated.

5.2.1.3 Italy

In response of the previous questionnaire, data on some provinces of mainly Northern Italy were provided. The data set contains heavy metal contents of arable soils for all

[4] *The data are partitioned in 'sandy soils' and 'other soils'.*

required elements but in different totality. The used digestion method is described as "hot acid digestion" (presumably *aqua regia*). The data refer to administrative boundaries (provinces). Following statistical parameters are given: minimum, maximum, median and mean values.

5.2.1.4 United Kingdom (Scotland)

Scottish data derive from a soil sampling database of the Macaulay Land Use Research Centre (MLURI). The soils were analysed on a 10 km² grid. Heavy metal contents were extracted with *aqua regia*. The quoted contents relate to Scottish agricultural soils as a whole.

5.2.2 Preliminary evaluation for 4 member states (Phase I)

5.2.2.1 Denmark

The Danish data for the preliminary evaluation derive from different data sets. The samples were collected in grid systems of two different densities (7 km², 22 km²), as depth increment and mixed core. The heavy metal contents were determined by digestion with 50 % HNO_3. Soil pH was measured in $CaCl_2$. Basic statistics of heavy metals in Danish top soils were delivered according to pH-classes, land use and soil texture. The soil texture classes are based on clay content. It was distinguished between "Sand" (< 10 % clay) and "Clay" (> 10 % clay). The applied pH-classes were consistent with the pH-classes of the new data request (pH ≤ 5, > 5-6, > 6-7, > 7). However pH-values are restricted to Jutland.

5.2.2.2 United Kingdom (England and Wales)

British data for the preliminary evaluation referred exclusively to England and Wales. The samples were taken in a regularly grid of 5 km · 5 km and as mixed soil core. As extraction method *aqua regia* was chosen. The soil-pH was measured in water. Amongst others, the data were evaluated in relation to soil pH and soil texture classes. The pH classes are equivalent to those in the new questionnaire. The applied texture classes refer to the country-specific soil taxonomy and were differentiated in seven classes. The evaluation reported here is based on the total sample population. Contaminated samples were not eliminated.

5.3 Status of the evaluation

The previous chapters described in detail the data the participating countries provided so far (status October 2004). Some countries could not undertake all postulated evaluations. Table 3 summarises the extent of available information.

Table 3 - Overview of available information

Country	***Evaluation according to***					
	Parent material + Land use			***pH***	***Soil texture***	***Other bases of reference[1]***
	Arable land	***Grass-land***	***Forest***			
Austria	√	√	√	√	√	
Belgium						√
Czech Republic					(√)	√
Denmark				√	(√)	√
Estonia	√	√	√	√	√	
Finland	√				√	
France	√			√	√	
Germany	√	√	√	√	√	
Ireland	√	√	√	√	√	
Italy				√	√	√
Lithuania	√	√	√	√	(√)	
The Netherlands	√	√	√	√		
Portugal			√	√	√	
Spain						
Slovak Republic	√		√	√	√	
Sweden				√	√	√
United Kingdom				√	(√)	√
Norway [2]	√		√	√	√	
Romania	√	√	√	√	√	

(√) Values refer to different texture classes

[1] For details see Tables 1 and 2

[2] Trace elements extracted by NH_4NO_3

6 Assessment of existing databases

The preceding description clearly reveals that the currently available information about heavy metal and organic matter contents in European soils varies significantly, both in quality and quantity. Nevertheless, a comparative presentation and evaluation of the provided data was attempted. Therefore, aspects of harmonisation had to be taken into account.

Figure 3 gives a brief overview of previous and following steps of data processing.

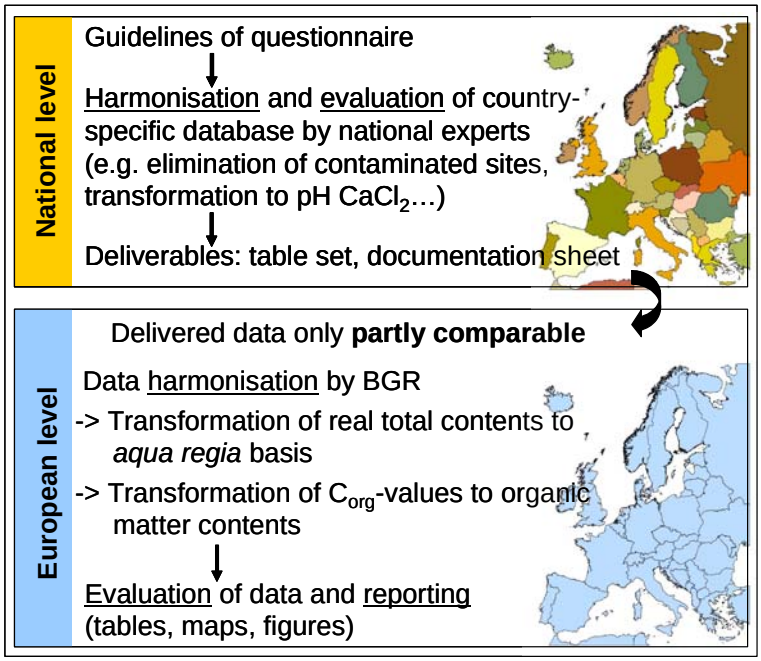


Figure 3 - Steps of data processing

In all discussion based on the data presented in this report it must be considered that "*a posteriori*" harmonised data sets, e.g. procedures and algorithms mentioned in the following, cannot replace data coming from standardised and commonly applied procedures for both sampling and analytical determination ("*a priori*" harmonised). The following chapters describe the proceeding of the comparative evaluation carried out by BGR. Commencing with the accomplished harmonisation steps, an overview of the results including some of the occurred problems is given.

6.1 Harmonisation aspects

6.1.1 Harmonisation of data regarding analytical procedures

The guideline of the revised questionnaire proposed *aqua regia* as reference method to determine heavy metal contents. This method is harmonised as ISO International Standard (ISO 11466) and applied as a reference for limit and threshold values in national

and European directives. Some of the participating countries could provide *aqua regia* extracted data, whereas others use stronger (e.g. hydrofluoric acid) or weaker (e.g. NH_4NO_3) extractants.

In Germany, comprehensive analytical investigations were carried out in order to ascertain relations between *aqua regia* soluble heavy metal contents and "real total contents" obtained through hydrofluoric acid digestion or X-ray-fluorescence (Utermann *et al.* 2000). A set of regression functions has been deduced that allows a conversion of data between the two fractions with a given statistical certainty (Table 4)[5].

Table 4 - Transformation of real total contents (RT) into aqua regia soluble contents (AR): regression functions and coefficients of determination (R^2; $\alpha \leq 0.05$)

Element	***Regression function***	***n***	***R^2***
Cd	log Cd (AR) = -0.12 + 1.19 log Cd (RT)	274	0.91
Cr	log Cr (AR) = -0.45 + 1.05 log Cr (RT)	514	0.83
Cu	log Cu (AR) = -0.19 + 1.12 log Cu (RT)	306	0.98
Ni	log Ni (AR) = -0.11 + 1.04 log Ni (RT)	290	0.99
Pb	log Pb (AR) = -0.45 + 1.24 log Pb (RT)	289	0.95
Zn	log Zn (AR) = -0.10 + 1.01 log Zn (RT)	465	0.96

These regression functions were applied respectively for the values of those countries in which "total heavy metal contents" were determined (e.g. by HF-mixture, DC Arc Emission Spectrometry). As the formulae were not adequate for the NH_4NO_3 extractable heavy metal fraction, these data were not transformed. Conversion of values was carried out in the three evaluation approaches for all elements other than Hg[6]. The application of the regression functions for Cu and Pb was limited for values below 40 (Cu) and 80 (Pb) $mg \cdot kg^{-1}$. Higher values cause an overestimation of the calculated *aqua regia* contents. In this case original data were kept. Tables I.2 – I.4 (annex I) illustrate values on *aqua regia* basis. Transformed data sets are marked (*). The original data are shown in annex II.

The analyses of **soil pH** should be based on, or related to, the pH on 0.01M $CaCl_2$ according to ISO 10390. The obtained data were measured either in water, $CaCl_2$ or KCl. Several conversion algorithms exist (e.g. Henderson & Bui 2002). However, a transformation could not be conducted as no original data were available. A transformation of the calculated values would lead to a shift of the pH classes, which are not directly comparable with the given pH classes. The provided data are compiled in Tables I.3 a - g (annex I). The respective method is indicated in the tables.

Soil organic carbon contents were determined by using an elemental analyser or by wet oxidation. The different results can be directly compared up to a soil organic matter level of about 12 % (European Soil Bureau 1999a). Some countries used the loss on ignition method (LOI). Herewith the organic matter content will be estimated directly. This

---

[5] *The regression functions are revised at present. The results will be published soon on http://www.bgr.de.*

[6] *A comparison of data from the International Soil-Analytical Exchange (ISE) programme (Wageningen University) has shown no significant differences between aqua regia extracted and total Hg contents.*

method is mainly suitable for soils without carbonates and little clay content. Otherwise it can lead to an overestimation of the organic matter.

The participating countries provided organic matter or organic carbon contents (annex II). In order to obtain a reasonable basis for comparison, the latter were transposed to organic matter contents (Tab. I.5, annex I). For the calculation the factor 1.72 was used (AG Boden 1996).

6.1.2 Harmonisation of data regarding sampling strategy

The sampling design has a crucial influence on the results and their comparability. The provided data are based on different sampling strategies: grid or random sampling, horizon layer or depth increment and single or mixed core. Criteria to compare or convert different sampling strategies at European scale have still to be developed and attuned. Within the scope of the evaluation this aspect could not be taken into consideration.

6.1.3 Elimination of samples from contaminated sites

One principal objective of the survey was to gather information about the usual contents of heavy metals in European soils. It is composed of the geogenetic baseline content and the ubiquitous substance distribution. Thus, data from known contaminated sites should be eliminated before data evaluation on national level. Otherwise increased values could influence the statistical distribution, especially the 90. percentile. Many of the evaluated data sets do not contain samples from contaminated sites. In the other case some countries eliminated corresponding samples (e.g. Germany) while others kept the data (e.g. Portugal).

6.1.4 Other aspects

The number of samples of which the national evaluations are based on, varies widely. When selecting the scope of the sampling, care must be taken to ensure that the relevant data record represents a random sample of the total population. A universal minimum size of samples can not be deduced. The number arises with increasing heterogeneity and spatial distribution of the reference units. With regard to the evaluation it was assumed that the transmitted values are representative for the respective units.

The evaluated and harmonised data are documented in tables and maps (annex I). The tables contain the number of samples (n), the median and the 90. percentile. If $n < 20$ only median is stated, if $n < 5$ neither median nor 90. percentile were given. These restrictions were stipulated for the presentation of the results and should not be equated with the minimum number of samples. The original data are attached in annex II.

6.2 Evaluation and presentation of data

6.2.1 Heavy metal contents in European soils according to soil parent material (MAT 11 level) and land use

6.2.1.1 Units of reference

Soil parent material has a significant influence on the geogenetic baseline content and usual content of heavy metals in soils respectively (ISO / CD 19258). The European Soil Data Base contains information on soil parent material at European scale (European Soil Bureau 1999b). For the investigation the MAT 11 level was chosen. On this highest aggregation level nine soil parent material legend units (LUs) were accounted as reference base. Table 5 gives an overview of the LUs and the including parent material units. The spatial distribution of the LUs is illustrated in Figure 4.

Table 5 - MAT 11 legend units (LUs) of the European Soil Data Base

MAT 11 LU	***Soil parent material***	***MAT 11 LU***	***Soil parent material***
1	**Undifferentiated alluvial deposits (or glacial deposits)**	**5**	**Loamy materials**
	River alluvium		Residual loam
	Estuarine/Marine alluvium		Eolian loam
	Glaciofluvial deposits		Siltstone
	Glaciofluvial drift	**6**	**Detrital formations**
	Colluvium		Arkose
2	**Calcareous rocks**		Breccia and Puddingstone
	Limestone		Flysch and Molasse
	Secondary chalk		Ranas
	Marl	**7**	**Crystalline rocks and migmatites**
	Gypsum		Acid crystalline rocks (and migmatites)
	Dolomite		Non acid crystalline rocks (and migmatites)
3	**Clayey materials**		Crystalline metamorphic rocks
	Old clayey sedimentary deposits		Schists
	Alluvial or glaciofluvial clay		Other metamorphic rocks
	Residual clay from calcareous rocks	**8**	**Volcanic rocks**
	Claystone, mudstone		Acid volcanic rocks
	Calcareous clay		Basic volcanic rocks
4	**Sandy materials**		Volcanic slag
	Old sandy sedimentary deposits	**9**	**Other rocks**
	Alluvial or glaciofluvial sands		Organic materials
	Eolian sands		
	Coastal sands (Dune sands)		**No information**
	Sandstone		

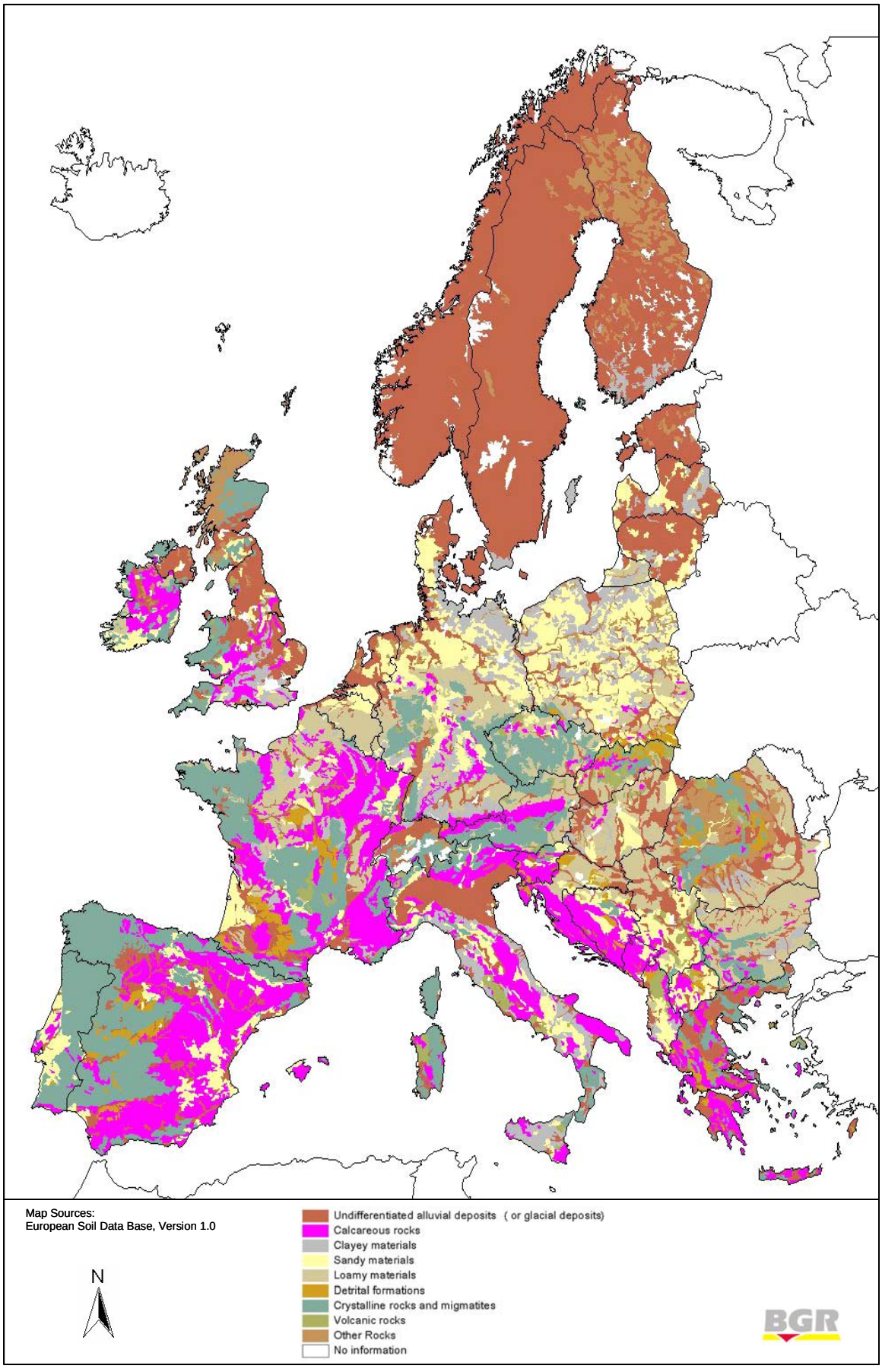


Figure 4 – European Soil Data Base: Soil Parent Material (MAT11-Level)

The MAT 11 level was chosen in order to avoid a too strong differentiation of the parent material units at European scale. Thus, the number of samples should be kept on a manageable amount. On the other hand the high aggregation level implicates that the MAT 11 LUs comprise a broad spectrum of parent material units with varying chemical compositions (e.g. acid and basic volcanic rocks – MAT 11 LU 8 "Volcanic Rocks"). With regard to the evaluation the heterogeneity of the LUs has to be borne in mind. Some aspects will be taken up more detailed in chapter 6.2.1.3.

Besides soil parent material, information on land use is considered as second reference for the evaluation. "Usage-related processing condition and the entry of specific materials into soils necessitate a differentiation of the soils or soil investigations on the basis of types of use" (LABO 1998). Due to regular soil treatment and cultivation measures the trace element contents of arable land are normally comparatively low. Soils under grassland show elevated contents in the upper soil horizon (Ah-horizon). They are frequently located within flood areas and can be affected by additional input of substances. Moreover there is no dilution effect through cultivation measures (e.g. ploughing). Increasing trace element contents in forest soils can be attributed for instance due to the fact that trees filter airborne emissions (interception).

Europe-wide spatial information on land use / land cover is provided by the CORINE Land Cover Database (**C**o-**or**dination of **In**formation on the **E**nvironment). The European Topic Centre on Terrestrial Environment made available the CLC90 version 12/2000 with a resolution of 250 m in a raster based format. The nomenclature comprises 44 units organised hierarchically in three levels. With regard to the evaluation approach (four main land use types), a simplified classification with seven land use units were generated (Table 6). Some CLC units were difficult to reassign clearly and assumptions had to be made. For example the unit "Complex cultivation pattern" (juxtaposition of small parcels of diverse annual crops, pasture and / or permanent crops) was allocated to unit 1 (Arable land), although unit 2 (Grassland) or 4 (Other land use) were possible. The entire CLC nomenclature and the reclassification key are shown in Table I.1 in annex I. Figure 5 presents the spatial distribution of the reclassified land use units.

Table 6 - Reclassified land use units (based on CLC 90, version 12/2000)

Unit	***Land use***
1	Arable land
2	Grassland
3	Forest
4	Other land use
5	No use (natural)
6	No use (artifical)
7	Water bodies

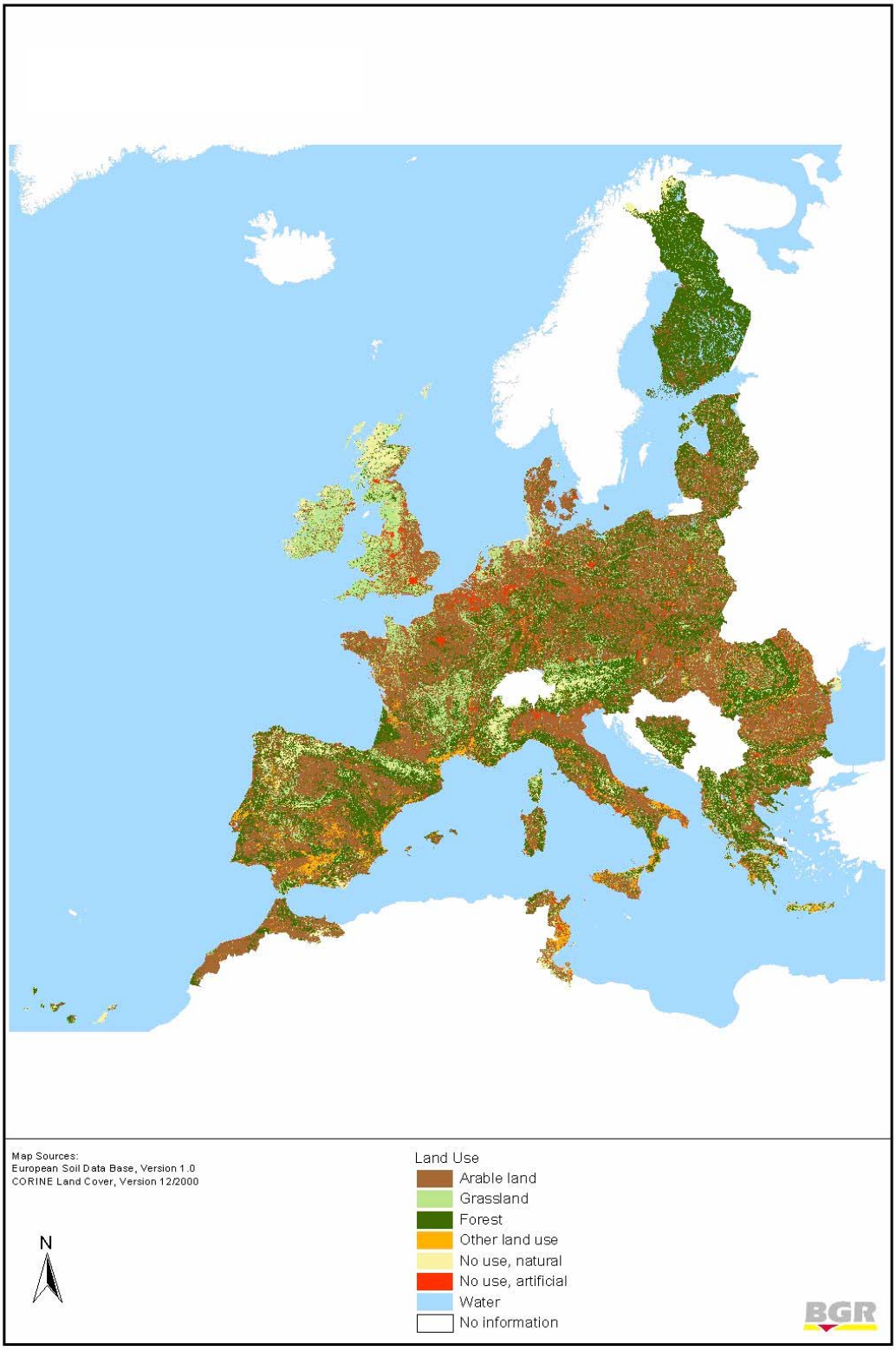


Figure 5 – Land use in Europe

For visualising the evaluated data in outline maps, the two information layers (MAT 11, land use) were combined (on raster basis) and completed with the respective trace element contents. Maps were generated for the 50. percentile (median) and the 90. percentile values.. The respective element contents were classified in five classes (Table 7) providing a most differentiated but still clearly presentation. The chosen upper limits comply with the occurred median values. Statistical evaluations were accomplished for median values exemplarily as this statistical parameter is more complete than the 90. percentile.

Table 7 - Classes of trace element contents for the spatial presentation [mg·kg^{-1}]

Class	***Cd***	***Cr***	***Cu***	***Hg***	***Ni***	***Pb***	***Zn***
1	≤ 0.25	≤ 15	≤ 10	≤ 0.1	≤ 10	≤15	≤ 30
2	>0.25 - 0.5	>15 – 30	>10 – 20	>0.1 - 0.2	>10 - 20	>15 - 30	>30 – 60
3	>0.5 - 0.75	>30 – 45	>20 – 30	>0.2 - 0.3	>20 - 30	>30 - 45	>60 – 90
4	>0.75 - 1.0	>45 – 60	>30 – 40	>0.3 - 0.4	>30 - 40	>45 - 60	>90 – 120
5	> 1.0	> 60	> 40	> 0.4	> 40	> 60	> 120

6.2.1.2 Evaluated data

For the evaluation according to soil parent material and land use only data from the current questionnaire (Phase II, 2nd part) were considered. Data of the former inquiries could not be taken into account as either the provided geographical references (soil units, administrative boundaries, etc.) could not be transferred directly to the stated bases of reference or spatial information was missing at all.

Comparable results (*aqua regia* basis) can be presented for eleven European countries: Austria, Estonia, Finland, France[7], Germany, Republic of Ireland, Lithuania, The Netherlands, Portugal, Romania and Slovak Republic (Tab. I.2 a – g, annex I). For reasons of comparability the data provided by UK could not be included as the maps were stratified according to soil parent material only. The spatial distribution of the MAT 11 LUs as well as the spatial coverage of the four main land use types in the respective countries are presented for information in Tables 8 and 9.

Table 8 - Area fraction of the MAT 11 LUs in per cent of the represented countries [%]

MAT 11 LU*	***A***	***EST***	***FIN***	***F***	***D***	***IRL***	***LT***	***NL***	***P***	***RO***	***SK***
1	4.1	79.7	66.1	9.3	11.0	6.6	74.0	46.6	1.4	20.1	15.7
2	23.6	-	-	30.0	5.9	34.3	-	-	6.6	0.9	8.2
3	0.1	-	4.1	4.5	21.0	-	5.5	-	0.1	4.4	-
4	0.0	-	-	5.7	25.0	15.4	16.3	42.2	20.3	2.3	2.2
5	25.4	-	-	16.8	21.2	9.0	-	2.0	-	27.4	19.8
6	0.5	-	-	4.8	-	-	-	-	0.3	5.1	14.9
7	42.1	-	0.9	26.9	11.8	28.7	-	-	70.9	14.0	11.5
8	3.5	-	-	1.0	0.7	-	-	-	-	2.4	27.6
9	0.1	8.4	23.4	-	2.3	4.3	-	7.9	-	21.5	-
Sum	99.4	88.1	94.5	99.0	98.9	98.3	95.8	98.7	99.6	98.1	99.9

*Cf. Table 5 for explanation

[7] *For the evaluation aqua regia data were used.*

Table 9 - Spatial coverage of land use types in the represented countries [%]

Land use type	***A***	***EST***	***FIN***	***F***	***D***	***IRL***	***LT***	***NL***	***P***	***RO***	***SK***
Arable land	24.5	24.3	6.6	45.1	47.5	11.0	52.7	40.2	44.3	46.3	45.0
Grassland	17.6	6.8	-	17.4	12.5	59.4	7.4	34.6	3.3	11.2	5.3
Forest	44.3	51.5	76.2	27.3	28.9	6.0	30.4	8.6	34.9	30.0	42.1
Other land use	0.7	0.0	-	2.6	0.7	-	0.1	0.3	7.7	2.7	0.8
Sum	87.1	82.6	82.8	92.4	89.6	76.4	90.6	83.7	90.2	90.2	93.2

The percentage values were calculated by using the number of pixels of the respective units. The spatial coverage of the MAT 11 LUs is mostly incomplete (Tab. 8), as in some areas the information about soil parent material is missing (see also Fig. 4). Regarding the land use coverage (Tab. 9), the remaining areas are water bodies or under no use (see also Fig. 5). Due to the preceding summing-up of land use units the figures are only partly comparable to other published land use statistics (e.g. Bruyas 2002).

Table 10 - Range of heavy metal contents (median) within the MAT 11 / land use -units [mg·kg^{-1}]

MAT 11 LU*	***Land use***	***Cd***	***Cr***	***Cu***	***Hg***	***Ni***	***Pb***	***Zn***
1	A	0.07 - 0.76	16 - 40	8 - 23	0.04 - 0.10	7 - 31	6 – 33	22 - 74
	G	0.12 - 0.75	15 - 36	8 - 30	0.04 - 0.24	8 - 29	10 – 64	24 - 128
	F	0.08 - 0.76	7 - 33	4 - 18	0.02 - 0.12	4 - 30	10 – 43	13 - 70
2	A	0.29 - 1.23	21 - 52	12 - 24	0.06 - 0.23	16 - 39	16 – 33	50 - 97
	G	0.26 - 1.13	18 - 38	13 - 24	0.07 - 0.17	14 - 40	19 – 38	61 - 100
	F	0.36 - 1.13	10 - 56	12 - 21	0.12 - 0.16	20 - 31	18 – 63	72 - 80
3	A	0.14 - 0.33	9 - 43	9 - 22	0.05 - 0.07	8 - 36	9 – 22	27 - 78
	G	0.22 - 0.76	18 - 19	10 - 18	0.07	12 - 27	10 – 24	27 - 52
	F	0.16 - 0.90	18 - 50	7 - 18	0.13	9 - 30	10 – 37	25 - 37
4	A	0.11 - 0.30	8 - 37	3 - 21	0.04 - 0.15	3 - 22	9 – 18	16 - 62
	G	0.22 - 0.30	9 - 20	6 - 11	0.07 - 0.08	4 - 9	10 – 20	19 - 37
	F	0.09 - 0.18	5 - 24	2 - 7	0.07 - 0.18	3 - 12	10 - 39	6 - 37
5	A	0.11 - 0.80	18 - 62	10 - 21	0.04 - 0.18	11 - 31	11 - 31	41 - 86
	G	0.21 - 0.76	19 - 35	14 - 21	0.10 - 0.13	9 - 27	20 - 44	53 - 80
	F	0.10 - 0.85	10 - 46	8 - 21	0.15	9 - 28	24 - 54	35 - 55
6	A	0.18	47	20	0.10	29	17	60
	G	0.27 - 0.76	16 - 43	20 - 24	0.13	22 - 25	29 - 31	81 - 107
	F	0.25 - 1.23	40 - 49	12 - 22	0.11	19 - 34	24 - 46	53 - 72
7	A	0.11 - 0.41	30 - 36	12 - 24	0.04 - 0.18	15 - 26	15 - 47	54 - 86
	G	0.21 - 0.76	15 - 33	13 - 19	0.10 - 0.11	10 - 24	25 - 59	42 - 101
	F	0.11 - 0.94	8 - 36	11 - 18	0.16 - 0.20	13 - 30	25 - 73	41 - 77
8	A	0.35	40	26	0.12	30	41	99
	G	0.42 - 1.48	10 - 44	18 - 22	0.11	22 - 37	29 - 49	73 - 130
	F	0.25 - 0.80	18 - 68	10 - 32	0.11 - 0.29	8 - 48	26 - 58	56 - 121
9	A	0.16 - 0.76	9 - 20	9 - 22	0.07 - 0.10	3 - 27	14 - 30	24 - 50
	G	0.26 - 0.76	13 - 40	11 - 32	0.09 - 0.24	7 - 37	24 - 79	26 - 125
	F	0.10 - 0.76	5 - 31	4 - 15	-	3 - 21	15 - 56	19 - 50

* cf. Table 5 for explanation; A: arable land, G: grassland, F: Forest

The presented results (Tab. I.2 a – g, annex I) show that not all elements were analysed in all countries. For Cd and Hg less data are available. Most countries could provide data for all of their respective MAT 11 LUs, whereas the main land use types within are covered

differently. Germany, The Netherlands and Romania made data available for all land use types. Results of the other countries are limited to a part of the land use types. The spatial distribution of the trace element contents is visualised in Figures I.1 – I.7 (median) and Figures II.1 – II.7 (90. percentile) in annex I.

Table 10 shows for the three main land use types (arable land, grassland, forest) the range of element contents (median) in each MAT 11 LU. Maximum median values exceed the respective lowest median values 1.1 to 10.9 times. The highest median values can be found in MAT 11 LUs 8 (Volcanic rocks) and 9 (Other rocks). They occur under grassland or forest but not under arable land. The lowest values are distributed to MAT LUs 1 (Undifferentiated alluvial or glacial deposits), 4 (Sandy material) and 9 (Other rocks). They emerge either under forest or arable land.

The range of median values is reflected likewise in the outline maps (Figures I.1 – I.7). Due to limits of presentability an aggregation of data in classes is required (see 6.2.1.1). The level of differentiation is partly governed by the width of classes and modifiable respectively.

In Table 11 the area fractions of the content classes are quoted for each element and country. In the following the results will be summarized briefly (see also Tab. I.2 a – g and Fig. I.1 – I. 7 in annex I):

Table 11 - Area fraction of content classes (median values) in the mapped countries [%]

Country	*Class**	*Cd*	*Cr*	*Cu*	*Hg*	*Ni*	*Pb*	*Zn*
Austria	1	50.4	42.9	-	11.0	-	6.0	-
	2	32.3	-	58.5	28.2	33.4	35.7	28.5
	3	-	39.3	24.2	0.7	49.4	26.8	49.2
	4	-	-	-	-	-	-	5.0
	5	-	-	-	-	-	14.3	-
	Sum	82.7	82.2	82.7	39.9	82.8	82.8	82.7
Estonia	1	44.8	-	67.1	73.2	-	73.2	44.8
	2	28.4	73.2	6.1	-	44.8	-	28.4
	3	-	-	-	-	28.4	-	-
	Sum	73.2	73.2	73.2	73.2	73.2	73.2	73.2
Finland	1	6.1	-	-	-	4.5	6.1	4.5
	2	-	4.5	6.1	-	1.5	-	1.5
	3	-	1.5	-	-	-	-	-
	Sum	6.1	6.0	6.1	-	6.0	6.1	6.0
France	1	11.1	1.3	11.6	37.0	1.3	1.3	1.3
	2	12.2	10.3	23.4	-	20.0	22.0	10.3
	3	13.7	11.7	2.0	-	-	13.7	11.7
	4	-	13.7	-	-	15.6	-	13.7
	Sum	37.0	37.0	37.0	37.0	36.9	37.0	37.0
Germany	1	55.5	36.3	40.7	61.1	41.7	1.0	24.8
	2	31.9	41.1	42.8	25.1	22.0	37.8	38.6
	3	2.3	12.0	5.8	3.1	22.4	30.3	21.8
	4	-	-	0.3	-	3.3	9.9	2.1
	5	-	0.2	-	-	0.2	10.5	2.4
	Sum	89.7	89.6	89.6	89.3	89.6	89.5	89.7
Ireland	1	37.5	-	1.2	62.1	22.1	13.6	1.2
	2	28.7	63.3	62.1	4.2	44.2	51.5	13.6
	3	-	3.0	3.0	-	-	1.2	51.5
	Sum	66.2	66.3	66.3	66.3	66.3	66.3	66.3
Lithuania	1	-	41.1	90.2	-	35.1	90.2	90.2

Country	*Class**	*Cd*	*Cr*	*Cu*	*Hg*	*Ni*	*Pb*	*Zn*
	2	-	49.1	-	-	55.1	-	-
	Sum	-	90.2	90.2	-	90.2	90.2	90.2
The Nether-lands	1	8.6	42.6	25.7	62.5	42.8	6.0	39.4
	2	70.5	0.4	34.1	17.3	37.2	56.9	3.4
	3	3.5	39.4	20.3	3.4	3.4	17.2	20.1
	4	1.0	-	3.4	-	-	0.2	17.1
	5	-	1.0	-	-	-	3.4	3.4
	Sum	83.6	83.4	83.5	83.2	83.4	83.7	83.4
Portugal	1	-	-	9.1	-	-	9.1	9.1
	2	24.4	9.1	24.4	-	9.1	24.4	24.4
	3	-	24.4	-	-	24.4	-	-
	Sum	24.4	33.5	33.5	-	33.5	33.5	33.5
Romania	1	-	2.4	-	-	-	-	-
	2	23.5	53.5	77.7	-	1.6	69.1	77.4
	3	2.1	22.5	7.9	-	41.5	11.4	8.2
	4	55.4	7.2	-	-	42.6	5.1	-
	5	4.6	-	-	-	-	-	-
	Sum	85.6	85.6	85.6	-	85.7	85.6	85.6
Slovak Rep.	1	69.8	-	19.5	38.0	18.5	29.3	-
	2	2.0	31.9	43.8	39.2	14.9	41.4	63.2
	3	5.4	38.7	13.9	-	41.8	6.5	14.0
	4	-	6.6	-	-	2.0	-	-
	Sum	77.2	77.2	77.2	77.2	77.2	77.2	77.2

* cf. Table 7 for explanation

For Cadmium the predominant part of the median values in the mapped countries is ≤ 0.75 mg·kg^{-1} (classes 1 - 3). An exception is Romania where the median values of more than half of the territory account for > 0.75 mg·kg^{-1}, 55 % belong to class 4 (> 0.75 – 1.00 mg·kg^{-1}) and 5 % to class 5 (> 1 mg·kg^{-1}).

The median values of Chromium are in the main parts of the territories ≤ 45 mg·kg^{-1} (classes 1 - 3). Few parts of France, Germany, the Netherlands, Romania and Slovakia show higher median values (classes 4 and 5).

The median values of Copper are mostly ≤ 30 mg·kg^{-1} (classes 1 - 3). Content class 2 (> 10 - 20 mg·kg^{-1}) has thereby the highest percentage in almost each country. In Lithuania median values are ≤ 10 mg·kg^{-1} (class 1) irrespective of parent material and land use. Few areas in Germany and the Netherlands contain median values belonging to class 4 (> 30 - 40 mg·kg^{-1}).

Mercury is the element with the lowest area coverage. Seven countries could provide comparable data. In none of the mapped countries the element contents (median) rise above 0.3 mg·kg^{-1} (class 3). The predominant part can be allocated to classes 1 (≤ 0.1 mg·kg^{-1}) and 2 (< 0.1 – 0.2 mg·kg^{-1}).

The presentation of median values for Nickel adds up to a more differentiated view. The broadest range of values can be found in Germany, with median values ≤ 10 mg·kg^{-1} (class 1) up to > 40 mg·kg^{-1} (class 5), whereby 42 % belongs to class 1 (≤ 10 mg·kg^{-1}). As Ni is a typical geogenic element, the MAT 11 LUs are in parts recognisable well. Romania with a similar complex geology shows a less diversified spectrum. There, 84 % of the territory contains median values between 20 - 40 mg·kg^{-1} (class 3 and 4). Generally, the median values of the major part of areas do not exceed content class 3.

The map of Lead contents in European soils illustrates likewise a highly distinguished picture, especially in Central Europe. Austria, Germany and The Netherlands show median values up to > 60 $mg \cdot kg^{-1}$ (class 5). These values occur mainly under forest and points out the influence of airborne deposition of lead in forests. Constantly low (≤ 15 $mg \cdot kg^{-1}$) remain the median values in Estonia, Lithuania and Finland.

Like for the previously regarded trace elements a differentiated view can be presented for Zinc. The German and Dutch values cover again the whole range of content classes (≤ 30 $mg \cdot kg^{-1}$ to > 120 $mg \cdot kg^{-1}$), whereas in Lithuania all median values belong to class 1 (≤ 30 $mg \cdot kg^{-1}$). In the major part of the countries median values are ≤ 90 $mg \cdot kg^{-1}$.

The spatial coverage of the countries is, with the exception of Finland, France and Portugal, fairly good (Fig. I.1 – I.7, Tab. 11). "White areas" can be traced back to different reasons and will be explained by the example of Finland. According to Tables 8 and 9, 5.5 % of Finland's area does not contain information regarding soil parent material. 17.2 % are not under agricultural or forestal use (whereby overlapping can occur - no information about soil parent material plus different land use). The main part of the missing information is however explained by the available database: Finland provided data for two out of four MAT 11 LUs. The data were restricted to arable land (Tab. I.2 a – g, annex I). As in Finland the MAT 11 units are mainly under forestal use, a spatial coverage of not more than 6% could be obtained with the given data.

The Portuguese data record is hardly more extensive, anyhow a higher spatial coverage can be achieved (34 %). Portugal provided forest data for five out of six MAT 11 LUs, whereas the number of samples (n) of the MAT units 1 - 3 are ≤ 3 and therefore not considered in the evaluation (Tab. I.2 a – g, annex I). The remaining MAT 11 LUs 4 and 7 account for 91 % of the territory. One third of that area is covered by forest where data are available. Due to that fact the better spatial coverage can be explained.

France made data for five out of eight MAT 11 LUs available (84 % of the territory), but for arable land only. In total a spatial coverage of 37 % could be achieved.

The maps enable a differentiated overview of the element contents. The influence of soil parent material and/or land use is noticeable to a different degree. Cross-bordering MAT 11 units show mostly a good compliance (Fig. I.1 – I.7). Contents of similar reference units (same MAT 11 LU + land use) on both sides of the border diverge seldom more than one unit.

On the basis of the generated maps the current status of available data on heavy metal contents in European top soils can be illustrated in a good way. A comparative spatial visualisation of heavy metal contents, which derive from reasonably harmonised databases, is possible to a certain extent. The degree of spatial coverage differs, depending on the element. Comparing the spatial coverage of median and 90. percentile values the level of the latter is lower (see Fig. I / II 1 – 7, annex I).

The maps show also that for the major part of Europe no adequate data are educible so far. The reasons therefore are manifold, whereas three main points can be mentioned:

- Data could not be prepared in time for this report, but a delivery was announced (e.g. Czech Republic).
- Data were not comparable because of missing harmonisation criteria (e.g. Norway), different geographical references (e.g. Belgium), etc.
- Relevant data in necessary quantity and / or quality are presently not available (e.g. Spain).

The listed reasons point out also that in many countries relevant data generally exist. An improvement of the database within short terms seems to be possible.

6.2.1.3 Significance of the MAT 11 level

In the course of the evaluation some countries expressed discontentment in matters of accuracy and significance of the MAT 11 level. As described in chapter 6.2.1.1 the MAT 11 LUs are characterised by a high heterogeneity. Using the example of the German evaluation, some difficulties are pointed out in the following.

In the German classification for soil parent material fifteen main soil parent material units (BAG unit) are differentiated (Utermann *et al.* 1999). Depending on the parent material heavy metal background contents vary significantly. Figure 6 illustrates exemplarily the Ni- and Pb- contents in German top soils (arable land) from different parent material (cf. Utermann et al. 2003).

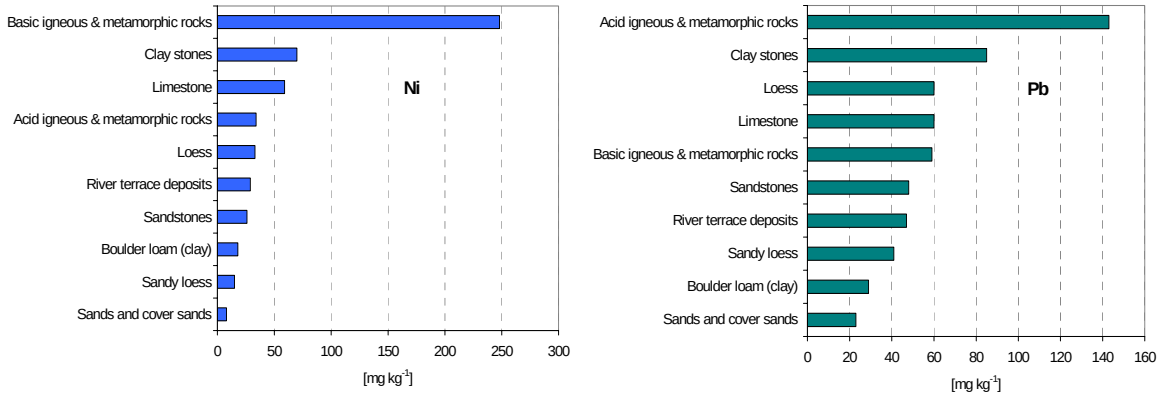


Figure 6 - Ni - and Pb - contents (90. percentile values) in German top soils (arable land) from different parent material

Following the guideline of the questionnaire the point data (including BAG unit) were allocated to the MAT 11 units and summarized. Table 12 shows the distribution of the assigned samples to the MAT 11 LUs.

As can be seen the German soil parent material units (BAG units) are only conditionally transferable to the MAT 11 LUs. For example the MAT 11 LU 'Sandy material' is governed chiefly by two BAG-units "Sands and cover sands" and "Sandstone". But the heavy metal background values of these two units differ by the factor 2 (Pb) and 3 (Ni) respectively (Utermann *et al.* 1999, 2003). Another example is the MAT 11 LU 'Loamy material' that includes besides a high share of 'Loess sites' a comparatively small amount of samples with the parent material 'Basic igneous and metamorphic rocks'. However, a closer look at the results showed that for example the upper Ni-values were almost exclusively determined by samples of the latter unit.

With regard to the given results the accuracy and significance of the MAT 11 units has to be scrutinised critically. At least for countries with a complex geology, it seems questionable if the heterogeneity is covered sufficiently through the high aggregation level. Another reference level should be taken into consideration. Moreover the site-specific data should be checked for their spatial and pedoregional representation. Criteria for a consistent and comprehensible procedure should be established. A minimum level of spatial coverage of the legend units should be ensured.

Table 12 - Allocation of German point data
(including information concerning soil parent material – BAG units) to the MAT 11 LUs

MAT 11 / BAG	Undifferentiated alluvial or glacial deposits	Calcarous rocks	Clayey material	Sandy material	Loamy material	Crystalline rocks and migmatites	Volcanic rocks	Other rocks
Marine, brackish, tidal sediments	46	-	-	-	-	-	-	-
Sediments in fluvial plains	297	-	-	-	-	-	-	-
River terrace deposits	169	-	1	-	11	-	-	1
Sands and cover sands	44	2	125	551	17	7	-	40
Boulder loam (clay)	-	1	231	31	4	-	-	21
Loess	66	23	11	16	539	35	6	2
Sandloess	10	-	2	6	131	-	-	-
Limestone	14	193	67	22	57	2	1	-
Claystone	5	67	79	17	133	548	2	-
Sandstones	12	19	23	184	28	20	1	-
Basic igneous and metamorphic rocks	2	-	2	1	69	18	80	3
Tuff rich in bases	-	-	-	-	-	3	3	-
Acid igneous and metamorphic rocks	6	-	3	4	109	245	8	10
Fens / Bogs	1	-	17	19	-	-	-	78
Sum	672	305	561	851	1098	878	101	155

6.2.2 Heavy metal contents in European soils according to soil pH

The evaluations according to soil pH and texture were mainly conducted with regard to the revision of the Sewage Sludge Directive 86/279/EEC. In this context, a more differentiated presentation of limit values is likely. The variability of soils and their usual contents respectively shall be taken more into account. For this, eligible bases of reference have to be assessed. In the context of the survey evaluations in relation to the two mentioned soil parameters were accomplished and their significance was checked.

The evaluation according to soil pH includes data from the current questionnaire (phase II, 2nd part) as well as from the preliminary study (European Soil Bureau 2000). Fourteen countries could provide data according to the postulated pH classes (Tab. I.3 a – g, annex I). Note that the values were analysed by different methods. Therefore the results are only partly comparable.

A comparison of the values which were determined in the same solution produces little consistent results. In Figures 7a and 7b different trends are illustrated exemplarily. For example in England / Wales the highest Zn contents can be found at pH (H_2O) 5-6. With increasing or decreasing pH the contents tend to decrease. The French data show the opposite trend with lowest Zn contents in this pH class. In contrast the Slovakian contents maintain at the same level throughout all pH classes (H_2O). The pH ($CaCl_2$)-data show similarly varying trends.

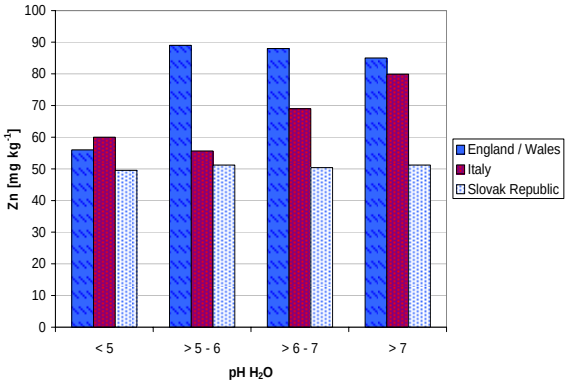


Figure 7a - Country-specific Zn contents in relation to pH (H_2O) classes

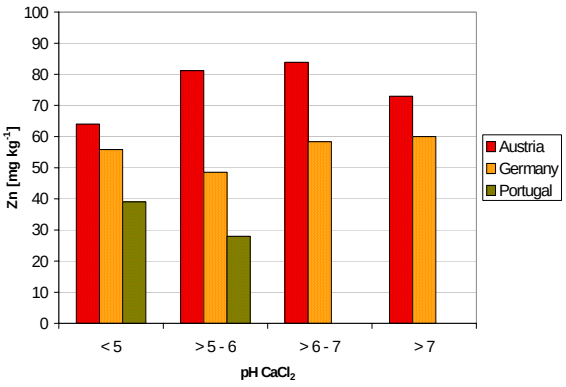


Figure 7b - Country-specific Zn contents in relation to pH ($CaCl_2$) classes

Comparing median values of the lowest (< pH 5) and highest pH class (> pH 7), it can be pointed out that Cu-, Ni- and Zn contents tends to be higher at high pH whereas Hg and Pb contents rather decrease (Tab. I.3 a – g). Cd and Cr contents act inconsistently. A clearer influence of pH on *aqua regia* extractable heavy metal contents cannot be deduced from the given data.

With regard to the limited number of available data, it remains to annotate that soil pH is in most of the relevant surveys and monitoring programmes a mandatory parameter to determine. Thus, an extension of the database should be possible.

6.2.3 Heavy metal contents in European soils according to soil texture

In the context of the current questionnaire eleven European countries dispose of comparable results (Tab. I.4 a – g, annex I). Texture related evaluations were carried out also in the preceding studies (European Soil Bureau 2000, Joint Research Centre 2001). At this, values refer to different texture classes. For example England / Wales distinguishes between seven classes, whereas Denmark or the Czech Republic separate two categories. The texture classes follow often national nomenclatures which deviate partly from international texture classes according to FAO or US Soil Taxonomy. A direct transfer of the evaluated data to the predetermined texture classes in this approach is not possible. Therefore, the original data of soil particle size would be necessary. Another point of concern in this context is the inconsistent partition of the fine soil (sand, silt, clay) in the available nomenclatures (particle size of sand: 2000 – 63 µm Ø (e.g. Germany) or 2000 – 50 µm Ø (e.g. Italy)).

Depending on the regarded trace element and country, different trends can be described (Tab. I.4 a - g, annex I). The results are illustrated exemplarily for Cu and Zn in Figures 8 and 9. For reasons of clarity not all countries are presented.

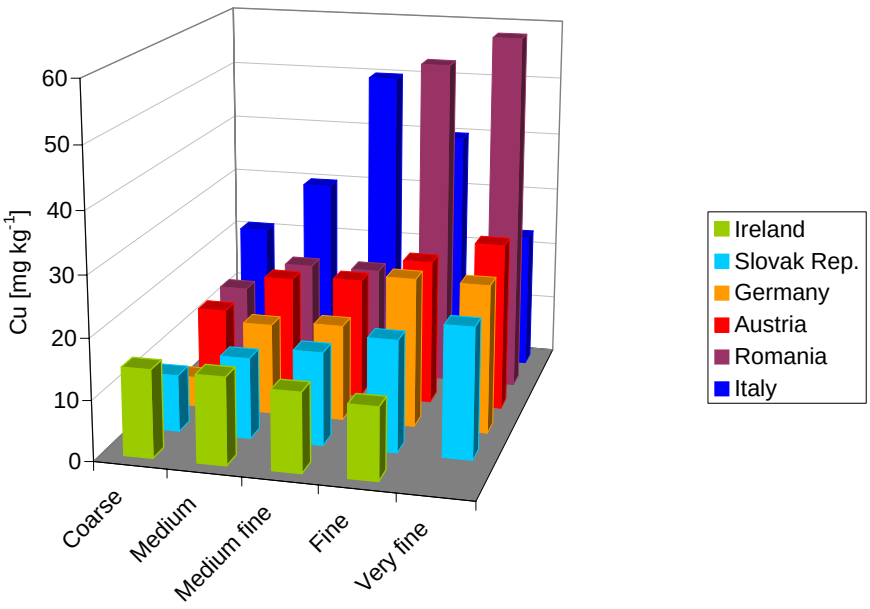


Figure 8 - Cu contents (Median values) in relation to soil texture classes

As can be seen in Figure 8, Austrian, German and Slovakian median values rise moderately when texture is getting finer. The Romanian values ascend also but with a big leap between the texture classes “Medium fine” and “Fine”. On the other hand the median values of Ireland tend to decrease in the finer texture classes. But, there are no values for the texture class “Very fine”. The Italian data show a pyramidal trend with the highest median value at texture class “Medium fine”.

The evaluation for Zn produces partly analogous but also discriminative tendencies (Fig. 9). Like for Cu the Austrian, German and Slovakian median values increase when texture is getting finer, whereby there is a bend at texture class “Medium fine”. Thereby the range of values differs considerably: Slovak Republic (Δ 21 $mg \cdot kg^{-1}$) - Germany (Δ 106 $mg \cdot kg^{-1}$). The Romanian values decrease up to texture class “Medium fine” and increase then. The Irish values show an opposite trend. Median values of Italia show a slight increase at first and keep then almost constant in the finer texture classes.

From the given data there is no definite trend of heavy metal contents in relation to soil texture classes deducible. In many cases increasing contents can be stated when texture is getting finer. Anyhow the opposite trend occurs as well. Texture is strongly related to the soil parent material. Therefore, similar trends are rather expected if the underlying data records are based on comparable groups of soil parent material. Another point to mention is that the underlying number of samples varies in each texture class and each country (Tab. I.4 a – g, annex I). Values relating to the texture class “Very fine” should be interpreted carefully as this class is, with the exception of the Slovak Republic and Estonia, poorly represented.

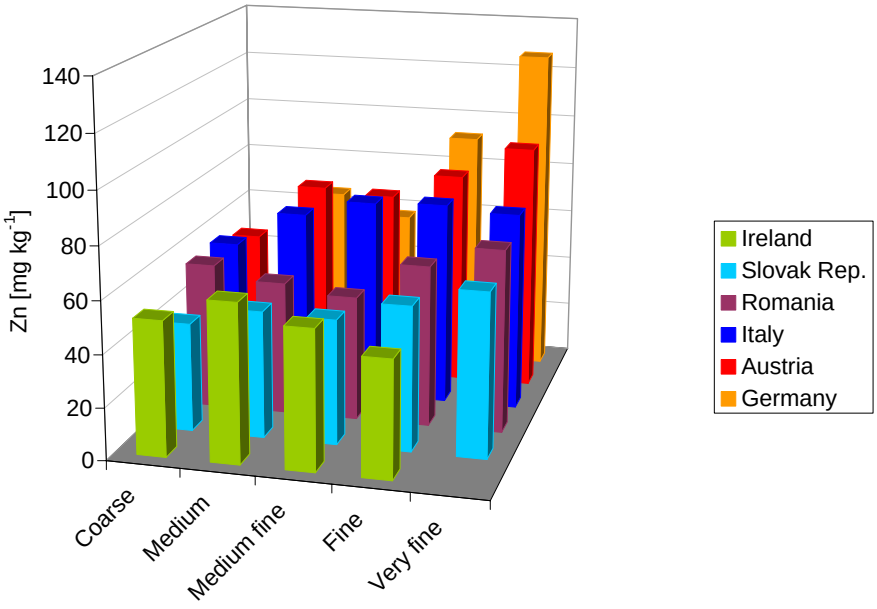


Figure 9 - Zn contents (Median values) in relation to soil texture classes

6.2.4 Organic matter contents in European soils

Organic matter contents were evaluated in relation to soils from different groups of soil parent material (MAT 11 level) and land use. Comparable information about organic matter or organic carbon contents is likewise available for eleven countries. Table I.5 (annex I) shows the organic matter contents. Slovak data were not presented in the table as they refer to soil types. The results (median, 90. percentile) were also visualised in outline maps (Fig. I.8 / II.8, annex I). Concerning the compilation of the maps the annotations of chapter 6.2.1.1 apply. The values of organic matter were classified into five classes (Tab. 13) following the humus classes of AG Boden (1996). The Norwegian data could not be illustrated in the map, because CORINE data were not available. Statistical evaluations were carried out exemplarily for median values as there are more data available than for the 90. percentile.

Table 13 - Classes of organic matter contents for the spatial representation [Mass-%]

Class	*OM*	*Description*
1	≤ 2	Low humus content
2	>2 – 4	Middle humus content
3	>4 – 8	High humus content
4	>8 – 15	Very high humus content
5	> 15	Extremely high humus content

Table 14 illustrates the range of organic matter contents (median) of the three main land use types within each MAT 11 LU. Highest median values occur for all three main land use types in MAT 11 LU 9 (Other rocks – Organic materials). But, this MAT 11 LU shows for arable land and forest also the lowest median values. The ratio between the highest and lowest values is respectively high (up to 36.5 times). Organic matter content in soils under grassland and forest tends to be higher than under arable land.

Table 14: Range of organic matter contents (median) within the MAT 11/ land use -units [Mass-%]

MAT 11 LU*	***Arable land***	***Grassland***	***Forest***
1	2.2 - 10.1	2.0 - 7.6	2.0 - 7.9
2	2.4 - 3.9	3.7 - 10.0	5.0 - 12.7
3	1.5 - 10.6	2.6 - 5.4	2.6 - 8.2
4	1.9 - 4.3	3.8 - 5.7	2.6 - 17.2
5	1.7 - 2.5	2.1 - 7.9	3.4 - 9.2
6	-	3.1 - 10.9	4.0
7	2.4 - 3.9	4.2 - 8.5	6.5 - 9.7
8	3.1	3.8 - 3.9	7.0 - 12.7
9	1.5 - 16.8	2.4 - 22.8	2.0 - 73.0

*Cf. Table 5 for explanation

The ranges listed in Table 14 give a first impression of the main influence of land use on the organic matter contents in soils. It becomes more obvious in the outline maps (Fig. I.8 and Fig. II. 8), where the spatial distribution of the organic matter contents follows mainly the land use units (see also Fig. 5). Effects of the climatic conditions (another main factor) are recognisable to a certain extent. For example, arable land in Finland and Norway show comparatively high humus contents. Anyhow, for more comprehensive statements an extended database is essential.

Like for the evaluation of the trace element contents, the area fractions of the organic matter classes (in per cent) were calculated for each country and presented in Table 15. A brief description of the results is given consecutively (see also Tab. I.5 and Fig. I.8).

Table 15 - Area fraction of organic matter classes (median values) in the mapped countries [%]

Class	***A***	***EST***	***FIN***	***F***	***D***	***IRL***	***LT***	***NL***	***P***	***RO***
1	-	-	-	11.6	12.2	-	-	-	-	12.5
2	22.5	73.2	-	25.4	37.5	7.6	35.1	20.1	9.1	59.2
3	11.4	-	-	-	20.7	57.4	55.1	56.6	24.4	13.9
4	48.9	-	6.1	-	18.5	-	-	0.2	-	-
5	-	-	-	-	0.8	1.2	-	6.7	-	-
Sum	82.8	73.2	6.1	37.0	89.7	66.2	90.2	83.6	33.5	85.6

The area fractions of the organic matter classes vary in each country. In Austria, the median values of about 60 % of the area lie in between > 4 and 15 mass-% (class 3 and 4). They belong to grassland or forest[8]. Soils of arable land are middle humous (class 2). Almost half of the German territory shows organic matter contents ≤ 4 mass-% (class 1 - 2) whereas the land use is thereby mainly arable land. Contents higher than 4 mass-% occur under forest or grassland. The humus contents of arable land in Finland and Norway are comparatively high (class 4). Whereas in France the respective organic matter contents (arable land) do not exceed 4 mass-% (class 2). In Ireland the main part of the island shows median values between 4 and 8 mass-% (high humus content). They belong all to grassland. ¾ of the Dutch area comprise soils with humus contents ≤ 8 mass-% (class 1 - 3). Organic matter contents of more than 15 mass-% can be found in soils of the MAT 11 LU 9 (Other rocks / Organic materials). In Portugal and Lithuania, the soils are middle to high humous (class 2 - 3). Here it should be kept in mind that the Portuguese

[8] *The breakdown according to land use types was conducted but not presented in the table.*

data refer to forest soils only. The Estonian soils show humus contents between 2 and 4 mass-% (class 2) irrespective of the land use type. In Romania organic matter contents of the main part of the area account for ≤ 4 mass-% (class 1 - 2). They do not exceed 8 mass-% (class 3).

The spatial coverage is similar to the one of heavy metals and range between 6 % (Finland) and 90 % (Lithuania). Regarding the 90 percentile (Tab. I.5, Fig. II.8), the spatial coverage decreases. The data gaps are also explainable by the reasons mentioned in chapter 6.2.1.2. Accordingly, a comparative spatial visualisation is possible to a limited extent. As organic carbon / matter is a key parameter for many soil relating problems a larger database could be expected.

The stratification according to parent material and land use gives a first idea of the distribution of organic matter contents in European soils. However, soil organic matter is much more closely related to soil type and land use than to parent material. Therefore, the distribution shown in Figures I.8 and II.8 (Annex I) should not be regarded as truly representative. Work done recently by Jones et al. (2003), based on Soil Typological Units (STU) in the European Soil Database and CORINE land use, is thought to provide a more realistic distribution of organic matter for Europe.

7 References

AG Boden (1996): *Bodenkundliche Kartieranleitung*. 4. Aufl., Nachdruck; Hannover, Germany.

Bruyas, P. (2002): *Land Use – Land Cover: LUCAS 2001 Primary Results.* In: EUROSTAT (2002): Statistics in focus, Agriculture and fisheries, Theme 5 – 8 / 2002; http://www.eu-datashop.de/download/EN/sta_kurz/thema5/nn_02_08.pdf

Commission of the European Communities (2002): *Communication of 16 April 2002 from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions - Towards a Thematic Strategy for Soil Protection.* COM (2002) 179 final; http://europa.eu.int/scadplus/printversion/en//lvb/l28122.htm

Čurlík, J. & Šefčik, P. (2001): *Heavy Metals and Organic Matter in Slovakian Soils*. Bratislava, Slovak Republic.

Direction générale des ressources naturelles et de l'environnement, Office wallon des Déchets (2001): *Inventaire de la qualité des sols en Région wallonne*. Première édition; Jambes, Belgium

European Soil Bureau – Scientific Committee (1999a): *Heavy Metals (Trace elements) and Organic Matter Content of European Soils – A Feasibility Study.* Report by the European Soil Bureau – Scientific Committee. Authors: Baize, D., Bidoglio, G., Cornu, S., Brus, D., Breuning-Madsen, H., Eckelmann, W., Ernsten, V., Gorny, A., Jones, R.J.A., King, D., Langenkamp, H., Loveland, P.J., Lobnik, F., Magaldi, D., Montanarella, L., Utermann & J., van Ranst, E.; Ispra, Italy

European Soil Bureau (1999b): *European Soil Data Base, Version 1.0.* Ispra, Italy

European Soil Bureau – Working Group on Heavy Metals in European Soils (2000): *Heavy Metal (Trace Element) and Organic Matter Contents of European Soils – Results of Preliminary Evaluations for 4 Member States*. Authors: Baize, D., Breuning-Madsen H., Eckelmann W., Gorny, A., Jones, Loveland, P.J. & Utermann, J.; Ispra, Italy.

Henderson, B.L. & Bui, E.N. (2002): *An improved calibration curve between soil pH measured in water and* $CaCl_2$. In: Aust. J. Soil Res., 2002, 40, p. 1399-1405; Melbourne, Australia

ISO 10390 (1994)*: Soil Quality – Determination of pH.*

ISO 11466 (1995)*: Soil Quality – Extraction of trace elements soluble in aqua regia*.

ISO / CD 19258 (2002)*: Soil Quality – Guidance on the determination of soil background values*.

Joint Research Centre, Institute for Environment and Sustainability, Soil and Waste Unit (2001): *Progress Report: Trace Element and Organic Matter Contents of European Soils – First results of the second phase of the "Short Term Action"*. Authors: Utermann, J. & Düwel, O.; Ispra, Italy.

Jones, R.J.A, Hiederer R., Rusco E., Loveland P.J. & Montanarella L. (2003). *Topsoil Organic Carbon in Europe.* Proceedings of the 4th European Congress on Regional Geoscientific Cartography and Information Systems (17.-20.06.2003), Vol.1, p. 249-251; Bologna, Italy.

LABO (1998): Bund/Länder Arbeitsgemeinschaft Bodenschutz (Heft 4): *Hintergrundwerte für organische und anorganische Stoffe in Böden*. 2. überarbeitete und ergänzte Auflage. In: Rosenkranz, D., Bachmann, G., König, W. & Einsele, G. [Hrsg.]: Bodenschutz. Ergänzbares Handbuch der Maßnahmen und Empfehlungen für Schutz, Pflege und Sanierung von Böden, Landschaft und Grundwasser; Berlin, Germany.

McGrath, S.P. & Loveland, P.J. (1992). *The Soil Geochemical Atlas of England and Wales*. London, UK.

Petersell, V., Mõttus, V., Täht, K. & Unt, L. (1996): *Bulletin of the Geochemical Monitoring of Soil 1992 – 1994*. Tallinn, Estonia.

Petersell, V., Ressar, H., Carlsson, M., Mõttus, V., Enel, M., Mardla, A. & Täht, K. (1997): *The Geochemical Atlas of the Humus Horizon of Estonian Soil*. Tallinn, Estonia.

Sáňka, M. & Němec, P. (2001): *ISO/TC 190/SC 7/WG 7, Background values – Position Document – Czech Republic*. Brno, Czech Republic.

Trávník, K. et al. (2000): *Contents of Risk Elements in Agricultural Soils of the Czech Republic - Cartograms of selected risk element contents*. Brno, Czech Republic.

Utermann, J., Düwel, O., Fuchs, M., Gäbler, H.-E., Gehrt, E., Hindel, R. & Schneider, J. (1999): *Methodische Anforderungen an die Flächenrepräsentanz von Hintergrundwerten in Oberböden*. UBA Texte 95/99; Berlin, Germany.

Utermann, J., Düwel, O., Gäbler, H.-E. & Hindel, R. (2000): *Beziehung zwischen Totalgehalten und königswasserextrahierbaren Gehalten von Schwermetallen in Böden.* In: Rosenkranz, D., Bachmann, G., König, W. & Einsele, G. [Hrsg.]: Bodenschutz. Ergänzbares Handbuch der Maßnahmen und Empfehlungen für Schutz, Pflege und Sanierung von Böden, Landschaft und Grundwasser; Berlin, Germany.

Utermann, J., Düwel, O. & Raber, B. (2003): *Background values for trace elements in German soils – The federal perspective* -. Proc. 7th Intern. Conf. On the Biogeochem. of Trace Elements; Vol 2, 402 – 403, Uppsala, Sweden.

Annex I: Evaluated data

- Table sets and maps -

Contents of Annex I

Evaluation according to soil parent material and land use

Tab. I.1: CORINE Land Cover nomenclature and reclassification key

CODE	LEVEL1	LEVEL2	LEVEL3	Reclass
1	Artificial surfaces	Urban fabric	Continuous urban fabric	6
2	Artificial surfaces	Urban fabric	Discontinuous urban fabric	6
3	Artificial surfaces	Industrial, commercial and transport units	Industrial or commercial units	6
4	Artificial surfaces	Industrial, commercial and transport units	Road and rail networks and associated land	6
5	Artificial surfaces	Industrial, commercial and transport units	Port areas	6
6	Artificial surfaces	Industrial, commercial and transport units	Airports	6
7	Artificial surfaces	Mine, dump and construction sites	Mineral extraction sites	6
8	Artificial surfaces	Mine, dump and construction sites	Dump sites	6
9	Artificial surfaces	Mine, dump and construction sites	Construction sites	6
10	Artificial surfaces	Artificial, non-agricultural vegetated areas	Green urban areas	6
11	Artificial surfaces	Artificial, non-agricultural vegetated areas	Port and leisure facilities	6
12	Agricultural areas	Arable land	Non-irrigated arable land	1
13	Agricultural areas	Arable land	Permanently irrigated land	1
14	Agricultural areas	Arable land	Rice fields	1
15	Agricultural areas	Permanent crops	Vineyards	4
16	Agricultural areas	Permanent crops	Fruit trees and berry plantations	4
17	Agricultural areas	Permanent crops	Olive groves	4
18	Agricultural areas	Pastures	Pastures	2
19	Agricultural areas	Heterogeneous agricultural areas	Annual crops associated with permanent crops	1
20	Agricultural areas	Heterogeneous agricultural areas	Complex cultivation patterns	1
21	Agricultural areas	Heterogeneous agricultural areas	Land principally occupied by agriculture, with significant areas of natural vegetation	1
22	Agricultural areas	Heterogeneous agricultural areas	Agro-forestry areas	1
23	Forest and semi natural areas	Forests	Broad-leaved forest	3
24	Forest and semi natural areas	Forests	Coniferous forest	3
25	Forest and semi natural areas	Forests	Mixed forest	3
26	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Natural grasslands	2
27	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Moors and heathland	5
28	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Sclerophyllous vegetation	3

29	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Transitional woodland-shrub	3
30	Forest and semi natural areas	Open spaces with little or no vegetation	Beaches, dunes, sands	5
31	Forest and semi natural areas	Open spaces with little or no vegetation	Bare rocks	5
32	Forest and semi natural areas	Open spaces with little or no vegetation	Sparsely vegetated areas	5
33	Forest and semi natural areas	Open spaces with little or no vegetation	Burnt areas	5
34	Forest and semi natural areas	Open spaces with little or no vegetation	Glaciers and perpetual snow	5
35	Wetlands	Inland wetlands	Inland marshes	5
36	Wetlands	Inland wetlands	Peat bogs	5
37	Wetlands	Maritime wetlands	Salt marshes	5
38	Wetlands	Maritime wetlands	Salines	6
39	Wetlands	Maritime wetlands	Intertidal flats	5
40	Water bodies	Inland waters	Water courses	7
41	Water bodies	Inland waters	Water bodies	7
42	Water bodies	Marine waters	Coastal lagoons	7
43	Water bodies	Marine waters	Estuaries	7
44	Water bodies	Marine waters	Sea and ocean	7
49	NODATA	NODATA	NODATA	
50	Sea and ocean	Sea and ocean	Sea and ocean	7

Tab. I.2 a: Cd contents in European soils according to soil parent material and land use [mg*kg^{-1}] - Aqua regia basis -

Mat 11 unit	Parent material		Austria			Finland			France			Germany			Ireland			The Netherlands			Portugal			Estonia			Slovakia			Romania		
			n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.
1	**Undifferentiated alluvial or glacial deposits**																															
Land use		Arable land	83	0.20	0.37	11	0.07	-				220	0.36	1.50				767	0.30	0.60				225	0.26	0.52	818	0.18	0.33	113	0.76	1.23
		Grassland	52	0.30	0.61							135	0.75	5.99	11	0.12	-	385	0.50	1.10				64	0.28	0.56				47	0.67	1.23
		Forest	11	0.13	-							108	0.21	2.01				50	0.08	0.30	1	-	-	123	0.24	0.45	30	0.25	0.51	24	0.76	1.47
		Other land use										42	0.41	2.57				181	0.50	1.00										10	0.76	-
2	**Calcareous rocks**																															
Land use		Arable land	32	0.29	0.42				144	0.52	1.57	79	0.34	0.90	12	0.47	-										80	0.33	0.67	19	1.23	-
		Grassland	204	0.43	0.80							39	0.26	1.28	91	0.43	0.93													13	1.13	-
		Forest	91	0.36	0.97							86	0.38	1.50							3	-	-				205	0.67	1.69	9	1.13	-
		Other land use										18	0.29	-																3	-	-
3	**Clayey materials**																															
Land use		Arable land				43	0.14	0.37	93	0.29	0.51	234	0.25	0.70																30	0.33	1.23
		Grassland										68	0.22	0.60																13	0.76	-
		Forest										161	0.16	0.70							1	-	-							8	0.90	-
		Other land use										16	0.28	-																2	-	-
4	**Sandy materials**																															
Land use		Arable land	40	0.23	0.42				9	0.25	-	216	0.19	0.43				321	0.30	0.70							29	0.11	0.25	3	-	-
		Grassland										117	0.23	0.70	41	0.22	0.36	345	0.30	0.70										3	-	-
		Forest										364	0.15	0.60	10	0.09	-	240	0.10	0.50	42	<0.5	0.50				35	0.18	0.38	2	-	-
		Other land use										38	0.21	0.61				177	0.30	0.70										1	-	-
5	**Loamy materials**																															
Land use		Arable land	721	0.20	0.33				20	0.34	0.76	495	0.34	0.70				18	0.80	-							329	0.11	0.20	203	0.33	1.23
		Grassland	337	0.28	0.63							140	0.44	0.91	11	0.21	-	6	0.50	-										15	0.76	-
		Forest	109	0.11	0.36							248	0.23	0.95				5	0.10	-										15	0.85	-
		Other land use										17	0.32	-				6	0.70	-										11	0.33	-
6	**Detrital formations**																															
Land use		Arable land																											76	0.18	0.37	2	-	-
		Grassland	8	0.27	-																									10	0.76	-
		Forest																											283	0.25	0.50	30	1.23	1.84
		Other land use																																
7	**Crystalline rocks and migmatites**																															
Land use		Arable land	224	0.19	0.30				19	0.16	-	120	0.41	0.86	10	0.23	-										283	0.11	0.25	3	-	-
		Grassland	589	0.29	0.58							110	0.44	0.93	74	0.21	0.36													22	0.76	1.23
		Forest	224	0.11	0.30							450	0.23	0.83							101	0.50	2.00				539	0.18	0.50	79	0.94	1.73
		Other land use										19	0.32	-																			
8	**Volcanic rocks**																															
Land use		Arable land										10	0.35	-																			
		Grassland										70	0.42	2.27																10	1.48	-
		Forest										12	0.42	-													109	0.25	0.58	12	0.80	-
		Other land use										4	-	-																			
9	**Other rocks**																															
Land use		Arable land	4	-	-							26	0.16	0.60				127	0.40	0.70										63	0.76	1.73
		Grassland	6	0.44	-							54	0.26	1.05				171	0.70	1.50										66	0.76	1.23
		Forest										16	0.54	-				10	0.10	-										85	0.76	1.49
		Other land use										7	0.50	-				27	1.00	2.00										7	0.76	-

Tab. I.2 b: Cr contents in European soils according to soil parent material and land use [mg*kg^{-1}] - Aqua regia basis -

Mat 11 unit	Parent material	Austria			Finland			France			Germany			Ireland			The Netherlands			Portugal			Estonia			Lithuania			Slovakia			Romania		
		n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.
1	**Undifferentiated alluvial or glacial deposits**																																	
Land use	Arable land	88	35	50	11	22	-				252	24	45				499	40	74				297	21	30	789	16	23	818	40	55	113	22	37
	Grassland	48	36	55							132	35	66	11	22	-	344	33	64				79	18	27	724	15	22				47	19	30
	Forest	12	11	-							166	20	41				48	7	49	1	-	-	161	17	26	540	10	18	30	33	59	24	31	72
	Other land use										43	30	54				56	24	49													10	22	-
2	**Calcareous rocks**																																	
Land use	Arable land	44	35	59				155	52	86	83	34	57	12	21	-													80	38	55	19	22	-
	Grassland	196	38	57							41	34	63	91	18	28																13	22	-
	Forest	147	10	17							136	30	45							3	-	-							205	29	51	9	56	-
	Other land use										23	28	44																			3	-	-
3	**Clayey materials**																																	
Land use	Arable land				43	33	71	103	43	73	267	9	37													353	18	25				30	20	24
	Grassland										86	18	47													275	18	25				13	19	-
	Forest										161	18	47							1	-	-				50	18	25				8	50	-
	Other land use										16	12	-																			2	-	-
4	**Sandy materials**																																	
Land use	Arable land	43	31	45				19	11	-	261	8	18				205	11	29							91	12	16	29	37	52	3	-	-
	Grassland										121	9	27	41	20	32	309	10	25							165	12	16				3	-	-
	Forest										368	7	23	10	19	-	228	5	13	42	19	44				420	9	14	35	24	39	2	-	-
	Other land use										38	8	23				92	7	33													1	-	-
5	**Loamy materials**																																	
Land use	Arable land	708	38	55				27	29	46	527	18	41				8	62	-										329	39	46	203	22	33
	Grassland	311	35	50							135	23	60	11	23	-	4	-	-													15	19	-
	Forest	111	10	15							346	27	51				5	18	-													15	46	-
	Other land use										37	32	53				1	-	-													11	22	-
6	**Detrital formations**																																	
Land use	Arable land																												76	47	84	2	-	-
	Grassland	7	43	-																												10	16	-
	Forest																												283	40	79	30	49	65
	Other land use																																	
7	**Crystalline rocks and migmatites**																																	
Land use	Arable land	204	33	58				19	36	-	120	30	55	10	33	-													283	36	61	3	-	-
	Grassland	438	33	55							111	29	52	74	25	39																22	15	24
	Forest	209	8	17							594	34	55							101	34	99							539	27	56	79	36	68
	Other land use										21	43	93																					
8	**Volcanic rocks**																																	
Land use	Arable land										11	40	-																					
	Grassland										13	44	-																			10	10	-
	Forest										72	68	171																109	18	33	12	38	-
	Other land use										4	-	-																					
9	**Other rocks**																																	
Land use	Arable land	4	-								32	9	20				101	14	26													63	20	33
	Grassland	6	36								73	13	44				151	40	80													66	22	38
	Forest										17	10	-				10	5	-													85	31	60
	Other land use										4	-	-																			7	26	-

Tab. I.2 c: Cu contents in European soils according to soil parent material and land use [mg*kg^{-1}] - Aqua regia basis -

Mat 11 unit	Parent material	Austria			Finland			France			Germany			Ireland			The Netherlands			Portugal			Estonia			Lithuania			Slovakia			Romania		
		n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.
1	**Undifferentiated alluvial or glacial deposits**																																	
Land use	Arable land	86	23	35	11	11	-				284	17	45				508	14	27				297	9	24	789	8	13	818	21	38	113	18	35
	Grassland	49	30	42							164	22	76	11	12	-	353	22	54				79	10	22	724	8	13				47	18	37
	Forest	11	17	-							173	11	47				50	4	9	1	-	-	161	7	20	540	5	10	30	18	34	24	18	42
	Other land use										47	24	176				72	16	50													10	18	-
2	**Calcareous rocks**																																	
Land use	Arable land	38	23	32				155	18	29	82	20	42	12	12	-													80	22	36	19	24	-
	Grassland	243	21	34							40	20	34	91	13	27																13	24	-
	Forest	145	12	25							156	15	30							3	-	-							205	15	34	9	21	-
	Other land use										20	19	56																			3	-	-
3	**Clayey materials**																																	
Land use	Arable land				43	16	41	103	22	35	279	9	24													353	10	14				30	18	-
	Grassland										89	11	32													275	10	15				13	18	-
	Forest										170	7	27							1	-	-				50	10	13				8	18	-
	Other land use										16	14	-																			2	-	-
4	**Sandy materials**																																	
Land use	Arable land	42	21	31				19	3	-	266	7	13				218	9	20							91	6	11	29	10	22	3	-	-
	Grassland										128	6	16	41	11	24	322	11	19							165	6	9				3	-	-
	Forest										411	4	13	10	5	-	239	3	7	42	2	39				420	5	8	35	7	10	2	-	-
	Other land use										39	8	24				96	5	14													1	-	-
5	**Loamy materials**																																	
Land use	Arable land	689	21	31				27	10	23	539	15	27				8	13	-										329	17	24	203	18	34
	Grassland	363	21	36							142	16	44	11	14	-	4	-	-													15	20	-
	Forest	104	12	24							362	13	35				5	8	-													15	21	-
	Other land use										37	16	33				1	-	-													11	18	-
6	**Detrital formations**																																	
Land use	Arable land																												76	20	36	2	-	-
	Grassland	8	20	-																												10	24	-
	Forest																												283	12	28	30	22	41
	Other land use																																	
7	**Crystalline rocks and migmatites**																																	
Land use	Arable land	218	18	33				19	12	-	121	22	36	10	24	-													283	16	34	3	-	-
	Grassland	582	19	38							117	19	37	74	19	34																22	13	34
	Forest	212	13	31							611	18	36							101	18	40							539	11	48	79	17	42
	Other land use										16	31	-																					
8	**Volcanic rocks**																																	
Land use	Arable land										11	26	-																					
	Grassland										13	22	-																			10	18	-
	Forest										73	32	76																109	10	18	12	18	-
	Other land use										4	-	-																					
9	**Other rocks**																																	
Land use	Arable land	4	-	-							34	9	16				101	22	37													63	18	29
	Grassland	5	23	-							97	11	26				160	32	72													66	18	35
	Forest										16	10	-				10	4	-													85	15	28
	Other land use										7	9	-				27	24	-													7	29	-

Tab. I.2 d: Hg contents in European soils according to soil parent material and land use [mg*kg^{-1}] - Aqua regia basis -

Mat 11 unit	Parent material		Austria			France			Germany			Ireland			The Netherlands			Estonia			Slovakia		
			n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.
1	**Undifferentiated alluvial or glacial deposits**																						
		Arable land	79	0.09	0.19				116	0.10	0.45				650	0.09	0.23	232	0.04	0.08	818	0.06	0.14
		Grassland	39	0.15	0.31				58	0.24	1.45	11	0.07	-	352	0.11	0.23	67	0.04	0.09			
		Forest							65	0.12	0.63				12	0.08	-	130	0.02	0.07	30	0.12	0.27
		Other land use							24	0.11	2.90				178	0.12	0.31						
2	**Calcareous rocks**																						
		Arable land	38	0.23	0.34	273	0.06	0.10	72	0.09	0.19	12	0.08	-							80	0.07	0.19
		Grassland	163	0.17	0.33				33	0.07	0.20	91	0.09	0.17									
		Forest							59	0.12	0.29										205	0.16	0.51
		Other land use							11	0.10													
3	**Clayey materials**																						
		Arable land				155	0.05	0.12	171	0.07	0.19												
		Grassland							32	0.07	0.15												
		Forest							98	0.13	0.26												
		Other land use							2	-	-												
4	**Sandy materials**																						
		Arable land	42	0.15	0.37	33	0.04	0.94	121	0.06	0.13				271	0.09	0.23				29	0.06	0.11
		Grassland							51	0.07	0.16	41	0.08	0.17	283	0.07	0.23						
		Forest							250	0.10	0.23	10	0.18	-	84	0.07	0.13				35	0.12	0.33
		Other land use							25	0.05	0.26				163	0.07	0.23						
5	**Loamy materials**																						
		Arable land	630	0.18	0.29	520	0.05	0.13	429	0.09	0.22				17	0.09	-				329	0.04	0.08
		Grassland	211	0.13	0.26				121	0.10	0.24	11	0.10	-	2	-	-						
		Forest							168	0.15	0.37												
		Other land use							17	0.09	-				6	0.16	-						
6	**Detrital formations**																						
		Arable land																			76	0.10	0.17
		Grassland	8	0.13	-																		
		Forest																			283	0.11	0.25
		Other land use																					
7	**Crystalline rocks and migmatites**																						
		Arable land	176	0.18	0.29	61	0.04	0.09	109	0.11	0.20	10	0.11	-							283	0.09	0.29
		Grassland	390	0.10	0.23				103	0.11	0.23	74	0.10	0.18									
		Forest							384	0.16	0.34										539	0.20	0.96
		Other land use							16	0.11	-												
8	**Volcanic rocks**																						
		Arable land							10	0.12	-												
		Grassland							11	0.11	-												
		Forest							49	0.29	0.51										109	0.11	0.28
		Other land use							4	-	-												
9	**Other rocks**																						
		Arable land							14	0.07	-				127	0.10	0.30						
		Grassland	6	0.09	-				7	0.24	-				170	0.21	0.42						
		Forest							3	-	-				3	-	-						
		Other land use							6	0.09	-				27	0.23	-						

Tab. I.2 e: Ni contents in European soils according to soil parent material and land use [mg*kg^{-1}] - Aqua regia basis -

Mat 11 unit	Parent material		Austria			Finland			France			Germany			Ireland			The Netherlands			Portugal			Estonia			Lithuania			Slovakia			Romania		
		n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.
1	**Undifferentiated alluvial or glacial deposits**																																	
Land use	Arable land	85	26	40	11	7	-				259	20	38				495	18	31				297	20	29	789	12	19	818	27	41	113	29	50
	Grassland	49	29	49							159	24	43	11	8	-	328	19	36				79	21	34	724	12	18				47	25	44
	Forest	12	27	-							170	13	35				48	4	9	1	-	-	161	17	29	540	8	13	30	24	42	24	28	50
	Other land use										46	24	39				56	13	28													10	34	-
2	**Calcareous rocks**																																	
Land use	Arable land	42	21	34				162	39	56	82	31	51	12	15	-													80	31	51	19	29	-
	Grassland	194	25	41							40	31	67	91	13	25																13	37	-
	Forest	146	21	35							154	28	46							3	-	-							205	19	49	9	29	-
	Other land use										22	28	70																			3	-	-
3	**Clayey materials**																																	
Land use	Arable land				43	14	37	103	36	55	275	8	35													353	14	22				30	25	34
	Grassland										85	12	47													275	15	21				13	25	-
	Forest										162	9	41							1	-	-				50	14	19				8	29	-
	Other land use										16	7	-																			2	-	-
4	**Sandy materials**																																	
Land use	Arable land	43	22	33				19	3	-	265	4	12				200	4	12							91	8	13	29	13	23	3	-	-
	Grassland										130	4	17	41	5	15	256	4	10							165	9	12				3	-	-
	Forest										408	4	14	10	3	-	208	3	5	42	12	42				420	7	11	35	9	13	2	-	-
	Other land use										38	3	7				92	4	13													1	-	-
5	**Loamy materials**																																	
Land use	Arable land	710	25	37				27	14	22	537	18	34				8	11	-										329	23	28	203	29	34
	Grassland	306	24	39							141	20	71	11	9	-	4	-	-													15	25	-
	Forest	110	19	36							360	18	44				5	9	-													15	26	-
	Other land use										39	19	38				1	-	-													11	29	-
6	**Detrital formations**																																	
Land use	Arable land																												76	27	47	2	-	-
	Grassland	8	25	-																												10	21	-
	Forest																												283	19	41	30	32	78
	Other land use																																	
7	**Crystalline rocks and migmatites**																																	
Land use	Arable land	216	18	36				19	18	-	121	26	60	10	15	-													283	19	38	3	-	-
	Grassland	452	22	41							117	24	61	74	10	20																22	21	34
	Forest	217	14	32							599	27	55							101	30	54							539	13	33	79	21	47
	Other land use										21	38	59																					
8	**Volcanic rocks**																																	
Land use	Arable land										11	30	-																					
	Grassland										13	37	-																			10	21	-
	Forest										73	48	154																109	8	16	12	14	-
	Other land use										4	-	-																					
9	**Other rocks**																																	
Land use	Arable land	4	-	-							34	5	19				86	3	6													63	25	41
	Grassland	6	37	-							91	7	15				142	22	38													66	29	46
	Forest										15	4	-				10	3	-													85	20	37
	Other land use										7	4	-				20	8	-													7	34	-

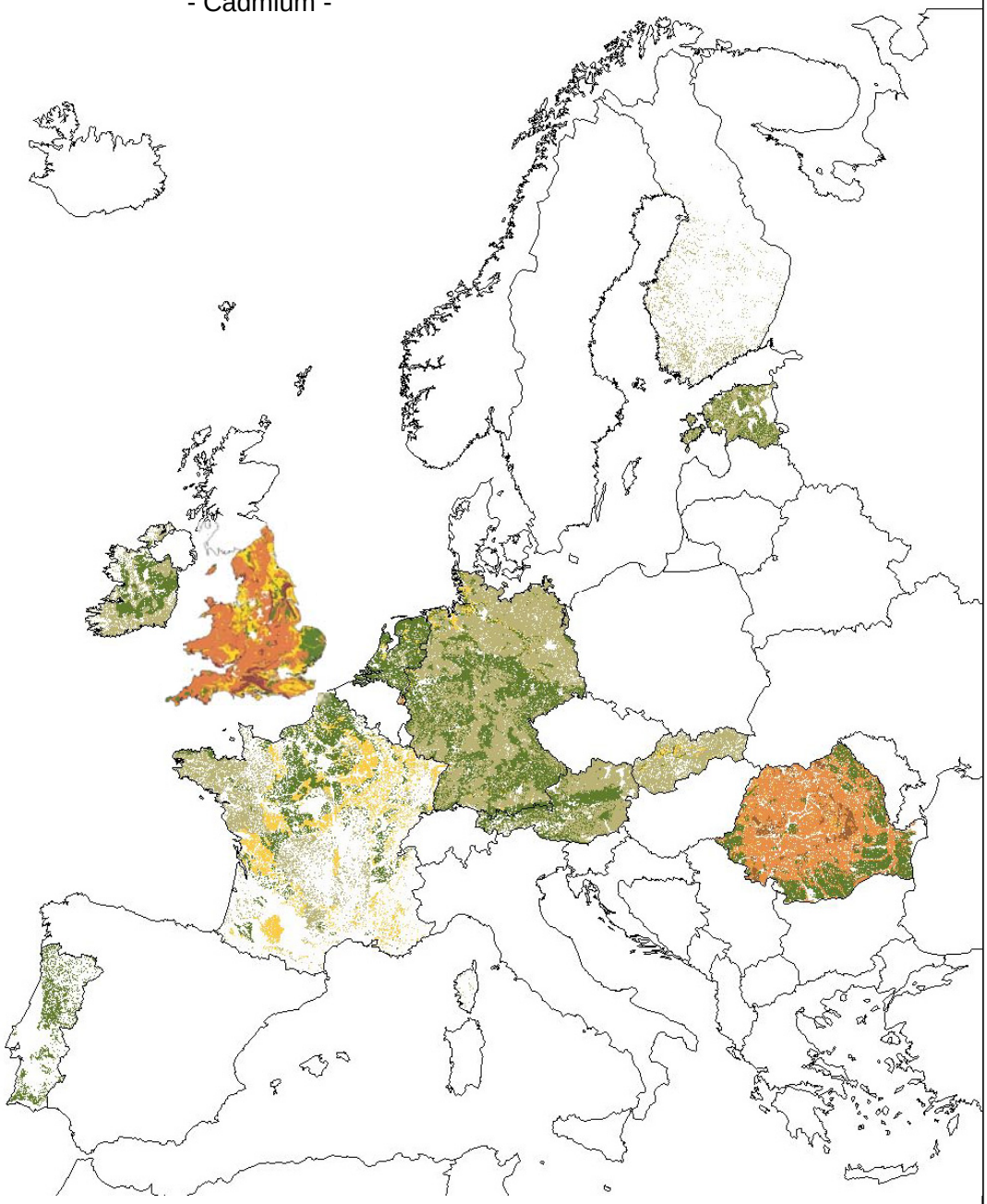
Tab. I.2 f: Pb contents in European soils according to soil parent material and land use [mg*kg^{-1}] - Aqua regia basis -

Mat 11 unit	Parent material		Austria			Finland			France			Germany			Ireland			The Netherlands			Portugal			Estonia			Lithuania			Slovakia			Romania		
			n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.
1	**Undifferentiated alluvial or glacial deposits**																																	
Land use	Arable land		81	18	28	11	6	-				280	33	171				767	22	42				297	13	21	789	10	15	818	13	23	113	24	38
	Grassland		49	31	60							164	64	367	11	14		385	45	120				79	11	24	724	10	15				47	20	36
	Forest		11	34	-							161	43	190				50	18	45	1	-	-	161	12	21	540	10	16	30	16	35	24	28	58
	Other land use											47	48	380				181	29	74													10	24	-
2	**Calcareous rocks**																																	
Land use	Arable land		33	19	34				154	32	51	81	33	61	12	16													80	20	56	19	19	-
	Grassland		220	38	69							40	37	68	91	19	34															13	24	-
	Forest		123	63	107							147	63	124							3	-	-							205	40	92	9	18	-
	Other land use											23	38	113																		3	-	-
3	**Clayey materials**																																	
Land use	Arable land					43	9	22	103	28	44	281	16	44													353	10	15				30	22	32
	Grassland											89	22	54													275	10	16				13	24	-
	Forest											167	33	66							1	-	-				50	10	18				8	37	-
	Other land use											14	31																			2	-	-
4	**Sandy materials**																																	
Land use	Arable land		41	18	28				19	15	-	265	17	35				321	17	43							91	9	15	29	10	24	3	-	-
	Grassland											128	20	48	41	15	40	345	19	42							165	10	16				3	-	-
	Forest											390	25	75	10	31	-	240	13	32	42	10	22				420	10	16	35	39	65	2	-	-
	Other land use											37	23	43				177	17	45													1	-	-
5	**Loamy materials**																																	
Land use	Arable land		713	17	26				27	22	34	532	31	65				18	27	-										329	11	14	203	19	29
	Grassland		347	28	54							141	44	102	11	20	-	6	26	-													15	25	-
	Forest		110	27	75							296	53	115				5	54	-													15	24	-
	Other land use											39	40	91				6	34	-													11	19	-
6	**Detrital formations**																																	
Land use	Arable land																													76	17	25	2	-	-
	Grassland		8	31	-																												10	29	-
	Forest																													283	24	59	30	46	84
	Other land use																																	
7	**Crystalline rocks and migmatites**																																	
Land use	Arable land		222	15	26				19	30	-	121	47	89	10	25	-													283	15	32	3	-	-
	Grassland		578	29	61							113	59	122	74	25	-																22	26	35
	Forest		218	35	74							463	73	167							101	27	52							539	25	77	79	37	73
	Other land use											19	41	-																					
8	**Volcanic rocks**																																	
Land use	Arable land											11	41	-																					
	Grassland											13	49	-																			10	29	-
	Forest											29	58	96																109	26	78	12	48	-
	Other land use											3	-	-																					
9	**Other rocks**																																	
Land use	Arable land		4	-	-							34	14	32				127	30	80													63	24	36
	Grassland		6	32	-							97	27	54				171	79	212													66	24	38
	Forest											10	56	-				10	15	-													85	29	58
	Other land use											7	27	-				27	88	355													7	33	-

Tab. I.2 g: Zn contents in European soils according to soil parent material and land use [mg*kg^{-1}] - Aqua regia basis -

Mat 11 unit	Parent material	Austria			Finland			France			Germany			Ireland			The Netherlands			Portugal			Estonia			Lithuania			Slovakia			Romania		
		n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.
1	**Undifferentiated alluvial or glacial deposits**																																	
Land use	Arable land	88	74	111	11	22	-				282	66	225				508	62	110				297	37	58	789	24	37	818	57	85	113	57	167
	Grassland	51	107	153							164	128	677	11	43	-	353	101	190				79	33	69	724	24	39				47	51	169
	Forest	12	58	-							174	49	192				50	13	43	1	-	-	161	25	49	536	17	29	30	54	86	24	69	134
	Other land use										48	101	498				72	78	148													10	57	-
2	**Calcareous rocks**																																	
Land use	Arable land	39	89	120				154	97	178	82	69	134	12	66	-													80	62	98	19	49	-
	Grassland	217	100	151							40	76	161	91	60	99																13	67	-
	Forest	130	70	117							155	80	173							3	-	-							205	72	132	9	75	-
	Other land use										22	80	147																			3	-	-
3	**Clayey materials**																																	
Land use	Arable land				43	39	109	103	78	121	281	34	79													353	26	43				30	57	222
	Grassland										86	39	99													275	27	46				13	51	-
	Forest										170	36	106							1	-	-				50	25	40				8	37	-
	Other land use										16	76																				2	-	-
4	**Sandy materials**																																	
Land use	Arable land	43	62	94				19	16	-	264	25	47				218	28	54							91	18	29	29	35	55	3	-	-
	Grassland										131	26	74	41	37	90	322	30	65							165	19	30				3	-	-
	Forest										412	17	55	10	19	-	240	8	23	42	6	25				416	15	27	35	36	61	2	-	-
	Other land use										39	39	97				96	22	80													1	-	-
5	**Loamy materials**																																	
Land use	Arable land	721	71	97				27	41	51	536	53	96				8	86	-										329	44	55	203	44	118
	Grassland	359	80	120							142	71	137	11	66	-	4	-	-													15	52	-
	Forest	110	44	84							367	55	144				5	35	-													15	47	-
	Other land use										39	66	157				1	-	-													11	48	-
6	**Detrital formations**																																	
Land use	Arable land																												76	59	78	2	-	-
	Grassland	8	107	-																												10	79	-
	Forest																												283	52	80	30	70	141
	Other land use																																	
7	**Crystalline rocks and migmatites**																																	
Land use	Arable land	222	84	119				19	62	-	122	86	158	10	83	-													283	53	91	3	-	-
	Grassland	593	78	123							117	101	149	74	61	93																22	41	196
	Forest	222	40	84							615	77	133							101	51	75							539	52	90	79	56	128
	Other land use										21	100	195																					
8	**Volcanic rocks**																																	
Land use	Arable land										11	99	-																					
	Grassland										13	130	-																			10	71	-
	Forest										68	121	203																109	55	75	12	55	-
	Other land use										4	-	-																					
9	**Other rocks**																																	
Land use	Arable land	4	-	-							34	24	58				101	31	56													63	49	148
	Grassland	6	79	-							90	26	99				160	125	210													66	55	174
	Forest										17	36	-				10	19	-													85	49	77
	Other land use										7	33	-				27	91	-													7	53	-

Fig. I.1: Heavy Metal Contents in European Soils according to Soil Parent Material and Land Use
- Cadmium -



Map Sources:
European Soil Data Base, Version 1.0
CORINE Land Cover, Version 12/2000

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

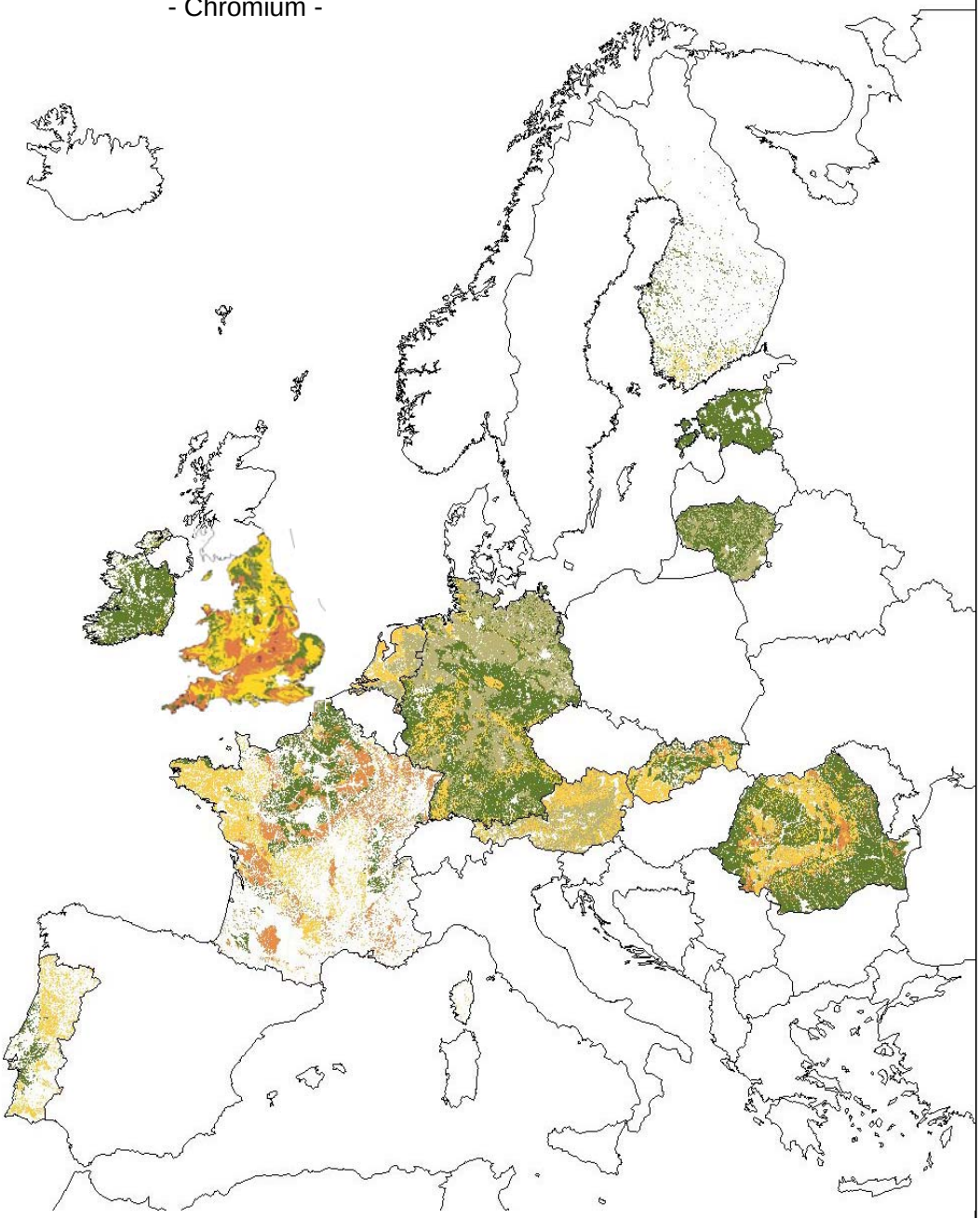
Classes of Cd Content
[mg/kg]
- Median values -

- <0.25
- >0.25-0.50
- >0.50-0.75
- >0.75-1.00
- >1.00
- No information

Status June 2003
NB. UK data stratified according to soil parent material only

N

Fig. I.2: Heavy Metal Contents in European Soils according to Soil Parent Material and Land Use
- Chromium -



Map Sources:
European Soil Data Base, Version 1.0
CORINE Land Cover, Version 12/2000

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

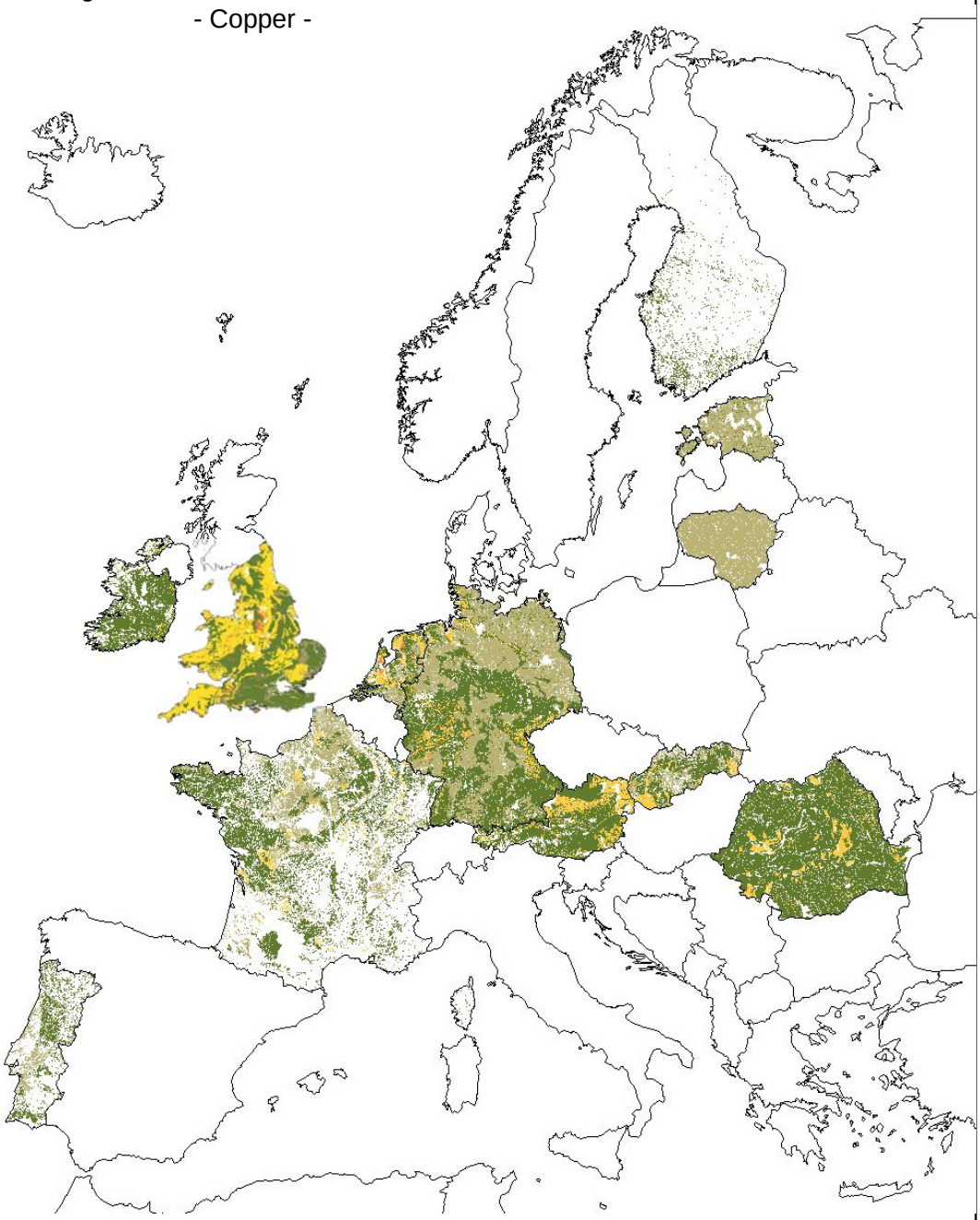
Classes of Cr Content
[mg/kg]
- Median values -

- <15
- >15-30
- >30-45
- >45-60
- >60
- No information

Status June 2003
NB. UK data stratified according to soil parent material only

N

Fig. I.3: Heavy Metal Contents in European Soils according to Soil Parent Material and Land Use
- Copper -



Map Sources:
European Soil Data Base, Version 1.0
CORINE Land Cover, Version 12/2000

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

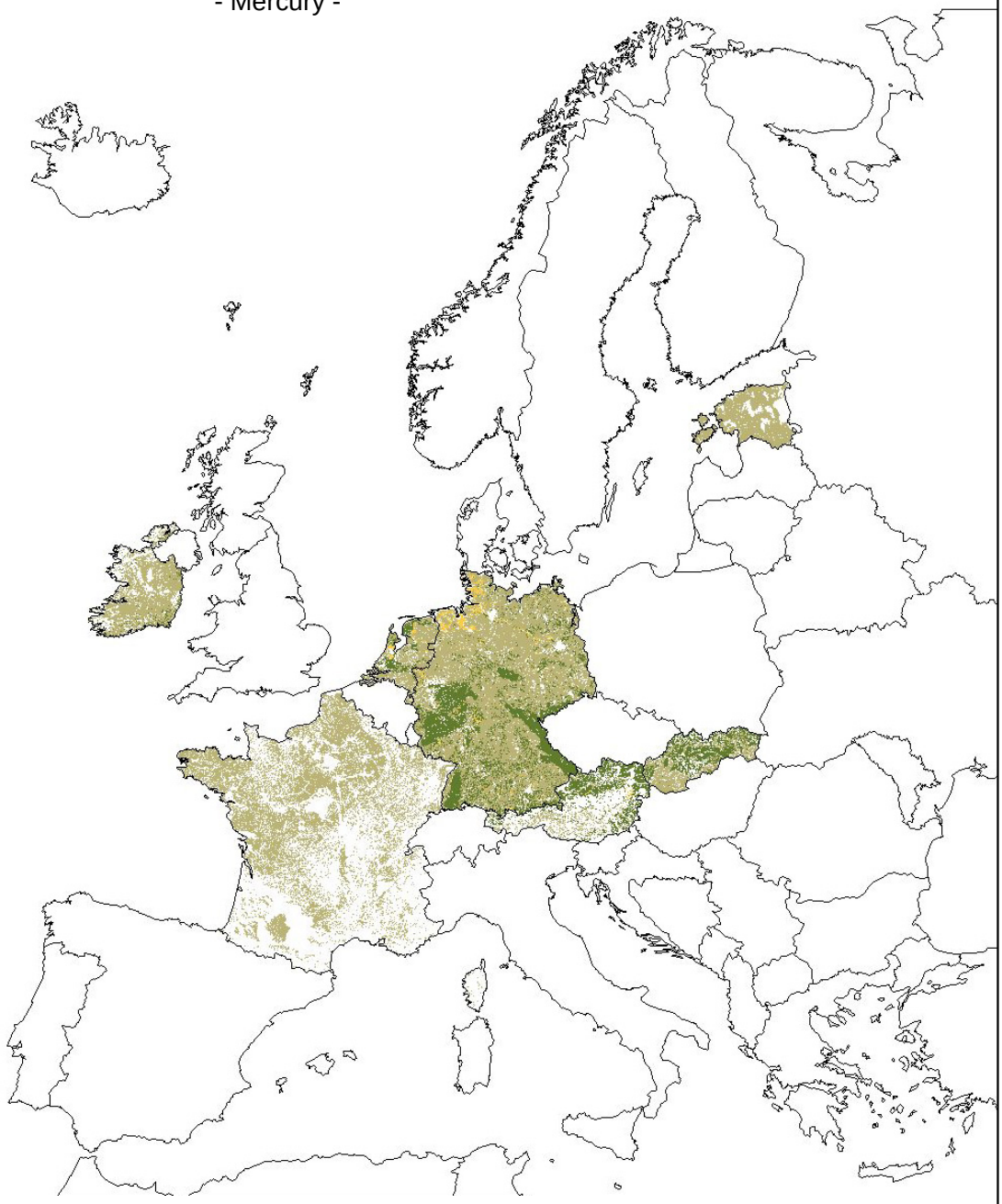
Classes of Cu Content
[mg/kg]
- Median values -

- <10
- >10-20
- >20-30
- >30-40
- >40
- No information

Status June 2003
NB. UK data stratified according to soil parent material only

N

Fig. I.4: Heavy Metal Contents in European Soils
according to Soil Parent Material and Land Use
- Mercury -



Map Sources:
European Soil Data Base, Version 1.0
CORINE Land Cover, Version 12/2000

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

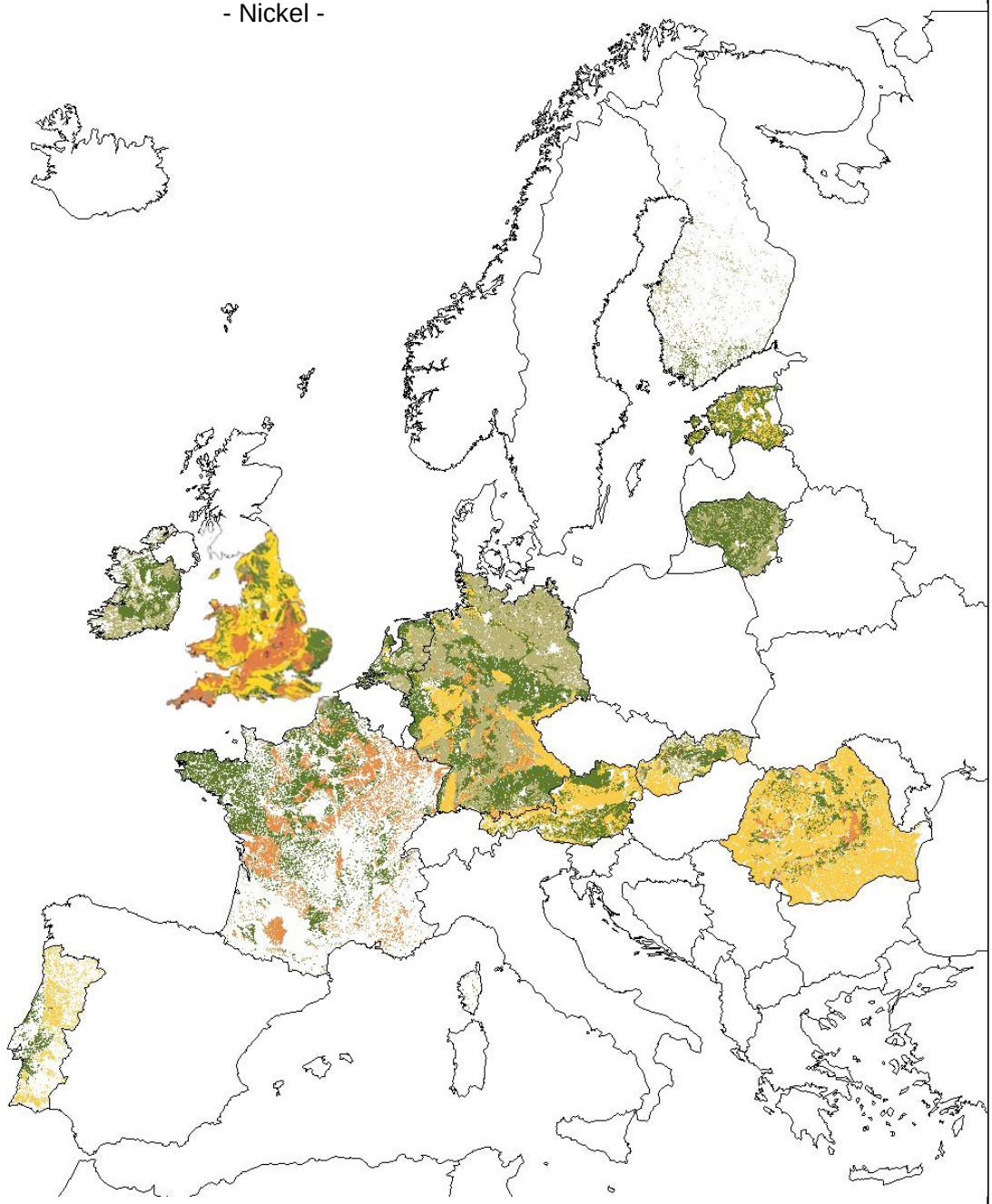
Classes of Hg Content
[mg/kg]
- Median values -

- <0.1
- >0.1-0.2
- >0.2-0.3
- >0.3-0.4
- >0.4
- No information

Status June 2003
NB. UK data stratified according to soil parent material only

N

Fig. I.5: Heavy Metal Contents in European Soils according to Soil Parent Material and Land Use
- Nickel -



Map Sources:
European Soil Data Base, Version 1.0
CORINE Land Cover, Version 12/2000

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

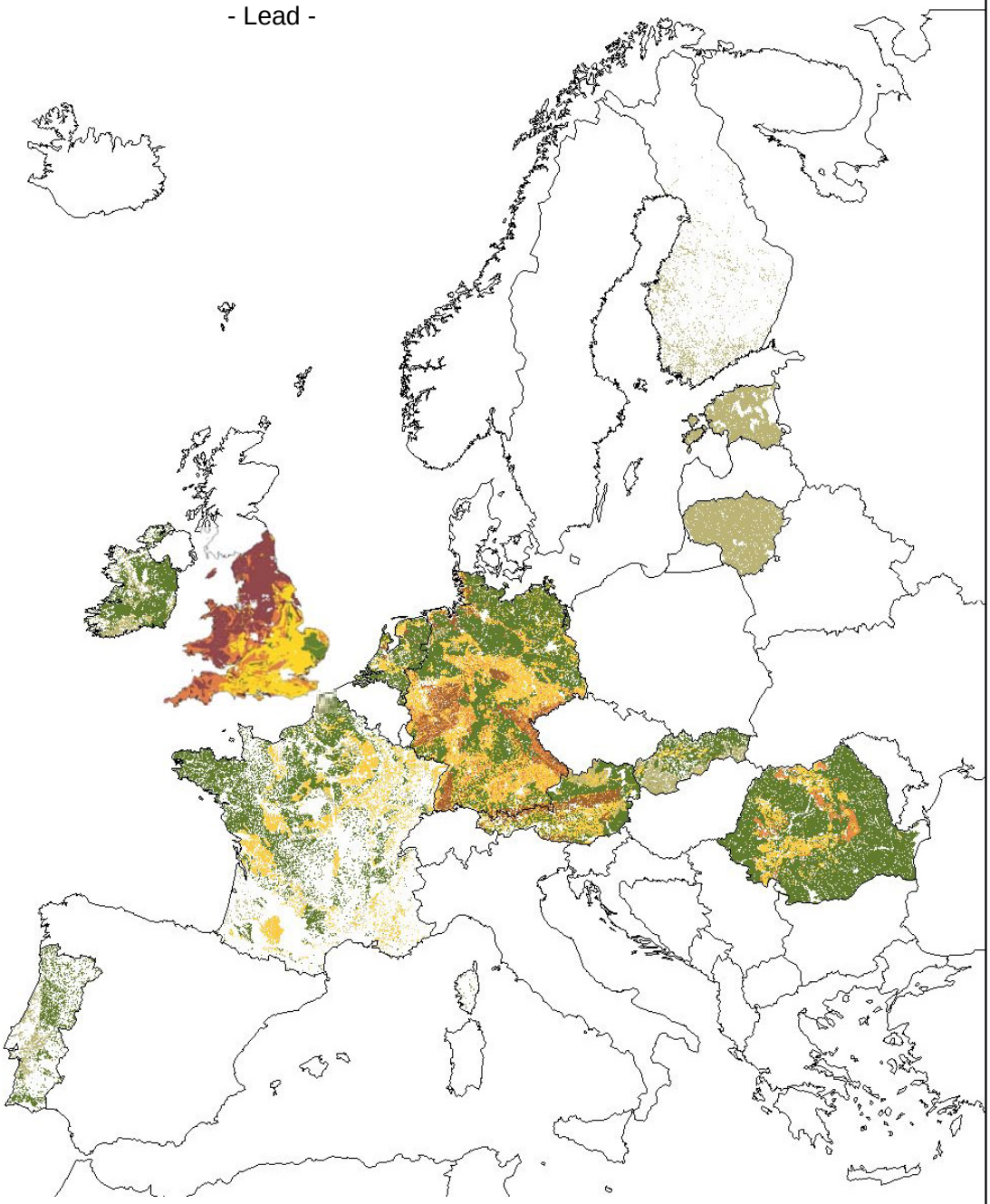
Classes of Ni Content
[mg/kg]
- Median values -

<10
>10-20
>20-30
>30-40
>40
No information

Status June 2003
NB. UK data stratified according to soil parent material only

N

Fig. I.6: Heavy Metal Contents in European Soils according to Soil Parent Material and Land Use
- Lead -



Map Sources:
European Soil Data Base, Version 1.0
CORINE Land Cover, Version 12/2000

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

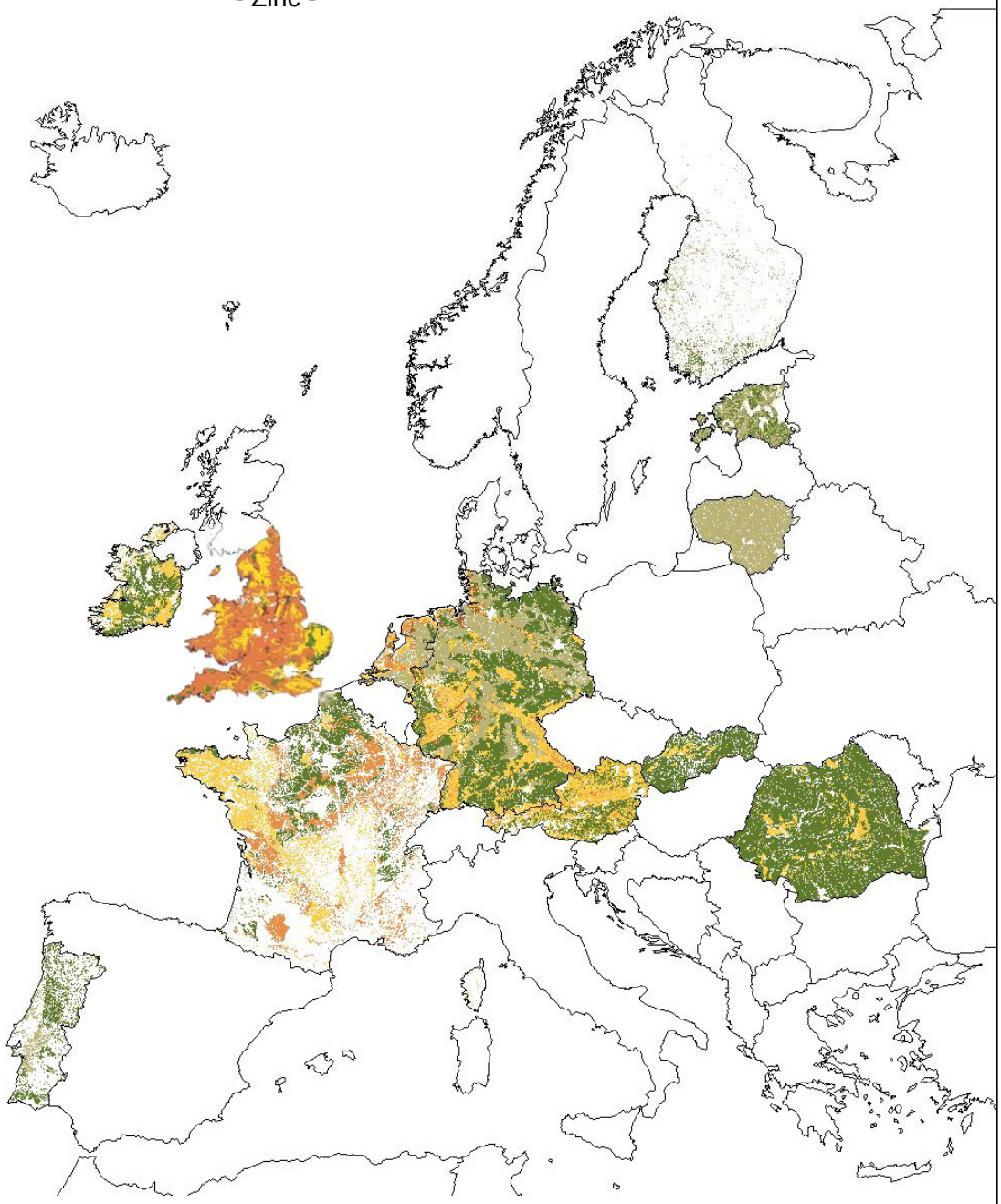
Classes of Pb Content
[mg/kg]
- Median values -

- <15
- >15-30
- >30-45
- >45-60
- >60
- No information

Status June 2003
NB. UK data stratified according to soil parent material only

N

Fig. I.7: Heavy Metal Contents in European Soils according to Soil Parent Material and Land Use
- Zinc -



Map Sources:
European Soil Data Base, Version 1.0
CORINE Land Cover, Version 12/2000

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Classes of Zn Content
[mg/kg]
- Median values -

- <30
- >30-60
- >60-90
- >90-120
- >120
- No information

Status June 2003
NB. UK data stratified according to soil parent material only

N

Evaluation according to soil pH

Tab. I.3 a-g: Heavy metal contents in European soils according to soil pH - Aqua regia basis

Tab. I.3 a: Cd contents in European soils according to soil pH [mg*kg-1] - Aqua regia basis -

Cd		soil pH			
		≤ 5	> 5 - 6	> 6 - 7	> 7
Austria	**n**	*933*	*796*	*463*	*491*
(pH $CaCl_2$)	**50. P.**	0.2	0.2	0.3	0.3
	90. P.	0.5	0.5	0.7	0.5
Denmark	**n**	*3*	*20*	*74*	-
(pH $CaCl_2$)	**50. P.**	-	0.1	0.2	-
	90. P.	-	-	-	-
England / Wales	**n**	*1014*	*1179*	*1322*	*2068*
(pH H_2O)	**50. P.**	0.6	0.8	0.8	0.8
	90. P.	-	-	-	-
France	**n**	*137*	*615*	*1063*	*1936*
(pH H_2O)	**50. P.**	0.4	0.2	0.3	0.4
	90. P.	1.5	0.6	0.6	0.8
Germany	**n**	*893*	*354*	*336*	*237*
(pH $CaCl_2$)	**50. P.**	0.2	0.3	0.3	0.3
	90. P.	0.8	0.9	1.8	0.7
Ireland	**n**	*43*	*168*	*74*	-
(pH $CaCl_2$)	**50. P.**	0.2	0.2	0.4	-
	90. P.	0.4	0.5	1.2	-
Italy	**n**	*56*	*136*	*199*	*1660*
(pH H_2O)	**50. P.**	2.0	1.8	0.7	0.5
	90. P.	3.5	4.0	2.6	1.2
The Netherlands	**n**	*976*	*589*	*442*	*740*
(pH KCl)	**50. P.**	0.3	0.3	0.4	0.3
	90. P.	1.0	0.9	0.9	0.7
Estonia	**n**	*26*	*29*	*142*	*203*
(pH H_2O)	**50. P.**	0.1	0.2	0.2	0.3
	90. P.	0.4	0.5	0.5	0.6
Romania	**n**	*209*	*276*	*180*	*269*
(pH H_2O)	**50. P.**	0.8	0.8	0.8	0.8
	90. P.	1.6	1.3	1.2	1.2
Slovakia	**n**	*1319*	*1070*	*973*	*1171*
(pH H_2O)	**50. P.**	0.2	0.2	0.1	0.1
	90. P.	0.4	0.4	0.4	0.4

Tab. I.3 b: Cr contents in European soils according to soil pH [mg*kg-1] - Aqua regia basis -

Cr		soil pH			
		≤5	> 5 - 6	> 6 - 7	> 7
Austria	**n**	*761*	*771*	*464*	*523*
(pH $CaCl_2$)	**50. P.**	27	35	36	35
	90. P.	48	54	54	54
Denmark	**n**	*3*	*20*	*74*	-
(pH $CaCl_2$)	**50. P.**	-	25	21	-
	90. P.	-	-	-	-
England / Wales	**n**	*1014*	*1179*	*1322*	*2068*
(pH H_2O)	**50. P.**	23	44	44	41
	90. P.	-	-	-	-
France	**n**	*176*	*687*	*1185*	*2096*
(pH H_2O)	**50. P.**	40	24	24	28
	90. P.	90	49	52	50
Germany	**n**	*1261*	*469*	*442*	*262*
(pH $CaCl_2$)	**50. P.**	27	20	25	30
	90. P.	54	51	50	50
Ireland	**n**	*43*	*168*	*74*	-
(pH $CaCl_2$)	**50. P.**	19	22	21	-
	90. P.	41	34	34	-
Italy	**n**	*56*	*138*	*171*	*1429*
(pH H_2O)	**50. P.**	44	47	45	31
	90. P.	126	128	97	49
The Netherlands	**n**	*839*	*434*	*286*	*407*
(pH KCl)	**50. P.**	10	13	30	31
	90. P.	52	45	69	76
Portugal	**n**	*120*	*24*	*2*	*2*
(pH $CaCl_2$)	**50. P.**	26	43	-	-
	90. P.	61	147	-	-
Estonia	**n**	*41*	*32*	*194*	*231*
(pH H_2O)	**50. P.**	11	14	17	21
	90. P.	21	21	27	30
Lithuania	**n**	*118*	*248*	*771*	*1401*
(pH H_2O)	**50. P.**	4	9	11	15
	90. P.	11	17	18	23
Romania	**n**	*209*	*276*	*180*	*269*
(pH H_2O)	**50. P.**	27	19	22	24
	90. P.	61	54	41	43
Slovakia	**n**	*1319*	*1070*	*973*	*1171*
(pH H_2O)	**50. P.**	33	39	40	39
	90. P.	56	58	58	54

Tab. I.3 c: Cu contents in European soils according to soil pH [mg*kg-1] - Aqua regia basis -

Cu		soil pH			
		≤5	> 5 - 6	> 6 - 7	> 7
Austria	**n**	*936*	*809*	*501*	*497*
(pH $CaCl_2$)	**50. P.**	16	20	21	22
	90. P.	33	35	35	33
Denmark	**n**	*3*	*20*	*74*	-
(pH $CaCl_2$)	**50. P.**	-	6	6	-
	90. P.	-	-	-	-
England / Wales	**n**	*1014*	*1179*	*1322*	*2068*
(pH H_2O)	**50. P.**	14	19	19	19
	90. P.	-	-	-	-
France	**n**	*176*	*686*	*1182*	*2080*
(pH H_2O)	**50. P.**	15	11	13	16
	90. P.	40	27	28	29
Germany	**n**	*1340*	*502*	*459*	*260*
(pH $CaCl_2$)	**50. P.**	12	12	16	17
	90. P.	31	33	39	36
Ireland	**n**	*43*	*168*	*74*	-
(pH $CaCl_2$)	**50. P.**	9	15	15	-
	90. P.	26	29	29	-
Italy	**n**	*60*	*201*	*481*	*2854*
(pH H_2O)	**50. P.**	21	21	34	40
	90. P.	89	60	75	80
The Netherlands	**n**	*881*	*468*	*301*	*425*
(pH KCl)	**50. P.**	9	14	15	12
	90. P.	43	36	35	29
Portugal	**n**	*120*	*24*	*2*	*2*
(pH $CaCl_2$)	**50. P.**	12	26	-	-
	90. P.	36	66	-	-
Estonia	**n**	*41*	*32*	*194*	*231*
(pH H_2O)	**50. P.**	7	5	9	9
	90. P.	20	14	29	19
Lithuania	**n**	*118*	*248*	*771*	*1401*
(pH H_2O)	**50. P.**	4	5	6	8
	90. P.	7	10	14	13
Romania	**n**	*209*	*276*	*180*	*269*
(pH H_2O)	**50. P.**	14	18	18	23
	90. P.	32	35	35	40
Slovakia	**n**	*1319*	*1070*	*973*	*1171*
(pH H_2O)	**50. P.**	11	14	16	18
	90. P.	26	30	31	35

Tab. I.3 d: Hg contents in European soils according to soil pH [mg*kg-1] - Aqua regia basis -

Hg		soil pH			
		≤5	> 5 - 6	> 6 - 7	> 7
Austria	**n**	*404*	*567*	*309*	*445*
(pH $CaCl_2$)	**50. P.**	0.12	0.13	0.13	0.16
	90. P.	0.27	0.27	0.26	0.28
France	**n**	*267*	*1367*	*2371*	*4792*
(pH H_2O)	**50. P.**	0.05	0.04	0.05	0.05
	90. P.	0.16	0.10	0.10	0.11
Germany	**n**	*702*	*252*	*237*	*181*
(pH $CaCl_2$)	**50. P.**	0.15	0.10	0.10	0.10
	90. P.	0.35	0.25	0.35	0.32
Ireland	**n**	*43*	*168*	*74*	-
(pH $CaCl_2$)	**50. P.**	0.14	0.08	0.10	-
	90. P.	0.26	0.17	0.16	-
Italy	**n**	*4*	*18*	*112*	*1944*
(pH H_2O)	**50. P.**	-	0.12	0.11	0.08
	90. P.	-	-	0.42	0.32
The Netherlands	**n**	*677*	*525*	*425*	*721*
(pH KCl)	**50. P.**	0.12	0.10	0.10	0.10
	90. P.	0.28	0.23	0.23	0.23
Estonia	**n**	*25*	*31*	*146*	*214*
(pH H_2O)	**50. P.**	0.01	0.02	0.03	0.04
	90. P.	0.03	0.05	0.07	0.08
Slovakia	**n**	*1319*	*1070*	*973*	*1171*
(pH H_2O)	**50. P.**	0.13	0.08	0.07	0.06
	90. P.	0.42	0.23	0.20	0.15

Tab. I.3 e: Ni contents in European soils according to soil pH [mg*kg-1] - Aqua regia basis -

Ni		soil pH			
		≤5	> 5 - 6	> 6 - 7	> 7
Austria	**n**	*783*	*773*	*462*	*524*
(pH $CaCl_2$)	**50. P.**	19	24	27	24
	90. P.	38	39	42	36
Denmark	**n**	*3*	*20*	*74*	-
(pH $CaCl_2$)	**50. P.**	-	14	10	-
	90. P.	-	-	-	-
England / Wales	**n**	*1014*	*1179*	*1322*	*2068*
(pH H_2O)	**50. P.**	9	23	25	27
	90. P.	-	-	-	-
France	**n**	*182*	*706*	*1205*	*2122*
(pH H_2O)	**50. P.**	25	17	17	21
	90. P.	62	35	37	41
Germany	**n**	*1314*	*495*	*460*	*264*
(pH $CaCl_2$)	**50. P.**	19	12	17	25
	90. P.	52	54	43	43
Ireland	**n**	*43*	*168*	*74*	-
(pH $CaCl_2$)	**50. P.**	4	9	14	-
	90. P.	20	21	25	-
Italy	**n**	*61*	*196*	*448*	*2731*
(pH H_2O)	**50. P.**	43	42	48	53
	90. P.	61	82	90	74
The Netherlands	**n**	*796*	*420*	*285*	*407*
(pH KCl)	**50. P.**	4	6	17	14
	90. P.	28	26	33	30
Portugal	**n**	*120*	*24*	*2*	*2*
(pH $CaCl_2$)	**50. P.**	21	31	-	-
	90. P.	51	54	-	-
Estonia	**n**	*41*	*32*	*194*	*231*
(pH H_2O)	**50. P.**	14	14	19	20
	90. P.	34	39	34	29
Lithuania	**n**	*118*	*248*	*771*	*1401*
(pH H_2O)	**50. P.**	5	7	9	12
	90. P.	9	14	16	19
Romania	**n**	*209*	*276*	*180*	*269*
(pH H_2O)	**50. P.**	19	25	29	29
	90. P.	38	40	40	49
Slovakia	**n**	*1319*	*1070*	*973*	*1171*
(pH H_2O)	**50. P.**	14	20	22	24
	90. P.	31	39	24	39

Tab. I.3 f: Pb contents in European soils according to soil pH [mg*kg-1] - Aqua regia basis -

Pb		soil pH			
		≤5	> 5 - 6	> 6 - 7	> 7
Austria	**n**	*913*	*803*	*486*	*506*
(pH $CaCl_2$)	**50. P.**	35	22	22	17
	90. P.	69	46	63	41
Denmark	**n**	*3*	*20*	*74*	-
(pH $CaCl_2$)	**50. P.**	-	10	10	-
	90. P.	-	-	-	-
England / Wales	**n**	*1014*	*1179*	*1322*	*2068*
(pH H_2O)	**50. P.**	76	42	39	32
	90. P.	-	-	-	-
France	**n**	*177*	*687*	*1185*	*2096*
(pH H_2O)	**50. P.**	28	23	23	24
	90. P.	50	40	41	43
Germany	**n**	*1126*	*497*	*459*	*265*
(pH $CaCl_2$)	**50. P.**	46	27	28	27
	90. P.	128	73	104	64
Ireland	**n**	*43*	*168*	*74*	-
(pH $CaCl_2$)	**50. P.**	31	20	19	-
	90. P.	76	41	39	-
Italy	**n**	*61*	*193*	*452*	*2889*
(pH H_2O)	**50. P.**	32	24	26	30
	90. P.	99	84	49	51
The Netherlands	**n**	*976*	*589*	*442*	*740*
(pH KCl)	**50. P.**	23	24	28	20
	90. P.	105	80	70	46
Portugal	**n**	*120*	*24*	*2*	*2*
(pH $CaCl_2$)	**50. P.**	25	17	-	-
	90. P.	49	41	-	-
Estonia	**n**	*41*	*32*	*194*	*231*
(pH H_2O)	**50. P.**	11	9	12	14
	90. P.	16	18	20	22
Lithuania	**n**	*118*	*248*	*771*	*1401*
(pH H_2O)	**50. P.**	15	11	10	10
	90. P.	54	25	19	16
Romania	**n**	*209*	*275*	*180*	*269*
(pH H_2O)	**50. P.**	34	24	24	19
	90. P.	69	45	34	35
Slovakia	**n**	*1319*	*1070*	*973*	*1171*
(pH H_2O)	**50. P.**	23	15	13	12
	90. P.	68	39	33	30

Tab. I.3 g: Zn contents in European soils according to soil pH [mg*kg-1] - Aqua regia basis -

Zn		soil pH			
		≤5	> 5 - 6	> 6 - 7	> 7
Austria	**n**	*952*	*814*	*492*	*521*
(pH $CaCl_2$)	**50. P.**	64	81	84	73
	90. P.	114	122	130	107
Denmark	**n**	*3*	*20*	*74*	-
(pH $CaCl_2$)	**50. P.**	-	28	29	-
	90. P.	-	-	-	-
England / Wales	**n**	*1014*	*1179*	*1322*	*2068*
(pH H_2O)	**50. P.**	56	89	88	85
	90. P.	-	-	-	-
France	**n**	*176*	*686*	*1184*	*2081*
(pH H_2O)	**50. P.**	69	47	50	64
	90. P.	198	89	94	96
Germany	**n**	*1343*	*494*	*465*	*268*
(pH $CaCl_2$)	**50. P.**	56	49	58	60
	90. P.	132	139	185	132
Ireland	**n**	*43*	*168*	*74*	-
(pH $CaCl_2$)	**50. P.**	27	56	64	-
	90. P.	79	95	103	-
Italy	**n**	*59*	*203*	*481*	*2853*
(pH H_2O)	**50. P.**	60	56	69	80
	90. P.	120	105	122	117
The Netherlands	**n**	*882*	*468*	*301*	*425*
(pH KCl)	**50. P.**	25	42	65	54
	90. P.	151	133	164	136
Portugal	**n**	*120*	*24*	*2*	*2*
(pH $CaCl_2$)	**50. P.**	39	28	-	-
	90. P.	71	72	-	-
Estonia	**n**	*41*	*32*	*194*	*231*
(pH H_2O)	**50. P.**	23	18	32	39
	90. P.	32	36	53	61
Lithuania	**n**	*118*	*247*	*771*	*1398*
(pH H_2O)	**50. P.**	17	17	21	24
	90. P.	47	40	46	41
Romania	**n**	*209*	*276*	*180*	*269*
(pH H_2O)	**50. P.**	47	52	53	53
	90. P.	129	151	164	147
Slovakia	**n**	*1319*	*1070*	*973*	*1171*
(pH H_2O)	**50. P.**	49	50	49	50
	90. P.	79	81	84	82

Evaluation according to soil texture

Tab. I.4 a-g: Heavy metal contents in European soils according to soil texture classes - Aqua regia basis -

Tab. I.4 a: Cd contents in European soils according to soil texture classes [mg*kg-1] - Aqua regia basis -

Cd		Texture classes (< 2 mm)					
		No texture	Coarse	Medium	Medium fine	Fine	Very fine
Austria	**n**		*88*	*1799*	*348*	*154*	*11*
	50. P.		0.2	0.2	0.2	0.3	0.4
	90. P.		0.6	0.5	0.5	0.8	-
Finland	**n**	*55*					
	50. P.	0.1					
	90. P.	0.3					
France	**n**		*79*	*580*	*335*	*223*	*10*
	50. P.		0.2	0.3	0.3	0.5	0.5
	90. P.		0.5	0.7	0.9	1.4	-
Germany	**n**	*84*	*760*	*1035*	*690*	*143*	*12*
	50. P.	0.5	0.2	0.2	0.4	0.4	0.7
	90. P.	1.6	0.6	0.8	0.8	1.2	-
Ireland	**n**	*10*	*23*	*210*	*8*	*28*	
	50. P.	0.2	0.2	0.2	0.4	0.2	
	90. P.	-	0.5	1.1	-	0.8	
Italy	**n**		*173*	*1021*	*41*	*265*	*6*
	50. P.		0.6	0.7	0.6	0.5	1.1
	90. P.		2.0	2.1	1.0	1.2	-
Portugal	**n**		*62*	*80*		*6*	
	50. P.		<0.5	<0.5		0.5	
	90. P.		1.5	2.0		-	
Estonia	**n**		*60*	*28*	*67*	*207*	*50*
	50. P.		0.2	0.3	0.3	0.2	0.3
	90. P.		0.4	0.6	0.7	0.5	1
Romania	**n**		*85*	*319*	*310*	*213*	*7*
	50. P.		0.8	0.8	0.8	0.8	0.8
	90. P.		1.5	1.4	1.2	1.7	-
Slovakia	**n**		*108*	*1284*	*2256*	*1177*	*335*
	50. P.		0.2	0.2	0.1	0.2	0.2
	90. P.		0.4	0.5	0.4	0.4	0.4

Tab. I.4 b: Cr contents in European soils according to soil texture classes [mg*kg-1] - Aqua regia basis -

Cr		Texture classes (< 2 mm)					
		No texture	Coarse	Medium	Medium fine	Fine	Very fine
Austria	**n**		*89*	*1841*	*357*	*176*	*13*
	50. P.		21	32	39	37	32
	90. P.		53	51	55	58	-
Finland	**n**	*55*					
	50. P.	15					
	90. P.	46					
France	**n**		*102*	*752*	*380*	*249*	*10*
	50. P.		13	28	38	52	60
	90. P.		41	48	66	85	-
Germany	**n**	*98*	*861*	*1263*	*859*	*142*	*12*
	50. P.	12	7	27	25	38	50
	90. P.	28	17	54	47	59	-
Ireland	**n**	*10*	*23*	*210*	*8*	*28*	
	50. P.	2	14	22	18	19	
	90. P.	-	25	41	-	27	
Italy	**n**		*173*	*1021*	*41*	*253*	*6*
	50. P.		27	35	26	38	36
	90. P.		73	76	44	51	-
Portugal	**n**		*62*	*80*		*6*	
	50. P.		19	34		58	
	90. P.		48	124		-	
Estonia	**n**		*80*	*39*	*95*	*260*	*63*
	50. P.		15	17	17	21	21
	90. P.		26	26	28	30	31
Romania	**n**		*85*	*319*	*310*	*213*	*7*
	50. P.		20	22	22	24	26
	90. P.		58	56	46	53	-
Slovakia	**n**		*108*	*1284*	*2256*	*1177*	*335*
	50. P.		30	35	38	40	40
	90. P.		58	58	55	56	58

Tab. I.4 c: Cu contents in European soils according to soil texture classes [mg*kg-1] - Aqua regia basis -

Cu		Texture classes (< 2 mm)					
		No texture	Coarse	Medium	Medium fine	Fine	Very fine
Austria	**n**		*88*	*1824*	*346*	*166*	*13*
	50. P.		13	20	20	24	28
	90. P.		32	34	31	36	-
Finland	**n**	*55*					
	50. P.	22					
	90. P.	49					
France	**n**		*101*	*741*	*378*	*245*	*9*
	50. P.		6	12	15	21	31
	90. P.		18	33	27	50	-
Germany	**n**	*135*	*909*	*1274*	*885*	*143*	*12*
	50. P.	12	5	15	16	25	25
	90. P.	32	14	37	32	42	-
Ireland	**n**	*10*	*23*	*210*	*8*	*28*	
	50. P.	3	15	14	13	12	
	90. P.	-	28	33	-	25	
Italy	**n**		*176*	*1056*	*33*	*264*	*6*
	50. P.		21	30	50	40	23
	90. P.		66	78	107	82	-
Portugal	**n**		*62*	*80*		*6*	
	50. P.		6	20		27	
	90. P.		36	52		-	
Estonia	**n**		*80*	*39*	*95*	*260*	*63*
	50. P.		6	9	9	9	12
	90. P.		15	40	18	22	26
Romania	**n**		*85*	*319*	*310*	*213*	*7*
	50. P.		13	18	18	55	60
	90. P.		50	35	29	119	-
Slovakia	**n**		*108*	*1284*	*2256*	*1177*	*335*
	50. P.		9	13	15	18	22
	90. P.		24	28	28	34	39

Tab. I.4 d: Hg contents in European soils according to soil texture classes [mg*kg-1] - Aqua regia basis -

Hg		Texture classes (< 2 mm)					
		No texture	Coarse	Medium	Medium fine	Fine	Very fine
Austria	**n**		*67*	*1246*	*227*	*139*	*9*
	50. P.		0.09	0.13	0.17	0.14	0.12
	90. P.		0.24	0.27	0.29	0.28	-
France	**n**		*185*	*2177*	*1513*	*544*	*18*
	50. P.		0.04	0.04	0.05	0.06	0.05
	90. P.		0.15	0.11	0.12	0.12	-
Germany	**n**	*17*	*408*	*837*	*608*	*112*	*5*
	50. P.	0.24	0.07	0.11	0.11	0.12	0.13
	90. P.	-	0.23	0.27	0.26	0.32	-
Ireland	**n**	*10*	*23*	*210*	*8*	*28*	
	50. P.	0.09	0.10	0.09	0.09	0.09	
	90. P.	-	0.16	0.21		0.17	
Italy	**n**		*97*	*725*	*40*	*262*	*6*
	50. P.		b.d.	0.07	0.12	b.d.	b.d.
	90. P.		0.40	0.43	0.35	0.34	-
Estonia	**n**		*60*	*29*	*74*	*212*	*54*
	50. P.		0.02	0.04	0.04	0.04	0.03
	90. P.		0.05	0.09	0.07	0.08	0
Slovakia	**n**		*108*	*1284*	*2256*	*1177*	*335*
	50. P.		0.10	0.09	0.07	0.07	0.09
	90. P.		0.27	0.27	0.24	0.25	0.27

b.d. = below detection limit

Tab. I.4 e: Ni contents in European soils according to soil texture classes [mg*kg-1] - Aqua regia basis -

Ni		Texture classes (< 2 mm)					
		No texture	Coarse	Medium	Medium fine	Fine	Very fine
Austria	**n**		*89*	*1872*	*353*	*173*	*13*
	50. P.		13	23	25	29	34
	90. P.		35	38	37	43	-
Finland	**n**	*55*					
	50. P.	0.1					
	90. P.	0.3					
France	**n**		*101*	*754*	*386*	*254*	*10*
	50. P.		7	19	25	39	45
	90. P.		20	35	43	62	-
Germany	**n**	*117*	*899*	*1275*	*880*	*140*	*11*
	50. P.	6	4	21	18	38	33
	90. P.	14	11	52	40	61	-
Ireland	**n**	*10*	*23*	*210*	*8*	*28*	
	50. P.	1	6	11	11	10	
	90. P.	-	11	25	-	17	
Italy	**n**		*163*	*1043*	*41*	*268*	*6*
	50. P.		22	28	23	34	31
	90. P.		68	67	53	68	-
Portugal	**n**		*62*	*80*		*6*	
	50. P.		12	32		43	
	90. P.		33	58		-	
Estonia	**n**		*80*	*39*	*95*	*260*	*63*
	50. P.		19	19	19	19	21
	90. P.		43	34	32	29	29
Romania	**n**		*85*	*319*	*310*	*213*	*7*
	50. P.		21	23	25	34	46
	90. P.		41	38	38	50	-
Slovakia	**n**		*108*	*1284*	*2256*	*1177*	*335*
	50. P.		12	18	20	24	29
	90. P.		31	33	35	40	49

Tab. I.4 f: Pb contents in European soils according to soil texture classes [mg*kg-1] - Aqua regia basis -

Pb		Texture classes (< 2 mm)					
		No texture	Coarse	Medium	Medium fine	Fine	Very fine
Austria	**n**		*86*	*1837*	*353*	*159*	*12*
	50. P.		21	23	20	34	61
	90. P.		57	59	45	68	-
Finland	**n**	*55*					
	50. P.	8					
	90. P.	17					
France	**n**		*102*	*753*	*379*	*249*	*10*
	50. P.		13	23	25	31	32
	90. P.		30	41	41	52	-
Germany	**n**	*128*	*897*	*1198*	*804*	*140*	*12*
	50. P.	30	18	42	48	45	61
	90. P.	86	54	124	121	116	-
Ireland	**n**	*10*	*23*	*210*	*8*	*28*	
	50. P.	13	24	20	18	18	
	90. P.	-	36	56	-	32	
Italy	**n**		*182*	*1072*	*41*	*266*	*6*
	50. P.		23	29	26	30	28
	90. P.		77	72	35	50	-
Portugal	**n**		*62*	*80*		*6*	
	50. P.		24	25		25	
	90. P.		47	50		-	
Estonia	**n**		*80*	*39*	*95*	*260*	*63*
	50. P.		8	10	12	14	12
	90. P.		20	19	21	21	25
Romania	**n**		*85*	*319*	*310*	*213*	*7*
	50. P.		24	25	24	24	29
	90. P.		58	60	40	40	-
Slovakia	**n**		*108*	*1284*	*2256*	*1177*	*335*
	50. P.		16	15	13	14	17
	90. P.		49	47	42	40	53

Tab. I.4 g: Zn contents in European soils according to soil texture classes [mg*kg-1] - Aqua regia basis -

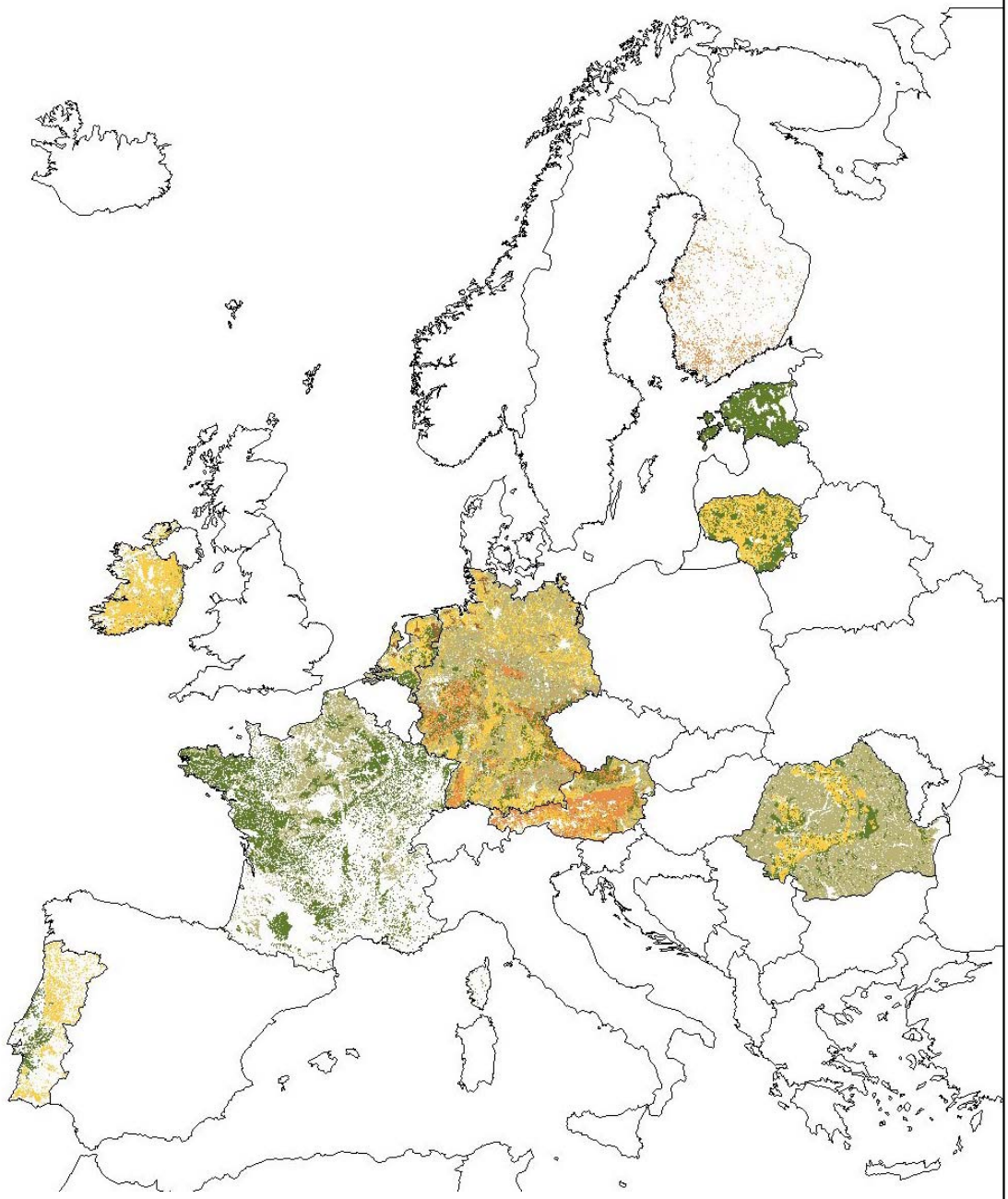
Zn		Texture classes (< 2 mm)					
		No texture	Coarse	Medium	Medium fine	Fine	Very fine
Austria	**n**		*88*	*1872*	*350*	*165*	*14*
	50. P.		53	75	73	83	96
	90. P.		96	119	106	123	-
Finland	**n**	*55*					
	50. P.	20					
	90. P.	59					
France	**n**		*102*	*743*	*377*	*245*	*9*
	50. P.		24	49	65	98	90
	90. P.		58	91	120	155	-
Germany	**n**	*128*	*914*	*1285*	*888*	*144*	*12*
	50. P.	29	21	66	58	92	127
	90. P.	105	54	146	132	165	-
Ireland	**n**	*10*	*23*	*210*	*8*	*28*	
	50. P.	11	51	59	52	44	
	90. P.	-	83	108	-	77	
Italy	**n**		*176*	*1058*	*33*	*264*	*6*
	50. P.		57	71	77	78	77
	90. P.		141	127	135	130	-
Portugal	**n**		*62*	*80*		*6*	
	50. P.		30	40		69	
	90. P.		63	73		-	
Estonia	**n**		*80*	*39*	*95*	*260*	*63*
	50. P.		23	25	39	35	32
	90. P.		46	63	61	57	67
Romania	**n**		*85*	*319*	*310*	*213*	*7*
	50. P.		55	50	47	61	69
	90. P.		127	156	118	187	-
Slovakia	**n**		*108*	*1284*	*2256*	*1177*	*335*
	50. P.		41	48	47	54	62
	90. P.		73	85	78	80	88

Organic matter contents in European soils

Tab. I.5: Organic matter contents in European soils according to soil parent material and land use [Mass-%]

Mat 11 unit	Parent material	Austria			Finland			France			Germany			Ireland			The Netherlands			Portugal			Estonia			Lithuania			Norway			Romania		
		n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.	n	50. P.	90. P.
1	**Undifferentiated alluvial or glacial deposits**																																	
Land use	Arable land	78	3	4	11	9	-				293	2	6				537	2	5				297	4	8	749	5	8	563	10	86	113	2	4
	Grassland	53	7	13							176	7	27	11	5	-	539	8	20				79	3	12	680	5	9				47	2	4
	Forest	11	8	-							230	8	21				184	5	9	1	-	-	161	3	10	521	4	9	1076	6	83	27	2	5
	Other land use										196	3	8				137	4	8													10	2	-
2	**Calcareous rocks**																																	
Land use	Arable land	37	3	4				403	4	8	167	3	5	12	2	-																20	3	4
	Grassland	228	10	20							69	4	10	91	5	10																13	4	-
	Forest	126	13	24							232	8	18							3	-	-										9	5	-
	Other land use										115	3	6																			3	-	-
3	**Clayey materials**																																	
Land use	Arable land				43	11	50	204	3	5	1294	1	3													341	5	8				30	2	4
	Grassland										118	5	21													254	5	10				13	3	-
	Forest										126	8	22							1	-	-				46	5	11				8	3	-
	Other land use										44	4	8																			2	-	-
4	**Sandy materials**																																	
Land use	Arable land	38	3	5				50	2	5	414	2	4				332	4	8							88	4	7				3	-	-
	Grassland										141	5	19	41	5	23	655	6	15							158	4	8				3	-	-
	Forest										543	7	18	10	17	-	303	4	11	42	3	8				407	4	8				2	-	-
	Other land use										110	4	10				101	5	15													1	-	-
5	**Loamy materials**																																	
Land use	Arable land	715	2	4				565	2	2	1291	2	4				41	2	3													202	2	4
	Grassland	359	7	16							318	4	8	11	8	-	36	5	8													15	2	-
	Forest	112	6	14							609	9	22				34	9	14													18	3	-
	Other land use										213	3	8				4	-	-													11	3	-
6	**Detrital formations**																																	
Land use	Arable land																															2	-	-
	Grassland	8	11	-																												10	3	-
	Forest																															31	4	12
	Other land use																																	
7	**Crystalline rocks and migmatites**																																	
Land use	Arable land	212	3	4				85	2	4	282	3	5	10	4	-																3	-	-
	Grassland	567	8	22							213	5	9	74	6	10																22	4	6
	Forest	221	10	19							840	10	21							101	7	15										79	7	17
	Other land use										252	4	8																					
8	**Volcanic rocks**																																	
Land use	Arable land										15	3	-																					
	Grassland										37	4	10																			10	4	-
	Forest										52	13	23																			12	7	-
	Other land use										6	4	-																					
9	**Other rocks**																																	
Land use	Arable land										101	1	5				110	17	34													63	2	4
	Grassland	5	7	-							106	23	53				148	22	44													66	2	4
	Forest										21	6	48				37	73	95													85	2	5
	Other land use										4	-	-				4	-	-													7	2	-

Fig. I.8: Organic Matter Contents in European Soils
according to Soil Parent Material and Land Use



Map Sources:
European Soil Data Base, Version 1.0
CORINE Land Cover, Version 12/2000

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Classes of Org. Matter Content
[mg/kg]
- Median values -

<2
>2-4
>4-8
>8-15
>15
No information

Status June 2003
NB. UK data stratified according
to soil parent material only

N

Annex II: Return of the revised questionnaires

- Original data: Documentation sheets and table sets -

Contents of Annex II

Documentation sheets and table sets of the revised questionnaire (Phase II, 2nd part) of following countries:

- Austria
- Finland
- France
- Germany
- Republic of Ireland
- Italy
- The Netherlands
- Portugal
- Estonia
- Lithuania
- Norway
- Slovak Republic
- Romania

Austria

Documentation Sheet (according to the evaluation of soil data from Austria)①

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils	
Details of the person who filled in the documentation sheet: Institute/Country: Federal Environment Agency / Austria Name: Freudenschuß Alexandra Position in the Institute: Address: Spittelauer Lände 5, 1090 Vienna Phone: 0043-1-31304-3691 Fax: 0043-1-31304-3700 e-mail: freudenschuss@ubavie.gv.at The data used for your request were provided by the Austrian Soils Surveys carried out by the Federal Provinces of Austria (Burgenland, Carinthia, Lower and Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg) and the Federal Forest Research Centre.	
Description of the data set	
General characteristic of the soil samples	*Land use* *Arable (cultivated) land* [x] *(managed) grassland* [x] *forest* [x] *other (urban etc.)* [ ]
	Please give a brief definition of the respective land use units:
	Arable Land: cultivated land
	Grassland: intensively and extensively cultivated grassland, meadows, (alpine) pastures
	Forest:
	Other:
	Geographical locations deliverable: Yes No Accuracy:

① If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

<table>
<tr><td>Sampling strategy</td><td colspan="3"><u>Kind of sampling</u>

Random ☐
Grid x☐
grid distance:
grassland and arable land 4x4km
forest sites: 8.7x8.7km
Nested Sampling ☐
Other ☐
please specify:

Soil horizon x☐ please specify: arable land 0-20cm (partly weighted mean values); grassland and forest sites 0-10cm (mostly weighted mean values)
Depth increment ☐ please specify:
☐
Single core ☐
Mixed core
Number of cores:</td></tr>
<tr><td>Soil type/
Soil parent material</td><td colspan="2"><u>Soil type</u>:
Information available ☐ please specify nomenclature:

<u>Source of information:</u>

Map (kind of map, scale)
☐

Profile description
☐</td><td><u>Soil parent material:</u>
Information available x☐ please specify nomenclature:
<u>point information was classified according to MAT 11 of the FAO soil map 1:1 Mio.</u>

<u>Source of information:</u>

Map (kind of map, scale)

Profile description
☐</td></tr>
</table>

Additional soil parameter	*Soil pH* pH (H_2O) ☐ pH (KCl) ☐ pH ($CaCl_2$) **x** ☐ *Information available, analytical method depends on each investigation* Analytical result **x** ☐ please specify analytical method (standard, solid : liquid ratio): *Austrian Standard L 1083 (0,01m $CaCl_2$)* Estimation ☐ please specify (e.g. target pH-values, maps):	*Soil texture* Analytical results **x** ☐ Profile description **x** ☐ *Availability of data depends on the investigation.* Please specify the nomenclature for classifying soil texture: - *analytical results mostly refer to Austrian Standard L1061 (soils with less than 5% organic matter need not be treated with H_2O_2 before texture analysis; pipette according KÖHN)* *other analytical methods: Sedigraph* - *some missing texture information was added by comparing with the profile descriptions done according to the Austrian nomenclature (Austrian Standard L 1050)* *in both cases a translation into the stipulated EU texture classes was carried out.* (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay)

Additional soil parameter	*Soil organic matter* Analytical results **x**☐ please specify analytical method (standard, digestion method): *analytical methods are different according to each investigation: Austrian Standard L1081 or calculated by TC (Austrian Standard L1080) minus TIC (Scheibler; Austrian Standard L 1084); varying wet and dry combustion;* *when necessary data were harmonised with regard to dry combustion (MUTSCH 1994: ALVA Methodenvergleich Humusbestimmung Enquete 1994. In: Berichte der Herbsttagung der Arbeitsgemeinschaft der Landwirtschaftlichen Versuchsanstalten).* *Data which were analysed as organic carbon were translated to organic matter using the factor 1.72.* Profile description ☐

Digestion method(s) for determination of trace elements	International standard ☐ please specify: National standard or other **x**☐ please describe in detail:
	arable land and grassland sites: most frequent extraction method is the aqua regia extraction (HCl: HNO3=3:1) following the Austrian Standard L 1085. Data from one investigation (Cd, Cr, Cu, Ni, Pb, Zn) were analysed with converse aqua regia which is found to be comparable to aqua regia and Hg in pure $HCLO_4$ (70%).
	forest sites: extraction method for all trace elements with a mixture of HNO_3 and $HCLO_4$ (5:1) according to Austrian Standard L 1085.
	Please give information of the detection limits in [mg/kg dry mass]; As: Cd: Cr: *not possible* Cu: Hg: Mo: Ni: Pb: Se: Zn:

Statistical Evaluation of the data sets	
Harmonisation of the data sets	If individual data sets refer to different analytical methods, does the evaluation take into account these differences (e.g. by correction factors or functions) Yes ☐ No **x**☐ ~~If Yes, please specify:~~ *Data were harmonised according to soil depth (arable land 0-20cm; grassland and forest sites: 0-10cm). The used data set was first checked for implausible values according to land use. Data which exceeded the 75. percentile more than the 1.5 fold of the interquartile distance (75. percentile- 25. percentile) were excluded from the data set. This was done for all elements.* *In case of grassland and forest soils the statistical results for implausible values showed a good accordance with the maximum Corg content for mineral soils (30%) according to the Austrian nomenclature.* Do the data sets include samples from contaminated sites? Yes ☐ No **x** ☐ If Yes, are these samples eliminated before data evaluation? Yes ☐ No ☐ If Yes, please specify how contaminated samples were identified:

Table set 1
Contents of trace elements related to soil parent material and land use
- Austria -

Mat 11 unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**83**	0.04	0.15	0.20	0.28	0.37	0.47
	grassland	**52**	0.13	0.23	0.30	0.45	0.61	0.71
	forest	**11**	0.03		0.22			0.57
	other land use							
2	**calcareous rocks**							
land use	arable land	**32**	0.13	0.19	0.29	0.37	0.42	0.44
	grassland	**204**	n.d.	0.30	0.43	0.60	0.80	0.91
	forest	**91**	0.03	0.32	0.53	0.93	1.23	1.41
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**40**	0.06	0.17	0.23	0.34	0.42	0.42
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**721**	0.01	0.14	0.20	0.26	0.33	0.47
	grassland	**337**	n.d.	0.20	0.28	0.39	0.63	0.91
	forest	**109**	0.01	0.11	0.19	0.315	0.54	1.29
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland	**8**	0.01		0.27			0.57
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**224**	0.02	0.15	0.19	0.24	0.30	0.44
	grassland	**589**	n.d.	0.21	0.29	0.40	0.58	0.91
	forest	**224**	0.01	0.14	0.19	0.31	0.47	1.42
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land	**4**	0.22		0.30			0.39
	grassland	**6**	0.24		0.44			0.85
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Austria -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**88**	12.0	28.9	35.4	41.9	49.5	72.0
	grassland	**48**	10.4	29.9	36.4	46.9	55.2	75.6
	forest	**12**	8.0		27.0			51.0
	other land use							
2	**calcareous rocks**							
land use	arable land	**44**	4.7	30.7	35.0	45.3	58.8	72.9
	grassland	**196**	n.d.	27.6	38.2	47.5	57.1	74.3
	forest	**147**	3.0	18.0	25.0	32.0	39.2	53.0
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**43**	11.6	26.5	31.1	36.4	44.6	72.3
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**708**	n.d.	31.4	37.8	46.4	55.2	72.4
	grassland	**311**	6.0	28.0	35.0	43.4	50.4	76.9
	forest	**111**	2.0	17.0	24.0	30.0	34.8	53.0
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland	**7**	22.0		43.4			58.7
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**204**	1.9	22.4	32.8	45.8	58.3	72.2
	grassland	**438**	n.d.	20.5	32.7	43.1	55.1	76.0
	forest	**209**	1.0	13.0	20.0	31.0	39.0	52.0
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land	**4**	14.8		26.8			33.9
	grassland	**6**	22.0		36.0			63.8
	forest							
	other land use							

Table set 1

Contents of trace elements related to soil parent material and land use
- Austria -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**86**	9.4	17.6	23.3	28.9	35.0	43.0
	grassland	**49**	7.7	21.5	29.9	36.6	41.7	47.8
	forest	**11**	6.0		19.0			34.0
	other land use							
2	**calcareous rocks**							
land use	arable land	**38**	6.4	19.2	23.0	28.9	32.3	38.0
	grassland	**243**	n.d.	16.2	21.5	28.0	34.4	50.2
	forest	**145**	1.0	10.0	14.0	18.0	26.0	39.0
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**42**	8.5	15.3	20.6	25.7	30.7	33.4
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**689**	6.2	17.2	20.8	25.1	31.5	44.0
	grassland	**363**	5.0	15.0	20.6	28.8	36.0	53.2
	forest	**104**	3.0	10.0	14.0	20.0	25.5	37.0
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland	**8**	9.2		19.9			34.5
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**218**	4.8	12.0	18.3	26.1	33.2	43.5
	grassland	**582**	n.d.	12.0	19.0	28.4	38.0	53.6
	forest	**212**	2.0	8.0	15.0	22.0	32.0	41.0
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land	**4**	13.4		15.9			30.8
	grassland	**5**	9.0		23.0			35.4
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Austria -

Mat 11 unit	parent material	Hg [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**79**	n.d.	0.06	0.09	0.14	0.19	0.39
	grassland	**39**	0.04	0.09	0.15	0.21	0.31	0.33
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**38**	0.02	0.12	0.23	0.26	0.34	0.35
	grassland	**163**	0.05	0.12	0.17	0.25	0.33	0.41
	forest							
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**42**	0.01	0.06	0.15	0.24	0.37	0.42
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**630**	n.d.	0.11	0.18	0.25	0.29	0.42
	grassland	**211**	0.02	0.08	0.13	0.19	0.26	0.40
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland	**8**	0.08		0.13			0.16
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**176**	0.03	0.11	0.18	0.25	0.29	0.42
	grassland	**390**	n.d.	0.08	0.10	0.15	0.23	0.40
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland	**6**	0.07		0.09			0.27
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Austria -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**85**	2.6	20.3	26.4	34.1	40.0	45.7
	grassland	**49**	6.0	21.1	29.1	39.9	48.5	58.2
	forest	**12**	8.0		32.5			54.0
	other land use							
2	**calcareous rocks**							
land use	arable land	**42**	5.5	17.8	21.4	29.7	34.3	41.3
	grassland	**194**	n.d.	18.8	25.0	33.9	41.5	58.7
	forest	**146**	2.0	17.8	25.0	32.0	42.3	60.0
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**43**	7.3	17.9	22.1	25.9	33.2	38.2
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**710**	4.1	20.2	24.6	30.4	36.8	48.6
	grassland	**306**	4.0	18.3	23.7	30.1	38.7	59.0
	forest	**110**	1.0	15.8	22.5	32.0	42.6	58.0
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland	**8**	10.1		24.7			38.3
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**216**	1.0	8.0	17.7	26.7	36.0	48.1
	grassland	**452**	1.0	11.0	21.6	31.7	41.0	59.4
	forest	**217**	1.0	10.0	17.0	30.0	38.0	56.0
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land	**4**	15.3		22.5			35.2
	grassland	**6**	12.0		36.5			55.0
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Austria -

Mat 11 unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**81**	2.6	13.9	17.8	24.0	27.9	37.2
	grassland	**49**	5.7	20.1	30.8	38.6	59.8	70.0
	forest	**11**	21.0		40.0			52.0
	other land use							
2	**calcareous rocks**							
land use	arable land	**33**	0.5	10.4	19.0	26.4	33.5	37.2
	grassland	**220**	3.0	26.2	37.5	53.9	68.9	89.0
	forest	**123**	15.0	47.0	65.0	90.0	106.8	138.0
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**41**	9.3	14.0	17.5	22.4	28.4	30.6
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**713**	0.2	11.9	16.9	20.8	25.5	37.7
	grassland	**347**	1.3	20.2	28.0	39.4	54.0	88.0
	forest	**110**	10.0	25.8	32.5	48.3	74.9	130.0
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland	**8**	23.6		31.0			38.4
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**222**	0.2	8.6	15.0	20.5	26.1	37.6
	grassland	**578**	1.0	21.0	29.0	46.0	61.0	88.3
	forest	**218**	1.0	29.0	41.0	57.5	74.0	128.0
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land	**4**	9.9		16.5			26.2
	grassland	**6**	30.7		32.0			46.8
	forest							
	other land use							

Contents of trace elements related to soil parent material and land use
- Austria -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**88**	28.0	64.2	74.5	89.8	111.4	130.0
	grassland	**51**	39.0	76.9	107.3	130.0	152.8	180.0
	forest	**12**	17.0		71.0			110.0
	other land use							
2	**calcareous rocks**							
land use	arable land	**39**	17.3	71.9	88.8	103.9	120.0	129.7
	grassland	**217**	19.0	79.6	100.0	126.6	150.5	183.3
	forest	**130**	6.0	61.8	86.5	114.3	143.9	177.0
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**43**	36.0	50.0	61.7	80.3	93.6	124.1
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**721**	20.8	60.8	71.4	82.9	97.3	131.4
	grassland	**359**	14.0	66.2	79.8	98.2	120.0	180.0
	forest	**110**	5.0	39.8	54.0	69.0	103.9	169.0
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland	**8**	41.7		106.5			158.3
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**222**	30.8	67.1	83.7	100.0	118.5	131.4
	grassland	**593**	13.0	52.8	78.0	104.7	122.8	181.2
	forest	**222**	7.0	32.0	50.0	75.0	103.5	178.0
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land	**4**	37.7		52.3			78.6
	grassland	**6**	49.0		79.3			105.0
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Austria -

Mat 11 unit	parent material	org. C [%] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**78**	1.2	1.9	2.5	3.2	4.0	5.2
	grassland	**53**	2.0	4.8	7.0	10.0	13.4	22.9
	forest	**11**	3.6		7.6			19.8
	other land use							
2	**calcareous rocks**							
land use	arable land	**37**	1.5	2.8	3.2	4.0	4.4	5.0
	grassland	**228**	0.3	7.4	10.0	15.4	20.5	29.2
	forest	**126**	2.9	8.0	12.7	19.0	24.1	29.3
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**38**	1.5	2.0	2.9	4.1	4.6	4.9
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**715**	0.5	1.9	2.4	2.9	3.6	5.3
	grassland	**359**	1.9	5.3	6.8	9.8	16.2	27.9
	forest	**112**	1.4	4.0	5.9	9.3	14.2	28.8
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland	**8**	0.3		10.9			16.9
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**212**	0.9	2.2	2.8	3.8	4.4	5.3
	grassland	**567**	0.8	5.9	8.5	15.6	21.7	29.3
	forest	**221**	1.7	6.0	9.7	13.8	19.0	27.6
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland	**5**	1.0		7.4			7.7
	forest							
	other land use							

Table set 2
Contents of trace elements related to soil pH
- Austria -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	933	n.d.	0.16	0.23	0.35	0.53	1.26
> 5 - 6	796	n.d.	0.17	0.22	0.32	0.49	1.4
> 6 - 7	463	n.d.	0.18	0.25	0.37	0.66	1.42
> 7	491	0.02	0.19	0.25	0.34	0.47	1.41

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	761	n.d.	16.1	26.9	37.4	47.8	76.0
> 5 - 6	771	n.d.	27.6	35.4	44.3	53.8	72.8
> 6 - 7	464	1.3	29.0	36.3	45.2	53.7	75.6
> 7	523	n.d.	27.9	35.0	43.8	54.4	72.9

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	936	n.d.	10.0	16.0	24.0	32.6	52.9
> 5 - 6	809	n.d.	15.2	20.4	27.8	35.2	53.6
> 6 - 7	501	5.0	16.6	21.2	27.9	35.0	53.2
> 7	497	3.0	17.8	21.8	26.5	32.6	51.0

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	404	n.d.	0.08	0.12	0.20	0.27	0.42
> 5 - 6	567	n.d.	0.08	0.13	0.19	0.27	0.40
> 6 - 7	309	0.01	0.08	0.13	0.20	0.26	0.41
> 7	445	n.d.	0.09	0.16	0.23	0.28	0.42

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	783	n.d.	10.4	19.0	29.2	38.2	59.3
> 5 - 6	773	n.d.	17.5	23.6	31.0	39.4	59.4
> 6 - 7	462	3.6	20.4	26.6	33.2	42.0	60.0
> 7	524	4.1	19.9	24.0	30.0	36.4	58.0

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	913	1.0	23.1	34.8	52.0	68.6	138.0
> 5 - 6	803	0.2	15.8	21.8	30.4	45.7	103.0
> 6 - 7	486	0.2	16.0	22.4	37.0	63.0	131.0
> 7	506	0.2	11.7	17.3	25.4	40.7	110.0

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	952	5.0	43.0	64.0	91.4	114.5	180.0
> 5 - 6	814	14.0	66.2	81.2	100.0	121.5	183.3
> 6 - 7	492	36.0	67.6	83.9	105.6	130.0	180.0
> 7	521	6.0	61.3	73.0	88.0	106.6	180.0

Table set 3
Contents of trace elements related to soil texture classes
- Austria -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**88**	0.03	0.12	0.20	0.32	0.58	0.91
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1799**	n.d.	0.16	0.22	0.32	0.48	1.42
3	Medium fine	< 35% clay and < 15% sand	**348**	0.03	0.17	0.23	0.30	0.46	1.24
4	Fine	35% ≤ clay < 60%	**154**	n.d.	0.20	0.30	0.52	0.78	1.22
5	Very fine	≥ 60% clay	**11**	n.d.	0.31	0.39	0.49	0.81	0.85

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**89**	2.0	11.8	21.0	36.4	53.0	68.3
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1841**	n.d.	24.0	32.3	41.7	51.0	76.0
3	Medium fine	< 35% clay and < 15% sand	**357**	0.5	32.0	38.8	45.6	55.1	74.3
4	Fine	35% ≤ clay < 60%	**176**	5.0	27.0	37.4	48.4	57.7	75.0
5	Very fine	≥ 60% clay	**13**	18.0	23.5	32.0	40.5	54.2	59.0

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**88**	1.0	6.1	13.0	20.5	32.1	51.0
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1824**	n.d.	13.6	19.5	26.2	34.0	53.6
3	Medium fine	< 35% clay and < 15% sand	**346**	7.0	16.0	20.2	24.5	30.8	50.2
4	Fine	35% ≤ clay < 60%	**166**	n.d.	18.1	24.3	29.3	35.8	51.5
5	Very fine	≥ 60% clay	**13**	9.0	16.0	28.0	30.0	34.5	37.0

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**67**	0.01	0.05	0.09	0.18	0.24	0.35
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1246**	n.d.	0.08	0.13	0.20	0.27	0.42
3	Medium fine	< 35% clay and < 15% sand	**227**	n.d.	0.11	0.17	0.23	0.29	0.39
4	Fine	35% ≤ clay < 60%	**139**	0.01	0.10	0.14	0.21	0.28	0.4
5	Very fine	≥ 60% clay	**9**	0.04		0.12			0.22

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**89**	1.0	6.7	13.0	22.9	35.4	48.0
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1872**	n.d.	15.6	22.8	30.0	38.3	60.0
3	Medium fine	< 35% clay and < 15% sand	**353**	3.0	20.8	25.0	31.0	36.8	58.7
4	Fine	35% ≤ clay < 60%	**173**	n.d.	22.0	29.1	36.5	43.2	59.0
5	Very fine	≥ 60% clay	**13**	10.0		34.0			59.0

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**86**	1.2	12.0	20.5	38.8	56.5	106.0
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1837**	0.2	15.8	23.3	37.0	59.0	138.0
3	Medium fine	< 35% clay and < 15% sand	**353**	0.2	15.2	20.4	28.0	45.0	81.0
4	Fine	35% ≤ clay < 60%	**159**	2.2	20.5	33.9	50.0	68.0	131.0
5	Very fine	≥ 60% clay	**12**	15.1	39.0	60.5	64.8	75.3	78.0

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**88**	5.0	36.5	52.8	72.3	96.0	144.0
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1872**	6.0	58.0	75.0	96.5	118.7	181.2
3	Medium fine	< 35% clay and < 15% sand	**350**	34.0	63.2	73.1	89.0	106.4	183.3
4	Fine	35% ≤ clay < 60%	**165**	14.0	68.0	82.9	101.0	123.3	178.8
5	Very fine	≥ 60% clay	**14**	48.5	76.7	95.5	106.5	115.5	118.0

Finland

Documentation Sheet[1]

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: Geological Survey of Finland (GTK) Name: Timo Tarvainen Position in the Institute: senior scientist Address:P.O. Box 96, 02151 ESPOO Phone: +358205011 Fax: +358205012 e-mail: timo.Tarvainen@gsf.fi

Description of the data set

Geographical locations (co-ordinates)	Geographical locations deliverable: Yes No Accuracy: 20 m Co-ordinate system used e.g. national, UTM etc. both national and UTM	
Sampling strategy	*Kind of sampling* Random: ☐ Grid: ■ grid distance: 50 km x 50 km Nested Sampling ☐ Other ☐ please specify: Area sample (m^2)	Soil horizon ☐ please specify: Depth increment ■ please specify: 0-25 cm Single core ☐ Mixed core ■ Number of cores: 5 subsamples from 100 m x 100 m area

[1] If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 “description of the data set”).

Soil parameter	■ *Soil pH* Analytical result: ☐ (If other procedures other than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear ☐dication of the chosen pH analytical method.) ☐ pH ($CaCl_2$) ☐ pH (H_2O) ☐ pH (KCl) Estimation: please specify (e.g. target pH-values, maps):	*Soil e particle size class* Analytical results ☐ Profile description ■ Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay)	*Soil organic matter* Analytical results ■ analytical method: LOI (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. Profile description
Digestion method(s) for determination of trace elements	The analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18.g/ml). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: Other (please specify): If other, were data transferred to aqua regia? Yes no		

Detection limits	Please give information of the detection limits in [mg/kg dry mass]; As: 0.2 Cd: 0.01 Cr: 1 Cu: 1 Hg: Mo: 2 Ni: 3 Pb: 0.2 Se:0.03 Zn: 1

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes ☐ No ■ If Yes, are these samples eliminated before data evaluation? Yes ☐ No ☐ If Yes, please specify how contaminated samples were identified:

Any other comments:

Table set 1
Contents of trace elements related to soil parent material and land use
- Finland -

Mat 11 unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**11**	0.019	0.048	0.071	0.176		0.209
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**43**	0.036	0.089	0.141	0.209	0.371	0.490
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Finland -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**11**	14.8	16.0	21.7	44.3		59.4
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**43**	6.0	20.4	33.2	46.3	70.8	74.4
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Finland -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**11**	6.0	7.8	11.0	18.9		24.6
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**43**	<1	10.7	16.2	25.8	41.2	51.2
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Finland -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**11**	4.6	5.5	7.1	17.5		23.8
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**43**	1.0	8.1	13.6	22.5	36.7	60.1
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Finland -

Mat 11 unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**11**	3.3	4.3	6.0	8.4		9.2
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**43**	3.1	5.7	8.6	12.2	22.1	24.4
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Finland -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**11**	11.8	18.5	21.5	51.4		57.9
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**43**	5.0	27.1	38.9	66.0	108.6	121.0
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Finland -

Mat 11 unit	parent material	org. C [%]						
		n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**11**	5.4	7.5	8.9	11.5		12.6
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**43**	4.9	8.2	10.6	17.8	50.1	63.1
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 3
Contents of trace elements related to soil texture classes
- Finland -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	55	0.04	0.098	0.148	0.228	0.315	0.349
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	≥ 60% clay							

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	55	2.51	6.32	14.8	23.7	45.72	86
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	≥ 60% clay							

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	55	<1	9.56	22	31.5	48.56	60.2
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	≥ 60% clay							

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	55	1	4.51	6.59	11.5	17.4	21.8
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	≥ 60% clay							

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	55	<0.1	6.34	7.87	10.5	16.76	30.9
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	≥ 60% clay							

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	55	<1	11.8	20.1	27.6	58.86	64.3
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	≥ 60% clay							

France

Appendix 3 Documentation Sheet①

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Denis Baize, Dominique King, Nicolas Saby Institute/Country: INRA France Name: King Dominique Position in the Institute: Address: INRA - Avenue de la Pomme de Pin BP 20619 – Ardon F-45166 OLIVET CEDEX Phone 33 (0)2 38 41 78 45 Fax 33 (0)2 38 41 78 69 e-mail: king@orleans.inra.fr

Description of the data set		
Geographical locations (co-ordinates)	Geographical locations deliverable: ~~Yes~~ No Accuracy: Co-ordinate system used e.g. national, UTM etc.	
Sampling strategy	*Kind of sampling*	
	Random: ■ Grid: ☐ grid distance: Nested Sampling ☐ Other ☐ please specify: Area sample (m^2) about 200 m²	Soil horizon ■ please specify: surface only Depth increment please specify: Single core Mixed core Probably Number of cores:

① If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

Soil parameter	■ *Soil pH* Analytical result: ■ (If other procedures other than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear ■dication of the chosen pH analytical method.) pH ($CaCl_2$) pH (H_2O) pH (KCl) Estimation: please specify (e.g. target pH-values, maps):	*Soil e particle size class* Analytical results ■ Profile description ☐ Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay)	*Soil organic matter* Analytical results ■ analytical method: (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. ☐ Wet chromic acid digestion Profile description
Digestion method(s) for determination of trace elements	The analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18.g/ml). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: Other (please specify): $HF + HClO_4$ (NF X 31-147) If other, were data transferred to aqua regia? Yes no		

Detection limits	Please give information of the detection limits in [mg/kg dry mass]; As: 2 Cd: 0.02 Cr: Cu: 2 Hg: 0.02 Mo: Ni: 2 Pb: 2 Se: Zn:

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes ☐ No ■ If Yes, are these samples eliminated before data evaluation? Yes ☐ No ☐ If Yes, please specify how contaminated samples were identified:

Any other comments:
There are 2 data sets: a data set on Aqua Regia data (ER) and other one on HF + $HClO_4$ data (HF).
Denis Baize changed Parental Material classification slightly.
Data concern arable land only.

Aqua regia

Table set 1
Contents of trace elements (Aqua regia) related to soil parent material and land use
- France -

reclass mat unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**144**	0.1	0.34	0.52	1.04	1.57	6.1
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**19**	0.2	0.74	0.85	0.89	0.94	1.07
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**93**	0.04	0.21	0.29	0.37	0.51	3.07
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**9**	0.03	0.15	0.25	0.3	0.31	0.33
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**20**	0.09	0.2	0.34	0.45	0.76	3.65
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**19**	0.05	0.12	0.16	0.2	0.21	0.24
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (Aqua regia) related to soil parent material and land use
- France -

reclass mat unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**155**	6.5	37.8	52.4	69.5	86	362
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**20**	5.4	9.5	12.7	14.7	18	18.4
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**103**	11	30.3	42.9	57.8	73	265
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**19**	3.2	6.7	10.6	21.3	25.3	35.7
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**27**	0.4	14.2	28.8	35.2	46	48.4
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**19**	13.5	29.7	36.4	45.2	56.5	156.3
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (Aqua regia) related to soil parent material and land use
- France -

reclass mat unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**155**	7.2	15.4	17.7	21.5	28.9	111.5
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**20**	6.4	8.7	11.7	14.6	29.1	34.8
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**103**	3.9	16.4	22.2	27.2	35.4	74.2
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**19**	1.2	2.3	2.6	4.2	5.3	6.8
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**27**	5.9	8	9.8	13.8	23.4	45
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**19**	6.4	9.1	11.6	13.5	18.9	19.2
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (Aqua regia) related to soil parent material and land use
- France -

reclass mat unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**162**	10.8	30.3	38.5	47.5	56	121
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**20**	1.7	8.7	10.7	14.9	29.6	31.1
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**103**	6	26.6	35.5	42.6	55.4	119
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**19**	0.5	1.5	2.5	4.6	7	13.5
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**27**	6	10	14.3	21.1	22.1	24.2
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**19**	10.4	12.8	17.9	21.6	25.3	47.6
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (Aqua regia) related to soil parent material and land use
- France -

reclass mat unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**154**	14.1	26.4	32	40	50.6	182
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**20**	9.3	12	16.7	40.5	56.5	60
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**103**	10.3	22.5	27.9	34.9	44.1	72.1
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**19**	5.4	8.4	14.9	21.2	22.4	23.7
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**27**	13	16.2	21.8	26.7	33.8	48
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**19**	16.4	23.2	29.6	37.8	41.6	51.8
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (Aqua regia) related to soil parent material and land use
- France -

reclass mat unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**154**	0.4	74.6	97	132.8	178.1	1099
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**20**	19.3	39.9	51.7	57.7	70.8	80.3
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**103**	30	67	77.6	98.9	121	284
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**19**	4.1	11.5	16.3	18.6	21.9	29.2
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**27**	15.9	35	41.4	46.9	51.4	59.7
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**19**	10	48	62.4	76.5	84.7	148.4
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 2
Contents of trace elements (Aqua regia) related to soil pH
- France -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	137	0.05	0.19	0.38	0.76	1.45	13
> 5 - 6	615	0.01	0.15	0.22	0.35	0.59	6.7
> 6 - 7	1063	0.01	0.19	0.3	0.4	0.6	17.1
> 7	1936	0.01	0.3	0.4	0.55	0.79	8.62

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	176	1.5	22.2	40.4	60.3	90	435
> 5 - 6	687	1.9	17.2	23.7	33	49.4	265
> 6 - 7	1185	0.4	18.6	24.2	35	52	175
> 7	2096	2	20.8	27.6	36.5	50.1	543.5

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	176	1.2	9	15	21	39.6	131
> 5 - 6	686	0.2	7.7	11.1	17.5	27.3	189.4
> 6 - 7	1182	0.3	8.8	13	19.6	28.3	663
> 7	2080	0.4	12.4	15.8	20.8	29	191.5

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	182	0.8	13.1	24.9	43.8	61.8	147
> 5 - 6	706	0.5	10.8	17.2	24.5	35.3	115
> 6 - 7	1205	0.4	12	17.3	25	37.2	119
> 7	2122	1.1	15.9	20.7	28.4	40.5	140

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	177	1.1	21	27.8	39	50.2	1240
> 5 - 6	687	0.6	17.3	23.4	31.3	39.9	1182
> 6 - 7	1185	2.9	18.2	23.1	31	41	369
> 7	2096	5.8	18.9	23.8	31.8	43.3	908.7

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	176	4.1	42.2	69.2	121.1	197.6	2707
> 5 - 6	686	0.4	32.7	46.6	64	88.9	531
> 6 - 7	1184	3.6	36	50	70.5	94	1444
> 7	2081	8.4	51.3	63.5	77.8	95.5	1099

Table set 3
Contents of trace elements (Aqua regia) related to soil texture classes
- France -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**79**	0.03	0.14	0.2	0.3	0.5	0.94
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**580**	0.01	0.18	0.25	0.4	0.7	8.9
3	Medium fine	< 35% clay and < 15% sand	**335**	0.04	0.2	0.3	0.5	0.93	6.1
4	Fine	35% ≤ clay < 60%	**223**	0.1	0.31	0.5	0.83	1.41	3.23
5	Very fine	≥ 60% clay	**10**	0.18	0.36	0.53	0.78	1.07	1.56

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**102**	1.5	8.4	13	19.5	40.9	60.4
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**752**	1.9	19.9	28	37.6	48	205
3	Medium fine	< 35% clay and < 15% sand	**380**	0.4	27.3	38	50	65.6	137
4	Fine	35% ≤ clay < 60%	**249**	8.4	38.2	51.8	68	85	362
5	Very fine	≥ 60% clay	**10**	28	52.3	59.9	68	70.7	72

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**101**	0.9	3.8	6.2	10	18.1	88
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**741**	1.1	8.4	12.4	19	32.7	146.2
3	Medium fine	< 35% clay and < 15% sand	**378**	1.9	11.5	15.4	20.6	27.1	104
4	Fine	35% ≤ clay < 60%	**245**	4.1	16.7	21.4	29.2	50	191.5
5	Very fine	≥ 60% clay	**9**	7.9	12.4	31.3	42.9	66.2	110.4

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**101**	0.5	3.6	7	12.6	19.5	39.6
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**754**	0.4	12	18.5	25.3	34.8	95
3	Medium fine	< 35% clay and < 15% sand	**386**	2.9	18.8	25.2	35.5	42.9	67
4	Fine	35% ≤ clay < 60%	**254**	10.8	30.2	39.3	49	62	140
5	Very fine	≥ 60% clay	**10**	18.4	26.7	44.7	47.4	51.4	79.9

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**102**	2.9	9	12.8	21.2	29.8	53.9
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**753**	4.9	16.3	22.5	30.3	40.8	1182
3	Medium fine	< 35% clay and < 15% sand	**379**	11.6	19.4	24.9	33.1	41	225
4	Fine	35% ≤ clay < 60%	**249**	12	24.7	31.3	41.2	52.3	174
5	Very fine	≥ 60% clay	**10**	18	26.5	31.7	38.2	56.1	107.4

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**102**	4.1	13	23.9	41.7	57.9	148.4
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**743**	0.4	36.1	49	65.6	91	438.3
3	Medium fine	< 35% clay and < 15% sand	**377**	15.9	49.2	64.9	84	120.2	1099
4	Fine	35% ≤ clay < 60%	**245**	3.6	76	98.3	125	155	700
5	Very fine	≥ 60% clay	**9**	49.8	63.1	90.4	117	228.7	391.5

HF-digestion

Table set 1
Contents of trace elements (HF-digestion) related to soil parent material and land use
- France -

reclass mat unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**123**	0.06	0.29	0.42	0.72	1.22	2.78
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**6**	0.45	0.48	0.52	0.58	0.7	0.8
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**93**	0.04	0.21	0.29	0.37	0.51	3.07
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**26**	0.02	0.08	0.1	0.16	0.22	0.27
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**502**	0.03	0.22	0.28	0.36	0.44	1.8
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**33**	0.04	0.1	0.14	0.21	0.23	0.33
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (HF-digestion) related to soil parent material and land use
- France -

reclass mat unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**121**	13.9	58.3	70.4	86.2	114.5	534
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**6**	17.3	17.9	21.2	23.9	24.8	25.6
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**69**	43	55.3	64.5	78.5	90.2	134
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**26**	6.7	14.4	16.4	19.6	24.4	43.6
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**499**	9.1	41.2	44.5	48.8	52.4	68.8
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**33**	12.2	26.3	42.6	51.9	96.8	177
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (HF-digestion) related to soil parent material and land use
- France -

reclass mat unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**123**	8.5	13.3	15.1	20.3	29.4	436.4
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**6**	7.2	7.9	8.8	9.3	9.6	9.7
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**69**	8.4	14.9	18.1	25.9	32.6	53.1
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**26**	2.3	3.5	4.8	6.6	8	18.5
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**502**	3.9	9.8	11.8	14.8	18.7	57.2
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**33**	4.3	11.5	16.4	19.3	21.1	36.8
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (HF-digestion) related to soil parent material and land use
- France -

reclass mat unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**122**	16.6	29.9	36.1	46	60.1	176
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**6**	7.5	8.7	9.6	11.5	13.1	14.1
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**69**	16.7	24.3	32.9	53.5	115.3	292
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**26**	2.8	4.3	6.1	7.3	10	11.6
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**501**	6.9	15.9	18.7	21.5	23.7	48.3
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**33**	4.1	9.5	17	24.8	36.5	95.6
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (HF-digestion) related to soil parent material and land use
- France -

reclass mat unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**124**	22.3	31.6	36.9	44.8	59	163.4
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**6**	14	15.1	15.3	15.9	17.4	18.8
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**69**	14.4	30.6	40.2	55.8	92.7	208.8
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**9**	0.03	0.15	0.25	0.3	0.31	0.33
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**500**	19	23.6	25.6	28.9	34.8	112
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**33**	0.1	34.2	38.6	46.6	54.7	367.5
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements (HF-digestion) related to soil parent material and land use
- France -

reclass mat unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**123**	46	71	86	125	168.2	483.9
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**6**	49	58	65	70.5	72	72
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**69**	46.3	66	87	166.7	255	503
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**26**	10	19.1	23.1	28.8	35.2	105
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**503**	21	49	54	61	70.6	150
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**33**	42	65.8	81	111	134.4	163.9
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 2
Contents of trace elements (HF-digestion) related to soil pH
- France -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	**81**	0.02	0.13	0.27	0.45	0.81	4.44
> 5 - 6	**634**	0.02	0.12	0.18	0.26	0.39	1.8
> 6 - 7	**1107**	0.04	0.17	0.24	0.32	0.45	5.12
> 7	**2389**	0.03	0.24	0.33	0.46	0.69	6.99

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	**86**	15.1	38.8	43.6	63.8	92.2	254
> 5 - 6	**633**	4.4	33.1	43.1	56.6	74	386
> 6 - 7	**1095**	7.1	37.8	44.6	53.4	73.8	2262
> 7	**2336**	2.5	41.3	49	59.1	73	581

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	**82**	2.8	9.3	12.6	16.7	24.8	93.9
> 5 - 6	**636**	2.3	8.2	11.7	16.7	26.3	365
> 6 - 7	**1106**	2.8	8.8	11.2	15	20.7	436.4
> 7	**2387**	2.3	10.5	13.5	17.4	23.9	420

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	**87**	3.8	14	17.4	30	49.6	199
> 5 - 6	**630**	1.5	11.3	17	24.5	34.3	250
> 6 - 7	**1097**	1.8	14.4	18.7	25	35.4	1333.4
> 7	**2350**	1.7	16.9	21.9	28.3	37.1	600.2

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	**83**	13.4	24.3	30.2	40.4	48.6	198
> 5 - 6	**634**	0.1	25	31.1	40.7	54.2	1183
> 6 - 7	**1106**	10.9	23.5	26.9	33.9	44.8	839.3
> 7	**2386**	8.8	23.2	26.9	33.5	43.9	1560

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	**83**	18	45.5	56.4	82.5	139.6	1110.3
> 5 - 6	**635**	6	41	54.1	75	104.3	436
> 6 - 7	**1110**	9	44	53	66	88.1	1247
> 7	**2404**	12	53	62.2	76	104.1	2276

Table set 3
Contents of trace elements (HF-digestion) related to soil texture classes
- France -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**145**	0.02	0.11	0.15	0.21	0.33	1.26
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1354**	0.04	0.15	0.22	0.33	0.53	6.75
3	Medium fine	< 35% clay and < 15% sand	**1262**	0.03	0.24	0.31	0.4	0.53	1.8
4	Fine	35% ≤ clay < 60%	**323**	0.06	0.26	0.44	0.74	1.24	6.99
5	Very fine	≥ 60% clay	**8**	0.09	0.12	0.22	0.3	0.64	1.27

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**144**	4.4	16.2	23.1	34.6	53.5	150
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1349**	7.1	34.7	42.9	54.1	69.6	2262
3	Medium fine	< 35% clay and < 15% sand	**1231**	9.6	43.1	47.9	54	61.7	190.4
4	Fine	35% ≤ clay < 60%	**323**	13.9	66	77.5	92.6	113	534
5	Very fine	≥ 60% clay	**8**	67.8	97.5	109	113.8	117.3	120

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**146**	2.3	5.2	7.5	11.3	21.9	49
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1354**	2.3	8.4	11.3	15.8	23.9	436.4
3	Medium fine	< 35% clay and < 15% sand	**1258**	2.8	10.7	13	16	20.4	169
4	Fine	35% ≤ clay < 60%	**325**	5.1	14	17.4	23.6	36.5	161
5	Very fine	≥ 60% clay	**8**	8.7	21.2	21.6	23.5	25.5	29.1

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**141**	1.7	5.8	8.1	13.4	23.5	45.6
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1349**	2.8	12.4	16.9	24	33	1333.4
3	Medium fine	< 35% clay and < 15% sand	**1241**	7	17.8	21.2	25.1	29.9	115.1
4	Fine	35% ≤ clay < 60%	**329**	13.6	31.5	38.5	51.7	81.8	600.2
5	Very fine	≥ 60% clay	**8**	33.5	55	61.2	71.9	88.8	98.3

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**146**	5.7	20.6	27.7	39	46.6	80.3
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1351**	0.1	23.9	28.5	35.4	46.5	1183
3	Medium fine	< 35% clay and < 15% sand	**1259**	14.4	23.8	26.3	31	40.8	352
4	Fine	35% ≤ clay < 60%	**328**	18.3	32.8	38	46.9	79.6	1560
5	Very fine	≥ 60% clay	**8**	25.6	35.4	38.2	44.5	57.7	77.5

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**146**	9	25.9	34	48	73.5	150
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1357**	6	43	53	69	91	1607
3	Medium fine	< 35% clay and < 15% sand	**1271**	25	52	59	69	81	511
4	Fine	35% ≤ clay < 60%	**326**	38	81	103	138	255	2276
5	Very fine	≥ 60% clay	**8**	65	106	117.5	186.3	253.6	409

Others

Table set 1
Contents of trace elements (HF-digestion) related to soil parent material and land use
- France -

reclass mat unit	parent material	Hg [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**273**	0.01	0.04	0.06	0.08	0.1	0.3
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**23**	0.02	0.02	0.03	0.03	0.04	0.12
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**155**	0.01	0.04	0.05	0.08	0.12	0.39
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**33**	0.02	0.02	0.04	0.05	0.94	2.6
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**520**	0.01	0.04	0.05	0.08	0.13	1.36
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**61**	0.01	0.03	0.04	0.06	0.09	7.8
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 2
Contents of trace elements (HF-digestion) related to soil pH
- France -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	267	0.01	0.04	0.05	0.07	0.16	1.91
> 5 - 6	1367	0.01	0.03	0.04	0.06	0.1	11.6
> 6 - 7	2371	0.01	0.03	0.05	0.06	0.1	4
> 7	4792	0.01	0.04	0.05	0.07	0.11	10.46

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

Table set 3
Contents of trace elements (HF-digestion) related to soil texture classes
- France -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**185**	0.01	0.03	0.04	0.07	0.15	2.6
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**2177**	0.01	0.03	0.04	0.07	0.11	11.6
3	Medium fine	< 35% clay and < 15% sand	**1513**	0.01	0.04	0.05	0.08	0.12	4
4	Fine	35% ≤ clay < 60%	**544**	0.01	0.04	0.06	0.08	0.12	1.91
5	Very fine	≥ 60% clay	**18**	0.02	0.04	0.05	0.07	0.11	0.69

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

Table set 1
Contents of trace elements (HF-digestion) related to soil parent material and land use
- France -

reclass mat unit	parent material	org. C [%] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
21	**calcareous**							
land use	arable land	**403**	0.65	1.48	2.25	3.44	4.86	9
	grassland							
	forest							
	other land use							
22	**chalk**							
land use	arable land	**40**	0.82	1.37	1.71	1.92	2.32	2.6
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land	**204**	0.24	1.27	1.56	2.04	2.74	18.3
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land	**50**	0.46	0.8	1.08	1.62	2.71	6.6
	grassland							
	forest							
	other land use							
5	**loamy materials**							
land use	arable land	**565**	0.63	0.91	1	1.1	1.22	2.24
	grassland							
	forest							
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**85**	0.47	1.02	1.39	1.79	2.36	6.13
	grassland							
	forest							
	other land use							
8	**volcanic rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Germany

Documentation Sheet[1]

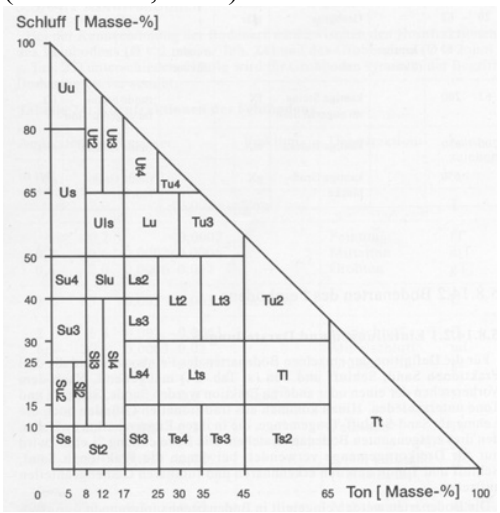
Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Germany Name: Inga Nagel, Olaf Düwel Position in the Institute: Research scientists Address: Stilleweg 2, 30655 Hannover Phone: ++49 - (0)511 - 643 – 2364 Fax: ++49 - (0)511 - 643 – 3662 e-mail: I.Nagel@bgr.de, Olaf.Düwel@bgr.de

Description of the data set

The evaluated data are part of the database FISBo that is governed by BGR. Data of the individual series derive from programmes of the Federal States as well as from national surveys. The following information indicates the ranges of the whole dataset.

Geographical locations (co-ordinates)	Geographical locations deliverable: Yes X No ☐ Accuracy: 1 – 1000m Co-ordinate system used e.g. national, UTM etc.: Gauß-Krüger	
Sampling strategy	*Kind of sampling*	
	Random: ■ Grid: ■ Only for data of Federal State of Saxony grid distance: 4 * 4 km ☐ Nested Sampling ☐ Other please specify: Area sample (m^2)	Soil horizon please specify: First A-horizon Depth increment please specify Single core: Mixed core Number of cores:

[1] If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

Soil parameter	*Soil pH*	*Soil particle size class*	*Soil organic matter*
■ ☐ ☐	Analytical result: (If other procedures than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear indication of the chosen pH analytical method.) pH ($CaCl_2$) *DIN ISO 10390* pH (H_2O) pH (KCl) Estimation: please specify (e.g. target pH-values, maps):	Analytical results ■ (mainly German standard DIN 19683) Profile description ■ Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay) The soil texture was classified according to the German nomenclature (AG Boden, 1996).  	Analytical results ■ analytical method: (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. Different analytical methods were used: Elemental analyser (DIN ISO 10694, Wösthoff) Wet oxidation by $K_2Cr_2O_7$ (DIN 19684 – 2) Organic matter is recorded (conversion factor 1.72). The data are corrected for inorganic carbonate content. Profile description

Digestion method(s) for determination of trace elements	The analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18.g/ml). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: ☐ Other (please specify): Total content: Hydrofluoric acid digestion, X-ray-fluorescence If other, were data transferred to aqua regia? Yes no
Detection limits	Please give information of the detection limits in [mg/kg dry mass]; Varying detection limits depending on methods: Cd: 0,01 – 1,0 Cr: 0,3 – 15,0 Cu: 0,1 – 25,0 Hg: 0,01 – 1,0 Ni: 0,1 – 10,0 Pb: 1,0 – 20,0 Zn: 1,0 – 4,0.

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes ■ No ☐ If Yes, are these samples eliminated before data evaluation? Yes ■ No ☐ If Yes, please specify how contaminated samples were identified: In Germany there are some marginal values for the identification of untypical heavy metal contents referring to the classes of parent material (so called “BAG-Units”; Utermann et al., 1999). Samples with high heavy metal contents were not eliminated, if a marginal value was not deduced for a BAG unit.

Any other comments:

Table set 1
Contents of trace elements related to soil parent material and land use
- Germany -

Mat 11 unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**220**	0.01	0.15	0.36	0.61	1.50	21.90
	grassland	**135**	0.02	0.30	0.75	2.69	5.99	20.00
	forest	**108**	0.01	0.10	0.21	0.60	2.01	15.90
	other land use	**42**	0.05	0.16	0.41	2.00	2.57	24.30
2	**calcareous rocks**							
land use	arable land	**79**	0.03	0.22	0.34	0.46	0.90	3.10
	grassland	**39**	0.03	0.13	0.26	0.50	1.28	3.19
	forest	**86**	0.04	0.15	0.38	0.94	1.50	3.00
	other land use	**18**	0.14		0.29			1.10
3	**clayey materials**							
land use	arable land	**234**	0.04	0.15	0.25	0.36	0.70	2.40
	grassland	**68**	0.03	0.14	0.22	0.32	0.60	1.10
	forest	**161 ***	0.05	0.10	0.16	0.35	0.70	1.70
	other land use	**16 ***	0.10		0.28			1.40
4	**sandy materials**							
land use	arable land	**216 ***	0.01	0.13	0.19	0.25	0.43	1.98
	grassland	**117**	0.01	0.14	0.23	0.32	0.70	2.15
	forest	**364 ***	0.01	0.09	0.15	0.25	0.60	2.26
	other land use	**38**	0.05	0.11	0.21	0.39	0.61	2.10
5	**loamy materials**							
land use	arable land	**495**	0.05	0.23	0.34	0.50	0.70	2.10
	grassland	**140**	0.03	0.27	0.44	0.64	0.91	3.70
	forest	**248**	0.01	0.12	0.23	0.55	0.95	4.33
	other land use	**17**	0.15		0.32			1.00
7	**crystalline rocks and migmatites**							
land use	arable land	**120**	0.07	0.25	0.41	0.67	0.86	1.90
	grassland	**110**	0.07	0.30	0.44	0.67	0.93	1.28
	forest	**450**	0.01	0.14	0.23	0.50	0.83	4.80
	other land use	**19**	0.16		0.32			0.97
8	**volcanic rocks**							
land use	arable land	**10**	0.15		0.35			0.82
	grassland	**70**	0.02	0.18	0.42	0.92	2.27	5.85
	forest	**12**	0.15		0.42			1.00
	other land use	**4**	0.26		0.43			0.70
9	**other rocks**							
land use	arable land	**26 ***	0.08	0.14	0.16	0.25	0.60	0.65
	grassland	**54**	0.06	0.17	0.26	0.54	1.05	1.69
	forest	**16**	0.13		0.54			1.16
	other land use	**7**	0.20		0.50			1.10

* more than 25% below detection limit

Table set 1
Contents of trace elements related to soil parent material and land use
- Germany -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**252**	1.8	15	24	34	45	83
	grassland	**132**	3.6	20	35	49	66	106
	forest	**166**	1.3	7	20	28	41	77
	other land use	**43**	3.2	20	30	41	54	99
2	**calcareous rocks**							
land use	arable land	**83**	7.4	25	34	44	57	89
	grassland	**41**	10.0	24	34	44	63	70
	forest	**136**	1.9	23	30	38	45	72
	other land use	**23**	0.9	19	28	34	44	52
3	**clayey materials**							
land use	arable land	**267**	0.2	6	9	17	37	79
	grassland	**86**	0.5	9	18	30	47	61
	forest	**161**	0.9	5	18	34	47	119
	other land use	**16**	0.2		12			47
4	**sandy materials**							
land use	arable land	**261**	0.2	5	8	13	18	59
	grassland	**121**	0.4	5	9	17	27	43
	forest	**368**	0.2	3	7	13	23	139
	other land use	**38**	0.5	4	8	12	23	119
5	**loamy materials**							
land use	arable land	**527**	0.5	13	18	29	41	360
	grassland	**135**	6.1	16	23	33	60	346
	forest	**346**	2.7	19	27	38	51	323
	other land use	**37**	7.4	25	32	47	53	59
7	**crystalline rocks and migmatites**							
land use	arable land	**120**	5.2	19	30	40	55	125
	grassland	**111**	4.0	18	29	45	52	76
	forest	**594**	0.5	23	34	47	55	337
	other land use	**21**	12.5	26	43	58	93	100
8	**volcanic rocks**							
land use	arable land	**11**	24.3		40			417
	grassland	**13**	23.1		44			197
	forest	**72**	6.8	36	68	115	171	432
	other land use	**4**	55.3		70			94
9	**other rocks**							
land use	arable land	**32**	0.2	5	9	12	20	35
	grassland	**73**	0.2	7	13	23	44	173
	forest	**17**	2.2		10			156
	other land use	**4**	1.1		4			8

Table set 1
Contents of trace elements related to soil parent material and land use
- Germany -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**284**	1.8	12	17	26	45	775
	grassland	**164**	1.8	15	22	39	76	265
	forest	**173**	1.0	6	11	25	47	1030
	other land use	**47**	3.5	13	24	54	176	391
2	**calcareous rocks**							
land use	arable land	**82**	3.4	15	20	27	42	63
	grassland	**40**	4.2	14	20	25	34	79
	forest	**156**	2.0	9	15	22	30	69
	other land use	**20**	2.2	13	19	37	56	76
3	**clayey materials**							
land use	arable land	**279**	1.5	6	9	14	24	99
	grassland	**89**	1.2	6	11	20	32	46
	forest	**170**	0.5	3	7	12	27	66
	other land use	**16**	1.5		14			44
4	**sandy materials**							
land use	arable land	**266**	0.0	5	7	10	13	54
	grassland	**128**	1.0	3	6	11	16	47
	forest	**411**	0.1	2	4	7	13	78
	other land use	**39**	0.7	3	8	11	24	43
5	**loamy materials**							
land use	arable land	**539**	0.5	10	15	20	27	76
	grassland	**142**	1.8	12	16	25	44	96
	forest	**362**	1.0	9	13	22	35	91
	other land use	**37**	2.2	12	16	24	33	80
7	**crystalline rocks and migmatites**							
land use	arable land	**121**	6.6	14	22	28	36	95
	grassland	**117**	4.8	14	19	27	37	80
	forest	**611**	1.8	12	18	26	36	173
	other land use	**16**	6.0		31			89
8	**volcanic rocks**							
land use	arable land	**11**	9.5		26			55
	grassland	**13**	10.5		22			74
	forest	**73**	3.0	21	32	62	76	216
	other land use	**4**	24.4		42			58
9	**other rocks**							
land use	arable land	**34**	2.2	6	9	11	16	52
	grassland	**97**	2.0	6	11	16	26	87
	forest	**16**	1.9		10			29
	other land use	**7**	1.5		9			24

Table set 1
Contents of trace elements related to soil parent material and land use
- Germany -

Mat 11 unit	parent material	Hg [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**116**	0.01	0.06	0.10	0.17	0.45	7.00
	grassland	**58**	0.02	0.09	0.24	0.72	1.45	8.65
	forest	**65**	0.01	0.05	0.12	0.20	0.63	2.90
	other land use	**24**	0.04	0.07	0.11	0.61	2.90	6.96
2	**calcareous rocks**							
land use	arable land	**72**	0.01	0.07	0.09	0.13	0.19	0.45
	grassland	**33**	0.02	0.05	0.07	0.10	0.20	0.45
	forest	**59**	0.02	0.09	0.12	0.18	0.29	0.82
	other land use	**11**	0.06		0.10			1.40
3	**clayey materials**							
land use	arable land	**171**	0.01	0.05	0.07	0.11	0.19	0.46
	grassland	**32**	0.03	0.05	0.07	0.11	0.15	0.24
	forest	**98**	0.01	0.07	0.13	0.18	0.26	1.00
	other land use	**2**	0.05					1.34
4	**sandy materials**							
land use	arable land	**121**	0.01	0.04	0.06	0.08	0.13	0.50
	grassland	**51**	0.01	0.04	0.07	0.12	0.16	0.22
	forest	**250**	0.01	0.04	0.10	0.17	0.23	0.75
	other land use	**25**	0.01	0.02	0.05	0.10	0.26	0.46
5	**loamy materials**							
land use	arable land	**429**	0.01	0.06	0.09	0.13	0.22	7.80
	grassland	**121**	0.01	0.07	0.10	0.15	0.24	0.66
	forest	**168**	0.01	0.09	0.15	0.24	0.37	3.50
	other land use	**17**	0.02		0.09			0.55
7	**crystalline rocks and migmatites**							
land use	arable land	**109**	0.01	0.08	0.11	0.14	0.20	1.17
	grassland	**103**	0.04	0.08	0.11	0.16	0.23	0.71
	forest	**384**	0.01	0.10	0.16	0.24	0.34	3.74
	other land use	**16**	0.04		0.11			1.71
8	**volcanic rocks**							
land use	arable land	**10**	0.07		0.12			0.16
	grassland	**11**	0.07		0.11			0.29
	forest	**49**	0.06	0.16	0.29	0.40	0.51	0.91
	other land use	**4**	0.13		0.18			0.21
9	**other rocks**							
land use	arable land	**14**	0.02		0.07			0.25
	grassland	**7**	0.01		0.24			0.55
	forest	**3**	0.05		0.06			0.18
	other land use	**6**	0.02		0.09			0.34

Table set 1
Contents of trace elements related to soil parent material and land use
- Germany -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**259**	0.5	13	20	30	38	96
	grassland	**159**	2.2	16	24	33	43	92
	forest	**170**	2.0	7	13	24	35	98
	other land use	**46**	2.0	16	24	33	39	65
2	**calcareous rocks**							
land use	arable land	**82**	3.4	20	31	37	51	93
	grassland	**40**	12.3	18	31	49	67	98
	forest	**154**	1.7	17	28	38	46	100
	other land use	**22**	6.8	23	28	38	70	92
3	**clayey materials**							
land use	arable land	**275**	0.4	5	8	15	35	95
	grassland	**85**	1.9	4	12	30	47	78
	forest	**162**	0.4	3	9	22	41	100
	other land use	**16**	0.4		7			55
4	**sandy materials**							
land use	arable land	**265**	0.4	2	4	7	12	33
	grassland	**130 ***	0.4	3	4	9	17	68
	forest	**408**	0.1	2	4	8	14	89
	other land use	**38**	0.4	2	3	4	7	83
5	**loamy materials**							
land use	arable land	**537**	0.5	10	18	25	34	268
	grassland	**141**	1.3	12	20	34	71	261
	forest	**360**	1.3	11	18	30	44	231
	other land use	**39**	6.8	11	19	27	38	69
7	**crystalline rocks and migmatites**							
land use	arable land	**121**	2.2	14	26	45	60	152
	grassland	**117**	2.2	14	24	46	61	89
	forest	**599**	0.7	15	27	42	55	354
	other land use	**21**	6.8	28	38	50	59	69
8	**volcanic rocks**							
land use	arable land	**11**	12.6		30			364
	grassland	**13**	21.0		37			184
	forest	**73**	5.4	24	48	88	154	385
	other land use	**4**	44.4		79			111
9	**other rocks**							
land use	arable land	**34**	0.4	3	5	9	19	27
	grassland	**91**	1.7	4	7	9	15	111
	forest	**15**	0.4		4			90
	other land use	**7**	1.7		4			15

* more than 25% below detection limit

Table set 1
Contents of trace elements related to soil parent material and land use
- Germany -

Mat 11 unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**280**	6.9	24	33	65	171	4900
	grassland	**164**	12.8	38	64	162	367	2334
	forest	**161**	2.0	29	43	86	190	5989
	other land use	**47**	5.0	23	48	117	380	3514
2	**calcareous rocks**							
land use	arable land	**81**	6.9	22	33	48	61	190
	grassland	**40**	2.3	25	37	51	68	139
	forest	**147**	12.4	43	63	87	124	200
	other land use	**23**	1.9	22	38	54	113	146
3	**clayey materials**							
land use	arable land	**281**	2.5	9	16	28	44	169
	grassland	**89**	3.9	14	22	36	54	141
	forest	**167**	0.5	19	33	50	66	178
	other land use	**14**	1.0		31			85
4	**sandy materials**							
land use	arable land	**265**	0.2	13	17	24	35	176
	grassland	**128**	0.6	13	20	34	48	85
	forest	**390**	1.2	14	25	44	75	193
	other land use	**37**	1.5	14	23	32	43	185
5	**loamy materials**							
land use	arable land	**532**	0.5	24	31	43	65	179
	grassland	**141**	11.9	33	44	67	102	12
	forest	**296**	1.1	34	53	87	115	195
	other land use	**39**	16.3	28	40	65	91	149
7	**crystalline rocks and migmatites**							
land use	arable land	**121**	16.6	34	47	66	89	200
	grassland	**113**	7.7	45	59	86	122	191
	forest	**463**	0.5	47	73	118	167	200
	other land use	**19**	22.2		41			141
8	**volcanic rocks**							
land use	arable land	**11**	19.1		41			74
	grassland	**13**	27.4		49			100
	forest	**29**	19.0	38	58	82	96	139
	other land use	**3**	43.2		47			82
9	**other rocks**							
land use	arable land	**34**	4.4	8	14	20	32	57
	grassland	**97**	0.8	16	27	39	54	221
	forest	**10**	6.8		56			86
	other land use	**7**	6.7		27			261

Table set 1
Contents of trace elements related to soil parent material and land use
- Germany -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**282**	8.7	45	66	114	225	4847
	grassland	**164**	7.9	78	128	315	677	1898
	forest	**174**	4.7	27	49	80	192	3628
	other land use	**48**	17.0	51	101	222	498	2048
2	**calcareous rocks**							
land use	arable land	**82**	20.0	55	69	88	134	496
	grassland	**40**	23.6	60	76	113	161	203
	forest	**155**	13.6	45	80	108	173	534
	other land use	**22**	13.3	53	80	101	147	191
3	**clayey materials**							
land use	arable land	**281**	8.8	26	34	50	79	229
	grassland	**86**	5.5	26	39	69	99	151
	forest	**170**	3.0	16	36	65	106	278
	other land use	**16**	12.3		76			171
4	**sandy materials**							
land use	arable land	**264**	0.4	18	25	31	47	166
	grassland	**131**	1.2	17	26	43	74	188
	forest	**412**	1.6	10	17	33	55	176
	other land use	**39**	5.4	16	39	61	97	183
5	**loamy materials**							
land use	arable land	**536**	0.5	41	53	68	96	194
	grassland	**142**	21.7	48	71	113	137	234
	forest	**367**	2.6	34	55	92	144	497
	other land use	**39**	33.8	46	66	116	157	181
7	**crystalline rocks and migmatites**							
land use	arable land	**122**	16.8	61	86	122	158	254
	grassland	**117**	23.3	80	101	125	149	269
	forest	**615**	3.0	52	77	102	133	276
	other land use	**21**	52.8	82	100	131	195	240
8	**volcanic rocks**							
land use	arable land	**11**	48.1		99			159
	grassland	**13**	56.5		130			291
	forest	**68**	32.8	90	121	159	203	263
	other land use	**4**	102.1		134			184
9	**other rocks**							
land use	arable land	**34**	13.4	21	24	33	58	115
	grassland	**90**	1.6	19	26	45	99	395
	forest	**17**	11.9		36			170
	other land use	**7**	12.8		33			153

Table set 1
Contents of trace elements related to soil parent material and land use
- Germany -

Mat 11 unit	parent material	OM [%] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**293**	0.2	1.7	2.4	3.6	5.6	45.1
	grassland	**176**	0.7	3.4	6.9	14.2	27.4	64.1
	forest	**230**	0.1	4.5	7.9	12.2	20.7	63.2
	other land use	**196**	0.5	1.9	3.1	4.7	8.4	27.9
2	**calcareous rocks**							
land use	arable land	**167**	1.1	2.2	2.8	3.6	5.3	32.5
	grassland	**69**	2.2	3.2	4.3	5.4	10.5	18.5
	forest	**232**	1.5	5.5	8.4	12.0	18.0	45.6
	other land use	**115**	1.0	2.6	3.2	4.1	6.4	66.9
3	**clayey materials**							
land use	arable land	**1294**	0.5	1.2	1.5	1.9	2.7	23.2
	grassland	**118**	0.3	1.9	5.1	12.5	21.0	68.6
	forest	**126**	0.5	4.4	8.2	16.1	21.5	96.3
	other land use	**44**	0.9	3.5	4.5	6.2	7.9	19.0
4	**sandy materials**							
land use	arable land	**414**	0.6	1.5	2.1	3.1	4.3	12.8
	grassland	**141**	0.9	2.8	4.7	9.6	19.4	84.9
	forest	**543**	0.1	3.4	6.7	10.8	18.2	88.2
	other land use	**110**	0.3	2.7	4.4	5.9	10.0	89.2
5	**loamy materials**							
land use	arable land	**1291**	0.3	1.9	2.4	3.1	4.1	22.6
	grassland	**318**	0.3	2.5	3.7	5.9	8.3	17.0
	forest	**609**	0.1	5.5	8.9	13.4	21.9	92.3
	other land use	**213**	0.5	2.2	3.1	4.8	7.9	25.9
7	**crystalline rocks and migmatites**							
land use	arable land	**282**	0.9	2.2	3.3	4.1	4.8	15.2
	grassland	**213**	1.2	3.8	5.2	7.1	8.9	26.7
	forest	**840**	0.1	6.4	9.6	14.4	20.8	79.1
	other land use	**252**	0.2	2.9	4.3	5.7	8.1	64.8
8	**volcanic rocks**							
land use	arable land	**15**	1.6		3.1			5.7
	grassland	**37**	2.1	3.0	3.8	6.0	10.3	53.4
	forest	**52**	4.7	7.3	12.7	16.7	23.3	39.8
	other land use	**6**	1.4		4.2			14.7
9	**other rocks**							
land use	arable land	**101**	0.7	1.1	1.5	2.4	4.7	47.7
	grassland	**106**	0.9	12.4	22.8	37.4	52.5	70.3
	forest	**21**	1.9	3.5	6.4	16.7	48.3	83.8
	other land use	**4**	1.9		13.4			19.7

Table set 2
Contents of trace elements related to soil pH
- Germany -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	893	0.01	0.10	0.18	0.37	0.77	8.58
> 5 - 6	354	0.02	0.15	0.25	0.44	0.90	20.00
> 6 - 7	336	0.03	0.15	0.25	0.56	1.80	7.00
> 7	237	0.01	0.17	0.26	0.37	0.70	24.30

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	1261	0.2	12	27	43	54	432
> 5 - 6	469	0.4	10	20	35	51	417
> 6 - 7	442	0.2	11	25	36	50	173
> 7	262	0.5	13	30	41	50	106

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	1340	0.0	6	12	22	31	216
> 5 - 6	502	1.5	7	12	21	33	1030
> 6 - 7	459	1.5	9	16	26	39	391
> 7	260	0.7	11	17	23	36	343

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	702	0.01	0.09	0.15	0.23	0.35	8.65
> 5 - 6	252	0.01	0.07	0.10	0.14	0.25	3.50
> 6 - 7	237	0.01	0.07	0.10	0.17	0.35	6.96
> 7	181	0.01	0.07	0.10	0.15	0.32	6.46

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	1314	0.4	7	19	35	52	385
> 5 - 6	495	0.4	6	12	29	54	364
> 6 - 7	460	0.4	7	17	32	43	173
> 7	264	0.4	12	25	33	43	86

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	1126	0.2	25	46	78	128	869
> 5 - 6	497	1.0	17	27	46	73	5989
> 6 - 7	459	0.8	17	28	50	104	1073
> 7	265	0.6	17	27	46	64	3514

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	1343	0.4	28	56	95	132	999
> 5 - 6	494	1.6	26	49	101	139	2561
> 6 - 7	465	3.2	34	58	104	185	873
> 7	268	1.2	39	60	80	132	2048

Table set 3
Contents of trace elements related to soil texture classes
- Germany -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**84**	0.10	0.25	0.50	0.98	1.60	4.30
1	Coarse	18% ≤ clay and ≥ 65% sand	**760**	0.01	0.10	0.15	0.25	0.55	20.00
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1035**	0.01	0.15	0.24	0.40	0.77	21.90
3	Medium fine	< 35% clay and < 15% sand	**690**	0.03	0.22	0.37	0.56	0.79	11.40
4	Fine	35% ≤ clay < 60%	**143**	0.03	0.21	0.35	0.70	1.15	8.58
5	Very fine	≥ 60% clay	**12**	0.18		0.67			2.69

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**98**	0.2	6	12	19	28	79
1	Coarse	18% ≤ clay and ≥ 65% sand	**861**	0.2	4	7	11	17	130
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1263**	0.5	16	27	40	54	417
3	Medium fine	< 35% clay and < 15% sand	**859**	1.9	17	25	36	47	226
4	Fine	35% ≤ clay < 60%	**142**	5.7	29	38	49	59	323
5	Very fine	≥ 60% clay	**12**	15.8		50			76

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**135**	1.5	7	12	21	32	87
1	Coarse	18% ≤ clay and ≥ 65% sand	**909**	0.0	3	5	9	14	125
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1274**	0.9	9	15	24	37	1030
3	Medium fine	< 35% clay and < 15% sand	**885**	1.8	10	16	23	32	216
4	Fine	35% ≤ clay < 60%	**143**	3.4	19	25	32	42	139
5	Very fine	≥ 60% clay	**12**	11.0		25			99

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**17**	0.01		0.24			0.55
1	Coarse	18% ≤ clay and ≥ 65% sand	**408**	0.01	0.04	0.07	0.12	0.23	3.50
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**837**	0.01	0.07	0.11	0.18	0.27	6.46
3	Medium fine	< 35% clay and < 15% sand	**608**	0.01	0.07	0.11	0.18	0.26	2.90
4	Fine	35% ≤ clay < 60%	**112**	0.01	0.07	0.12	0.18	0.32	1.00
5	Very fine	≥ 60% clay	**5**	0.10		0.13			0.46

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**117**	1.7	4	6	9	14	31
1	Coarse	18% ≤ clay and ≥ 65% sand	**899**	0.1	2	4	7	11	176
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1275**	1.1	11	21	35	52	364
3	Medium fine	< 35% clay and < 15% sand	**880**	1.7	12	18	28	40	231
4	Fine	35% ≤ clay < 60%	**140**	6.8	30	38	53	61	329
5	Very fine	≥ 60% clay	**11**	12.0		33			77

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**128**	0.8	20	30	51	86	261
1	Coarse	18% ≤ clay and ≥ 65% sand	**897**	0.2	12	18	32	54	508
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1198**	0.5	26	42	71	124	1302
3	Medium fine	< 35% clay and < 15% sand	**804**	9.0	33	48	78	121	5989
4	Fine	35% ≤ clay < 60%	**140**	10.6	33	45	70	116	2903
5	Very fine	≥ 60% clay	**12**	20.0		61			168

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**128**	1.6	21	29	54	105	395
1	Coarse	18% ≤ clay and ≥ 65% sand	**914**	0.4	13	21	32	54	419
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1285**	1.2	40	66	102	146	4847
3	Medium fine	< 35% clay and < 15% sand	**888**	9.6	44	58	87	132	1960
4	Fine	35% ≤ clay < 60%	**144**	20.9	73	92	119	165	1049
5	Very fine	≥ 60% clay	**12**	41.2		127			474

Republic of Ireland

Documentation Sheet①

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: Teagasc, Republic of Ireland Name: David McGrath Position in the Institute: Principal Research Officer Address: Johnstown Phone: 353 53 42818 Fax: 353 53 42004 e-mail: dmcgrath@johnstown.teagasc.ie

Description of the data set

Geographical locations (co-ordinates)	Geographical locations deliverable: Yes No Accuracy: 50 m Co-ordinate system used e.g. national, UTM etc. National Grid				
Sampling strategy	*Kind of sampling*				
	Random:	☐	Soil horizon	☐	please specify:
	Grid:	■			
	grid distance:	7.07 km	Depth increment	■	please specify: 0-10 cm only
	Nested Sampling	☐	Single core	☐	
	Other please specify:	☐	Mixed core	■	
	Area sample (m^2)	400	Number of cores:	25	

① If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

Soil parameter	*Soil pH*	*Soil e particle size class*	*Soil organic matter*
☐ ■ ☐	Analytical result: (If other procedures other than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear indication of the chosen pH analytical method.) pH ($CaCl_2$) pH (H_2O) pH (KCl) Estimation: please specify (e.g. target pH-values, maps): PH water – 0.6 reported	Analytical results ☐ Profile description ☐ Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay)	Analytical results ■ analytical method: (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. Organic carbon by dichromate (Walkley Black) method. Factor x 1.16 Profile description

Digestion method(s) for determination of trace elements	☐ The analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18.g■ml). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: ■ Other (please specify): HF / HNO3 /HCL / H2O microwave assisted If other, were data transferred to aqua regia? Yes no

Detection limits	Please give information of the detection limits in [mg/kg dry mass]; As: Cd: 0.1 Cr: 2 Cu: 2 Hg: 0.01 Mo: Ni: 2 Pb: 2 Se: Zn: 0.05

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes ☐ No ☐ If Yes, are these samples eliminated before data evaluation? Yes ☐ No ■ If Yes, please specify how contaminated samples were identified:

Any other comments:

Table set 1
Contents of trace elements related to soil parent material and land use
- Ireland -

Mat 11 unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland	**11**	0.09	0.17	0.21	0.27	0.44	0.79
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**12**	0.01	0.54	0.67	0.96	1.52	2.81
	grassland	**91**	0.17	0.40	0.62	0.85	1.19	3.24
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland	**41**	0.07	0.22	0.35	0.46	0.54	1.74
	forest	**10**	0.07	0.12	0.16	0.29	0.36	0.44
	other land use							
5	**loamy materials**							
land use	arable land							
	grassland	**11**	0.16	0.31	0.34	0.43	0.58	0.78
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**10**	0.13	0.20	0.37	0.54	1.56	2.80
	grassland	**74**	0.01	0.24	0.34	0.43	0.54	1.48
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Ireland -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland	**11**	36.6	45.5	50.7	63.2	68.2	88.7
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**12**	20.7	37.9	48.8	54.3	54.8	59.0
	grassland	**91**	14.8	33.1	41.2	50.9	63.6	88.7
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland	**41**	8.9	34.4	47.3	58.4	71.8	84.9
	forest	**10**	17.7	27.7	43.8	56.4	68.4	76.2
	other land use							
5	**loamy materials**							
land use	arable land							
	grassland	**11**	35.2	50.2	53.2	58.5	72.7	74.7
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**10**	38.7	51.9	74.2	87.1	98.8	101.0
	grassland	**74**	9.8	44.6	57.8	76.7	88.3	121.4
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Ireland -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland	**11**	8.1	11.1	14.0	18.0	27.7	28.0
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**12**	5.6	10.5	13.8	18.2	21.0	26.7
	grassland	**91**	5.6	10.8	14.6	21.1	27.9	45.4
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland	**41**	2.4	7.1	12.1	18.0	25.6	36.6
	forest	**10**	1.2	4.8	6.7	11.1	15.4	20.3
	other land use							
5	**loamy materials**							
land use	arable land							
	grassland	**11**	7.3	9.4	15.6	18.2	27.9	29.4
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**10**	16.1	24.4	25.7	32.0	37.1	40.8
	grassland	**74**	4.0	14.6	20.4	28.6	34.7	72.6
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Ireland -

Mat 11 unit	parent material	Hg [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland	**11**	0.03	0.04	0.07	0.09	0.12	0.19
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**12**	0.04	0.07	0.08	0.10	0.10	0.15
	grassland	**91**	0.04	0.07	0.09	0.11	0.17	1.05
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland	**41**	0.04	0.06	0.08	0.12	0.17	0.30
	forest	**10**	0.02	0.09	0.18	0.20	0.26	0.42
	other land use							
5	**loamy materials**							
land use	arable land							
	grassland	**11**	0.07	0.09	0.10	0.15	0.17	0.18
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**10**	0.07	0.08	0.11	0.16	0.20	0.29
	grassland	**74**	0.04	0.07	0.10	0.14	0.18	0.57
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Ireland -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland	**11**	1.1	4.3	9.2	12.2	13.6	34.4
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**12**	4.7	8.4	18.1	25.7	29.5	43.0
	grassland	**91**	1.0	9.4	15.9	23.3	29.1	48.7
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland	**41**	1.0	3.1	6.1	13.9	17.5	29.1
	forest	**10**	1.1	2.3	3.3	4.3	7.9	13.0
	other land use							
5	**loamy materials**							
land use	arable land							
	grassland	**11**	1.4	8.4	10.9	14.1	18.7	19.4
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**10**	10.2	12.3	17.4	21.8	26.8	51.5
	grassland	**74**	1.0	6.3	12.2	17.3	23.9	42.3
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Ireland -

Mat 11 unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland	**11**	10.0	16.9	19.3	24.0	36.5	50.8
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**12**	14.9	17.4	21.1	25.4	29.5	30.6
	grassland	**91**	14.0	19.8	24.8	32.5	39.9	91.0
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland	**41**	10.7	16.9	20.8	35.9	45.1	67.7
	forest	**10**	10.8	30.7	37.0	62.4	76.6	80.1
	other land use							
5	**loamy materials**							
land use	arable land							
	grassland	**11**	17.1	21.9	25.7	32.8	34.9	36.5
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**10**	24.0	26.5	30.6	46.2	57.0	82.5
	grassland	**74**	14.6	24.2	31.0	44.8	53.3	108.5
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Ireland -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland	**11**	23.6	35.3	53.3	63.1	83.2	145.3
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**12**	37.2	62.1	81.3	96.8	117.7	139.7
	grassland	**91**	23.6	58.8	74.3	94.9	121.8	175.6
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland	**41**	4.1	33.9	45.3	71.1	110.2	141.2
	forest	**10**	13.2	20.7	24.3	40.3	44.3	44.3
	other land use							
5	**loamy materials**							
land use	arable land							
	grassland	**11**	14.1	44.7	81.3	95.4	123.0	133.6
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**10**	46.2	73.4	101.8	105.2	140.2	239.5
	grassland	**74**	15.5	55.7	75.8	94.7	114.4	178.4
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Ireland -

Mat 11 unit	parent material	org. C [%]						
		n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland	**11**	2.66	4.40	4.72	5.50	6.48	13.87
	forest							
	other land use							
2	**calcareous rocks**							
land use	arable land	**12**	1.40	1.94	2.42	2.87	3.43	4.50
	grassland	**91**	2.12	4.07	5.08	6.68	9.96	37.34
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland	**41**	1.92	4.03	5.19	9.53	22.75	44.51
	forest	**10**	5.82	10.30	17.16	28.17	33.49	38.66
	other land use							
5	**loamy materials**							
land use	arable land							
	grassland	**11**	5.64	6.07	7.90	8.38	9.93	15.42
	forest							
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**10**	2.53	3.14	3.90	5.68	7.48	8.84
	grassland	**74**	3.46	5.24	6.44	7.56	9.80	16.72
	forest							
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 2
Contents of trace elements related to soil pH
- Ireland -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	43	0.00	0.17	0.31	0.41	0.58	3.24
> 5 - 6	168	0.01	0.26	0.38	0.54	0.75	2.53
> 6 - 7	74	0.01	0.35	0.57	0.95	1.45	2.81
> 7	0						

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	43	8.9	28.0	43.2	67.8	92.9	323.6
> 5 - 6	168	9.8	37.2	50.7	62.9	77.2	101.0
> 6 - 7	74	16.5	37.6	47.7	56.3	77.7	103.2
> 7							

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	43	1.2	5.7	10.0	15.9	26.9	45.4
> 5 - 6	168	3.2	10.7	16.5	23.8	29.6	72.6
> 6 - 7	74	4.8	12.4	16.2	22.3	30.2	41.6
> 7							

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	43	0.02	0.10	0.14	0.18	0.26	0.42
> 5 - 6	168	0.04	0.06	0.08	0.12	0.17	0.57
> 6 - 7	74	0.03	0.07	0.10	0.11	0.16	1.05
> 7							

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	43	1.0	2.0	4.1	9.3	23.5	150.2
> 5 - 6	168	1.0	6.1	11.1	17.6	24.7	51.5
> 6 - 7	74	1.1	12.4	16.2	22.1	29.5	48.7
> 7							

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	43	10.8	26.4	37.0	51.3	75.6	108.5
> 5 - 6	168	10.7	20.8	25.9	33.4	46.0	82.5
> 6 - 7	74	10.0	21.4	24.4	31.6	43.9	90.9
> 7							

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	43	4.1	23.3	33.5	61.9	97.1	132.6
> 5 - 6	168	14.1	49.1	69.7	91.8	116.4	239.5
> 6 - 7	74	23.6	58.7	78.7	106.6	126.3	150.6
> 7							

Table set 3
Contents of trace elements related to soil texture classes
- Ireland -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**10**	0.09	0.22	0.29	0.47	0.56	0.60
1	Coarse	18% ≤ clay and ≥ 65% sand	**23**	0.00	0.25	0.36	0.57	0.67	2.80
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**210**	0.01	0.24	0.39	0.61	1.38	2.81
3	Medium fine	< 35% clay and < 15% sand	**8**	0.04	0.49	0.53	0.58	0.62	0.62
4	Fine	35% ≤ clay < 60%	**28**	0.08	0.25	0.34	0.64	1.00	3.24
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**10**	3.7	4.6	5.7	7.5	7.8	8.2
1	Coarse	18% ≤ clay and ≥ 65% sand	**23**	15.6	23.3	33.7	44.7	58.3	80.1
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**210**	14.5	39.4	51.6	65.6	92.6	322.6
3	Medium fine	< 35% clay and < 15% sand	**8**	19.7	36.1	42.8	47.2	54.8	55.8
4	Fine	35% ≤ clay < 60%	**28**	8.9	31.8	44.6	55.7	62.4	76.2
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**10**	1.3	2.0	3.9	5.1	9.6	9.8
1	Coarse	18% ≤ clay and ≥ 65% sand	**23**	7.7	9.7	16.1	20.2	29.4	72.6
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**210**	1.2	11.8	16.0	23.8	33.4	53.8
3	Medium fine	< 35% clay and < 15% sand	**8**	10.1	12.3	14.7	15.6	20.4	31.1
4	Fine	35% ≤ clay < 60%	**28**	3.9	9.8	13.5	19.3	25.9	45.4
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**10**	0.05	0.07	0.09	0.16	0.22	0.32
1	Coarse	18% ≤ clay and ≥ 65% sand	**23**	0.03	0.07	0.10	0.15	0.16	0.18
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**210**	0.04	0.07	0.09	0.13	0.21	0.44
3	Medium fine	< 35% clay and < 15% sand	**8**	0.06	0.08	0.09	0.15	0.46	1.05
4	Fine	35% ≤ clay < 60%	**28**	0.04	0.08	0.09	0.12	0.17	0.21
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**10**	1.1	1.1	1.7	6.7	8.9	11.2
1	Coarse	18% ≤ clay and ≥ 65% sand	**23**	1.1	1.8	6.7	10.8	13.3	15.5
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**210**	1.0	6.7	13.5	20.3	29.8	150.2
3	Medium fine	< 35% clay and < 15% sand	**8**	5.5	11.5	12.4	16.3	18.5	19.0
4	Fine	35% ≤ clay < 60%	**28**	1.0	4.7	11.2	17.5	20.3	48.7
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**10**	3.7	9.7	17.7	25.9	29.7	32.3
1	Coarse	18% ≤ clay and ≥ 65% sand	**23**	10.0	25.2	30.1	34.5	41.9	50.2
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**210**	16.7	20.4	26.1	34.9	59.1	91.1
3	Medium fine	< 35% clay and < 15% sand	**8**	22.0	23.0	24.0	26.6	49.3	90.9
4	Fine	35% ≤ clay < 60%	**28**	13.9	18.9	23.8	28.2	38.1	42.9
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**10**	3.3	5.3	14.1	30.6	57.5	70.0
1	Coarse	18% ≤ clay and ≥ 65% sand	**23**	15.5	35.4	62.6	77.7	102.4	110.2
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**210**	4.1	49.8	73.4	94.2	132.7	239.5
3	Medium fine	< 35% clay and < 15% sand	**8**	40.0	56.0	64.8	80.2	109.7	150.6
4	Fine	35% ≤ clay < 60%	**28**	21.4	42.4	54.4	67.7	94.7	141.2
5	Very fine	≥ 60% clay							

Italy

Documentation Sheet[①]

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: ARPAV – Centro Agroambientale di Castelfranco Veneto/ITALY Name: Paolo Giandon Position in the Institute: Manager of soil survey office Address: Via Baciocchi 9 – 31033 Castelfranco Veneto (TV) - ITALY Phone: 0423/422325 Fax: 0423/720388 e-mail: pgiandon@arpa.veneto.it

Description of the data set

Geographical locations (co-ordinates)	Geographical locations deliverable*:* Yes 1736 No Accuracy: 1m Co-ordinate system used e.g. national, UTM etc.: UTM			
Sampling strategy	*Kind of sampling*			
	Random:		Soil horizon ■	please specify: horizon A
	Grid: ☐ grid distance:			
	Nested Sampling ☐		Depth increment ☐	please specify:
	Other ☐ please specify:		Single core ■	
	Area sample (m^2)		Mixed core ☐	
			Number of cores:	

[①] If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

Soil parameter	*Soil pH*	*Soil e particle size class*	*Soil organic matter*
☐ ■ ☐	Analytical result: (If other procedures other than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear indication of the chosen pH analytical method.) pH ($CaCl_2$) pH (H_2O) pH (KCl) Estimation: please specify (e.g. target pH-values, maps):	Analytical results ■ Profile description Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay) clay <0.002 mm silt 0.002-0.05 mm sand 0.05-2 mm	Analytical results ■ analytical method: (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. - Wet oxidation (Walkley-Black) - recording of organic carbon ☐ - no correction for inorganic carbonate Profile description

Digestion method(s) for determination of trace elements	The analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18.g□hl). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: □ Other (please specify): If other, were data transferred to aqua regia? Yes no

Detection limits	Please give information of the detection limits in [mg/kg dry mass]; As: 0.5 Cd: 0.4 Cr: 1 Cu: 1 Hg: 0.1 Mo: Ni: 0.4 Pb: 2 Se: Zn: 4

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes □ No ■ If Yes, are these samples eliminated before data evaluation? Yes □ No □ If Yes, please specify how contaminated samples were identified:

Any other comments:

Table set 2
Contents of trace elements related to soil pH
- Italy-

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	56	<LR	0.80	2.00	2.23	3.50	7.00
> 5 - 6	136	<LR	1.00	1.80	2.33	4.00	7.53
> 6 - 7	199	<LR	0.11	0.66	1.40	2.60	5.00
> 7	1660	<LR	0.19	0.50	0.86	1.24	6.76

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	56	15.3	33.0	44.4	67.7	126.0	167.0
> 5 - 6	138	10.0	34.0	47.0	87.8	127.6	319.0
> 6 - 7	171	<LR	27.0	45.0	68.1	97.1	263.0
> 7	1429	<LR	20.0	31.0	43.0	49.0	247.0

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	60	3.3	11.7	21.3	36.3	88.7	720.0
> 5 - 6	201	3.2	12.0	20.8	35.0	60.0	355.0
> 6 - 7	481	<LR	15.5	33.7	53.0	75.0	355.0
> 7	2854	<LR	26.1	40.0	54.0	79.8	369.0

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	4	<LR	<LR	<LR	0.1	0.1	0.2
> 5 - 6	18	<LR	<LR	0.1	0.3	0.3	1.1
> 6 - 7	112	<LR	0.1	0.1	0.2	0.4	1.8
> 7	1944	<LR	<LR	0.1	0.2	0.3	6.4

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	61	3.0	18.0	43.0	52.0	61.0	117.0
> 5 - 6	196	2.0	12.0	41.9	57.3	82.0	201.0
> 6 - 7	448	<LR	14.1	48.0	74.0	90.0	214.0
> 7	2731	<LR	28.0	53.0	67.9	74.0	337.0

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	61	2.0	18.5	32.1	87.0	99.0	333.0
> 5 - 6	193	2.0	14.1	23.8	61.0	83.8	267.0
> 6 - 7	452	<LR	16.0	26.0	34.6	48.6	136.0
> 7	2889	<LR	22.0	30.0	39.0	51.0	750.0

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	59	4.0	33.9	60.0	85.0	120.0	780.0
> 5 - 6	203	2.0	29.3	55.7	75.3	105.0	940.0
> 6 - 7	481	1.5	41.0	69.0	81.0	122.0	1399.5
> 7	2853	<LR	61.5	79.9	96.0	116.8	514.0

Table set 3
Contents of trace elements related to soil texture classes
- Italy -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**173**	<LR	0.21	0.56	0.91	2.00	7.00
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1021**	<LR	0.34	0.69	1.10	2.10	7.00
3	Medium fine	< 35% clay and < 15% sand	**41**	<LR	0.40	0.59	0.90	1.00	2.60
4	Fine	35% ≤ clay < 60%	**265**	<LR	0.25	0.52	0.90	1.20	7.53
5	Very fine	≥ 60% clay	**6**	0.21	0.85	1.05	1.18	1.30	1.40

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**173**	<LR	16.7	26.7	40.3	72.9	172.0
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1021**	<LR	22.1	34.8	47.0	76.4	319.0
3	Medium fine	< 35% clay and < 15% sand	**41**	1.7	19.5	26.0	29.8	43.6	105.0
4	Fine	35% ≤ clay < 60%	**253**	<LR	30.4	38.1	46.1	50.7	155.0
5	Very fine	≥ 60% clay	**6**	23.0	31.6	35.5	42.0	46.3	49.5

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**176**	<LR	10.5	21.0	37.2	66.0	355.0
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1056**	<LR	18.1	30.0	46.2	78.0	369.0
3	Medium fine	< 35% clay and < 15% sand	**33**	13.1	33.2	50.0	76.3	107.0	151.0
4	Fine	35% ≤ clay < 60%	**264**	2.9	31.4	40.0	53.2	82.0	362.0
5	Very fine	≥ 60% clay	**6**	6.4	17.5	23.0	31.8	41.8	49.1

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**97**	<LR	<LR	<LR	0.2	0.4	1.1
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**725**	<LR	<LR	0.1	0.2	0.4	6.4
3	Medium fine	< 35% clay and < 15% sand	**40**	<LR	<LR	0.1	0.2	0.4	0.7
4	Fine	35% ≤ clay < 60%	**262**	<LR	<LR	<LR	0.2	0.3	1.5
5	Very fine	≥ 60% clay	**6**	<LR	<LR	<LR	<LR	0.2	0.4

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**163**	<LR	13.6	21.8	44.4	68.4	163.1
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1043**	<LR	18.5	28.2	49.5	67.1	214.0
3	Medium fine	< 35% clay and < 15% sand	**41**	8.3	14.9	23.2	38.6	52.8	71.5
4	Fine	35% ≤ clay < 60%	**268**	0.0	24.9	33.8	60.1	68.0	337.0
5	Very fine	≥ 60% clay	**6**	26.8	27.3	30.5	42.8	55.7	65.3

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**182**	<LR	13.0	23.0	39.4	77.4	376.0
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1072**	0.0	18.8	29.1	45.4	72.0	750.0
3	Medium fine	< 35% clay and < 15% sand	**41**	8.4	16.5	26.4	32.5	35.4	44.2
4	Fine	35% ≤ clay < 60%	**266**	<LR	18.3	30.2	41.0	49.8	102.0
5	Very fine	≥ 60% clay	**6**	19.0	23.1	27.6	31.2	33.5	35.0

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**176**	0.4	36.2	57.0	93.8	141.0	1399.5
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**1058**	<LR	48.2	70.9	96.9	127.0	940.0
3	Medium fine	< 35% clay and < 15% sand	**33**	16.9	52.3	77.3	117.0	135.0	188.0
4	Fine	35% ≤ clay < 60%	**264**	0.6	62.2	78.4	98.3	130.1	213.5
5	Very fine	≥ 60% clay	**6**	57.0	60.2	76.5	92.0	116.0	139.0

The Netherlands

Documentation Sheet①

Heavy Metal (Trace Elements) in Dutch Soils
Details of the person who filled in the documentation sheet: Institute/Country: Alterra, Green World Research Name: Dick J. Brus Position in the Institute: senior scientist Address: P.O. Box 47, 6700 AA, Wageningen, The Netherlands Phone: 0317-474237 Fax: e-mail: d.j.brus@alterra.wag-ur.nl

Description of the data set

Geographical locations	Geographical locations deliverable: Yes	Accuracy: 1 m - 1 km
Sampling strategy	*Kind of sampling*	
	Random: ☐ Grid: ☐ grid distance: Nested Sampling ☐ Other ■ please specify: purposive sampling (representative locations for soil-land use combinations)	Soil horizon ☐ please specify: Depth increment please specify: differs between datasets: see metainformation.doc Single core ☐ Mixed core ■ Number of cores: differs between datasets, also area of sampled plots differs between datasets (see metainformation.doc)

① If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 “description of the data set”).

Soil parameter	*Soil pH* Analytical result: ■ (If other procedures than $CaCl_2$ are applied, please try to transform the data pH in $CaCl_2$ and/or indicate the method used. In any other cases please give a clear indication of the chosen pH analytical method.) pH ($CaCl_2$) ☐ pH (H_2O) ☐ pH (KCl) ■ Estimation: ☐ please specify (e.g. target pH-values, maps):	*Soil texture* Analytical results ■ Profile description ☐ Please specify the nomenclature for classifying soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay)	*Soil organic matter* Analytical results ■ analytical method: (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) LOI ☐ Profile description
Digestion method(s) for determination of trace elements	The analyses of heavy metals should be based on or be transferred to aqua regia. If the data were transferred from other digestion procedures the respective transfer rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. Aqua regia: ■ (for all datasets: hot acid destruction, see metainformation.doc) Other (please specify): ☐ If other, were data transferred to aqua regia? Yes ☐ no ☐		

Detection limits	Please give information of the detection limits in [mg/kg dry mass]; see detection limits.doc

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes ☐ No ■ (**Remark:** dataset includes locations in areas (with sizes of several hundreds to several thousands of hectares) known to be contaminated by nearby diffuse sources, such as by atmospheric deposition (Example: Brantse Kempen). Excluded are locations in recent floodplain of Rhine and Meuse, and roadsides. If Yes, are these samples eliminated before data evaluation? Yes ☐ No ☐ If Yes, please specify how contaminated samples were identified:

Metainformation on datasets (NSQM: national soil quality monitoring network. PSQM: provincial soil quality monitoring network)

Dataset	Number of locations	Year of sampling	Support	Depth (cm)	Destruction method	Literature
IB	308	1960-1980	20x20 m^2	0-20	**Cd,Ni,Pb**: Destruction with HNO_3 (5 times fuming to dryness), then ash dissolved in HCl and H_2O **Cr,Cu,Zn**: destruction with H_2SO_4-HNO_3 (1:1) and perchloric acid	Van Driel & Smilde (1981)
IB/RIKILT	694	1977,1978	20x20 m^2 greenhouses: 10x10 m^2 orchards: around 20 trees	arable land: 0-20(25) grassland: 0-5	**Cd,Pb**: ashed at 450 ^oC; ash dissolved in HCl (3M); **Hg:** destruction with concentrated HNO3 at 120 °C	Wiersma e.a. (1986)
SC-DLO	192	1995	forest stand	0-10	**Cd,Pb**: 9% HCl **Cu,Zn**: H_2SO_4-HNO_3	Leeters en de Vries (2001)
RIN	40	1980-1983	3 plots of 10x12m^2; distance between plots: 50 a 100 m	0-10		Edelman & de Bruin (1986)
CCRX	40	1988	20x20 m^2	0-10		van Duijvenboden e.a. (1995)
NSQM	112	1993-1995	all fields of a farm	0-10	see IB **Hg**: microwave (NVN 5770)	Groot e. a. (1996,1997,1998)
PSQM_GRO	152	1995	field (> 1ha)	10 (0-10?)		Provincie Groningen, 1997
PSQM_FRL	116	1995/1996				
PSQM_DR	93	1996	field	0-10		CSO, 1997
PSQM_DRa	67	1994	100 x 100 m^2	0-10		Seine, 1996
PSQM_GLD	139	1998	(part of) field; maximum area appr. 1 ha)	0-10	see IB	
PSQM_U	70					CSO,1994
PSQM_ZH	369					
PSQM_NBR	124	1995	all fields of a farm			
PQSM_FLV	52					
PQSM_NH	338			5-10	Aqua regia (NEN 6465)	Ertsen,1993
ZLD	122	1996, 1998	150 x 150 m^2	5-20	Aqua regia	De Jong, 1997(a,b)

Detection limits heavy metals

All detection limits are substituted by 0.7 * detection limit.

Cd	frequency
1.0	239
0.4	44
0.33	236
0.2	88
0.15	1
0.1	90
0.01	9

Cr	frequency
10	119
5	16
3	8
2	1
1	2
0.33	4

Cu	frequency
10	38
5	51
2.5	2
1	12

Hg	frequency
1	1
0.33	339
0.15	1
0.1	281
0.05	58
0.01	1

Ni	frequency
10	65
5	211
3.3	71
2	13
1	5
0.5	3

Pb	frequency
10	54
4.17	14
1	2

Zn	frequency
10	26
5	12
4	1
0.33	1

Documentation Sheet[1]

Organic Carbon Contents in Dutch Soils
Details of the person who filled in the documentation sheet: Institute/Country: Alterra, Green World Research Name: Dick J. Brus Position in the Institute: senior scientist Address: P.O. Box 47, 6700 AA, Wageningen, The Netherlands Phone: 0317-474237 Fax: e-mail: d.j.brus@alterra.wag-ur.nl

Description of the data set

Geographical locations

Geographical locations deliverable: Yes Accuracy: 1 m.

Sampling strategy

Kind of sampling

Random: ■

Grid: □
grid distance:

Nested Sampling □

Other ■
please specify:
Remark: the summary statistics are based on two datasets. The first dataset consists of purposively selected sample points (representative soil profiles of units of soil map of the Netherlands 1:50000), the second consists of a probability sample (sampling design: stratified simple random sampling; strata: groups of map units)

Soil horizon ■ please specify: A-horizon

Depth increment □ please specify:

Single core ■

Mixed core □

Number of cores:

[1] If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

Table set 1
Contents of trace elements related to soil parent material and land use
- The Netherlands -

Mat 11 unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**767**	0.01	0.2	0.3	0.4	0.6	2.8
	grassland	**385**	0.07	0.3	0.5	0.8	1.1	4.3
	forest	**50**	0	0.05	0.08	0.1	0.3	0.6
	other land use	**181**	0.06	0.2	0.5	1	1	1
4	**sandy materials**							
land use	arable land	**321**	0.01	0.2	0.3	0.4	0.7	2.6
	grassland	**345**	0.07	0.2	0.3	0.7	0.7	17.2
	forest	**240**	0	0.08	0.1	0.3	0.5	45.1
	other land use	**177**	0.04	0.2	0.3	0.5	0.7	1.8
5	**loamy materials**							
land use	arable land	**18**	0.4		0.8			1.1
	grassland	**6**	0.1		0.5			1.2
	forest	**5**	0		0.1			0.2
	other land use	**6**	0.4		0.7			1.1
9	**other rocks**							
land use	arable land	**127**	0.01	0.3	0.4	0.7	0.7	2.5
	grassland	**171**	0.07	0.3	0.7	1.1	1.5	3.6
	forest	**10**	0		0.1			0.6
	other land use	**27**	0.2	0.3	1	1.5	2	3.5

Table set 1
Contents of trace elements related to soil parent material and land use
- The Netherlands -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**499**	0.7	26	40	59	74	111
	grassland	**344**	2.6	24	33	49	64	111
	forest	**48**	0.6	5	7	13	49	117
	other land use	**56**	0.2	14	24	37	49	99
4	**sandy materials**							
land use	arable land	**205**	1.3	8	11	17	29	86
	grassland	**309**	0.2	7	10	17	25	407
	forest	**228**	0.9	4	5	7	13	54
	other land use	**92**	1	5	7	12	33	61
5	**loamy materials**							
land use	arable land	**8**	9		62			78
	grassland	**4**	7		8			14
	forest	**5**	6		18			20
	other land use	**1**	39		39			39
9	**other rocks**							
land use	arable land	**101**	4	10	14	21	26	94
	grassland	**151**	0.2	24	40	58	80	115
	forest	**10**	3		5			66
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- The Netherlands -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**508**	0.5	10	14	21	27	86
	grassland	**353**	0.7	14	22	36	54	179
	forest	**50**	0	2	4	5	9	32
	other land use	**72**	1	9	16	30	50	165
4	**sandy materials**							
land use	arable land	**218**	0.2	5	9	15	20	40
	grassland	**322**	0.2	8	11	15	19	50
	forest	**239**	0	1	3	5	7	37
	other land use	**96**	0.3	2	5	8	14	29
5	**loamy materials**							
land use	arable land	**8**	6		13			18
	grassland	**4**	5		9			14
	forest	**5**	6		8			9
	other land use	**1**	10					10
9	**other rocks**							
land use	arable land	**101**	0.9	15	22	29	37	67
	grassland	**160**	5	15	32	52	72	220
	forest	**10**	0.8		4			31
	other land use	**27**	6		24			127

Table set 1
Contents of trace elements related to soil parent material and land use
- The Netherlands -

Mat 11 unit	parent material	Hg [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**650**	0.01	0.07	0.09	0.14	0.23	1.5
	grassland	**352**	0.02	0.1	0.11	0.22	0.23	1.4
	forest	**12**	0.02		0.08			0.36
	other land use	**178**	0.01	0.07	0.12	0.2	0.31	0.61
4	**sandy materials**							
land use	arable land	**271**	0	0.06	0.09	0.23	0.23	8.5
	grassland	**283**	0	0.05	0.07	0.15	0.23	0.93
	forest	**84**	0.01	0.03	0.07	0.09	0.13	5.7
	other land use	**163**	0.01	0.03	0.07	0.21	0.23	1.8
5	**loamy materials**							
land use	arable land	**17**	0.06		0.09			0.17
	grassland	**2**	0.06		0.06			0.06
	forest	**0**						
	other land use	**6**	0.08		0.16			0.44
9	**other rocks**							
land use	arable land	**127**	0	0.06	0.1	0.2	0.3	0.75
	grassland	**170**	0.03	0.13	0.21	0.25	0.42	6.1
	forest	**3**	0.1		0.1			1.43
	other land use	**27**	0.07		0.23			1.75

Table set 1
Contents of trace elements related to soil parent material and land use
- The Netherlands -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**495**	0.7	12	18	23	31	57
	grassland	**328**	0.7	15	19	27	36	56
	forest	**48**	1	2	4	6	9	47
	other land use	**56**	0.7	6	13	17	28	41
4	**sandy materials**							
land use	arable land	**200**	0.4	2	4	7	12	31
	grassland	**256**	0.9	3	4	7	10	127
	forest	**208**	0.5	2	3	4	5	21
	other land use	**92**	0.6	2	4	7	13	30
5	**loamy materials**							
land use	arable land	**8**	4		11			18
	grassland	**4**	4		4			4
	forest	**5**	3		9			11
	other land use	**1**	7		7			7
9	**other rocks**							
land use	arable land	**86**	0.4	2	3	4	6	28
	grassland	**142**	1	10	22	33	38	66
	forest	**10**	1		3			19
	other land use	**20**	2		8			64

Table set 1
Contents of trace elements related to soil parent material and land use
- The Netherlands -

Mat 11 unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**767**	3	16	22	31	42	280
	grassland	**385**	3	29	45	75	120	850
	forest	**50**	4	14	18	25	45	58
	other land use	**181**	2	18	29	44	74	253
4	**sandy materials**							
land use	arable land	**321**	0.7	11	17	25	43	78
	grassland	**345**	7	13	19	26	42	340
	forest	**240**	3	9	13	21	32	164
	other land use	**177**	2	10	17	25	45	185
5	**loamy materials**							
land use	arable land	**18**	17		27			35
	grassland	**6**	17		26			36
	forest	**5**	36		54			67
	other land use	**6**	24		34			48
9	**other rocks**							
land use	arable land	**127**	2	18	30	50	80	202
	grassland	**171**	7	39	79	137	212	952
	forest	**10**	6		15			160
	other land use	**27**	17	56	88	110	355	560

Table set 1
Contents of trace elements related to soil parent material and land use
- The Netherlands -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**508**	10	44	62	82	110	310
	grassland	**353**	2	70	101	145	190	610
	forest	**50**	3	9	13	23	43	153
	other land use	**72**	10	54	78	105	148	639
4	**sandy materials**							
land use	arable land	**218**	5	20	28	40	54	117
	grassland	**322**	0.2	23	30	43	65	799
	forest	**240**	2	5	8	13	23	916
	other land use	**96**	2	9	22	49	80	185
5	**loamy materials**							
land use	arable land	**8**	39		86			97
	grassland	**4**	29		37			62
	forest	**5**	23		35			73
	other land use	**1**	62		62			62
9	**other rocks**							
land use	arable land	**101**	3	22	31	46	56	280
	grassland	**160**	18	57	125	165	210	410
	forest	**10**	5		19			99
	other land use	**27**	8		91			362

Table set 1
Contents of trace elements related to soil parent material and land use
- The Netherlands -

Mat 11 unit	parent material	org. C [%] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**537**	0.4	1.7	2.3	3.4	5	30.8
	grassland	**539**	0.5	4.3	7.6	12.9	19.8	49.4
	forest	**184**	0.3	2.9	4.6	6.4	8.7	44.3
	other land use	**137**	0.1	2.6	3.6	5.5	8.4	31.2
4	**sandy materials**							
land use	arable land	**332**	0.3	2.8	4.3	5.5	7.5	28.1
	grassland	**655**	0.3	4	5.7	8.7	14.5	69
	forest	**303**	0.4	3.1	4.3	6.6	11.2	96.8
	other land use	**101**	0.1	2.5	5.2	9.8	14.7	90.2
5	**loamy materials**							
land use	arable land	**41**	1	2	2.3	2.5	2.9	4.1
	grassland	**36**	2.3	4	5.2	7.5	8.4	9.7
	forest	**34**	4	5.7	9.2	11.6	13.5	18
	other land use	**4**	2.2		4.4			5.1
9	**other rocks**							
land use	arable land	**110**	1.2	10.1	16.8	22.9	33.5	72.1
	grassland	**148**	2.7	12.6	21.8	33.1	43.7	83.9
	forest	**37**	1.2	16	73	92.1	94.8	96.5
	other land use	**4**	33.9		90.2			95.4

Table set 2
Contents of trace elements related to soil pH
- The Netherlands -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	976	0	0.1	0.3	0.7	1	45
> 5 - 6	589	0	0.2	0.3	0.7	0.9	4
> 6 - 7	442	0.01	0.2	0.4	0.6	0.9	14
> 7	740	0.01	0.2	0.3	0.5	0.7	3

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	839	0.2	6	10	26	52	407
> 5 - 6	434	1.4	7	13	30	45	117
> 6 - 7	286	1.3	20	30	44	69	410
> 7	407	0.7	16	31	53	76	119

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	881	0	4	9	21	43	135
> 5 - 6	468	0.7	10	14	22	36	220
> 6 - 7	301	0.2	10	15	25	35	270
> 7	425	0.2	7	12	20	29	165

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	677	0	0.07	0.12	0.23	0.28	6.1
> 5 - 6	525	0	0.07	0.1	0.18	0.23	1.4
> 6 - 7	425	0.01	0.07	0.1	0.22	0.23	13.8
> 7	721	0.01	0.07	0.1	0.23	0.23	8.5

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	796	0.5	2	4	12	28	127
> 5 - 6	420	0.4	4	6	16	26	55
> 6 - 7	285	1	9	17	22	33	75
> 7	407	2	8	14	22	30	57

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	976	2	14	23	52	105	850
> 5 - 6	589	4	15	24	42	80	953
> 6 - 7	442	3	18	28	42	70	840
> 7	740	0.7	14	20	30	46	280

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	882	0.2	10	25	68	151	916
> 5 - 6	468	3	27	42	80	133	610
> 6 - 7	301	7	45	65	109	164	1700
> 7	425	7	36	54	83	136	524

Portugal

Documentation Sheet[①]

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: Laboratório Químico Agrícola Rebelo da Silva / PORTUGAL Name: Raquel Mano Position in the Institute: Research Assistant Address: Tapada da Ajuda, Apartado 3228, P-1301-903 Lisboa, PORTUGAL Phone: + 351 213 617 740 Fax: + 351 213 636 460 e-mail: lqars.informatica@mail.telepac.pt

Description of the data set

Geographical locations (co-ordinates)	Geographical locations deliverable: Yes Accuracy: Co-ordinate system used e.g. national, UTM etc.: European Datum (1950)	
Sampling strategy	*Kind of sampling*	
	Random: ☐ Grid: ☒ grid distance: 16 × 16 km Nested Sampling ☐ Other ☐ please specify: Area sample (m^2)	Soil horizon ☐ please specify: Depth increment ☒ please specify: organic; 0-5cm;5-10cm and 10-20cm Single core ☐ Mixed core ☒ Number of cores: *16 sub-samples randomly collected per composite sample*

[①] If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 “description of the data set”).

Soil parameter	*Soil pH* Analytical result: ☒ (If other procedures other than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear indication of the chosen pH analytical method.) pH ($CaCl_2$) ☒ *1:5 soil : 0.01M $CaCl_2$ mixture* pH (H_2O) pH (KCl) Estimation: please specify (e.g. target pH-values, maps):	*Soil e particle size class* Analytical results ☐ Profile description ☐ Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay) Soil texture is given by expert judgement based on field observations. Three classes are used: coarse, medium and fine texture.	*Soil organic matter* Analytical results ☒ analytical method: *Wet oxidation (dichromate oxidation)* (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. *Organic carbon is recorded;* *Data is not corrected for inorganic carbonate content*. Profile description

Digestion method(s) for determination of trace elements	The analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18g/ml). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: ☒ *2g of soil (<2mm) are treated with a mixture of conc. HCl, HNO_3 and H_2O_2 (3:1:2). The mixture is boiled for 2 hours. After cooling to room temperature the solution is filtered. The residue is rinsed 5 times with 1M HNO_3.* *Cd, Cr, Cu, Ni, Pb and Zn were measured by Flame AAS.* Other (please specify): If other, were data transferred to aqua regia? Yes no
Detection limits	Please give information of the detection limits in [mg/kg dry mass]; As: Cd: Cr: 3.7 Cu: 1.8 Hg: Mo: Ni: 1.9 Pb: Se: Zn: 1.6

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? A*lthough there was no record of contamination in the forest soils sampled, there is the suspect of contamination in a very small number of samples.* Yes ☒ No ☐ If Yes, are these samples eliminated before data evaluation? Yes ☐ No ☒ If Yes, please specify how contaminated samples were identified: *samples having concentrations of the specific element higher than the typical concentrations, taking in consideration the soil parent material.*

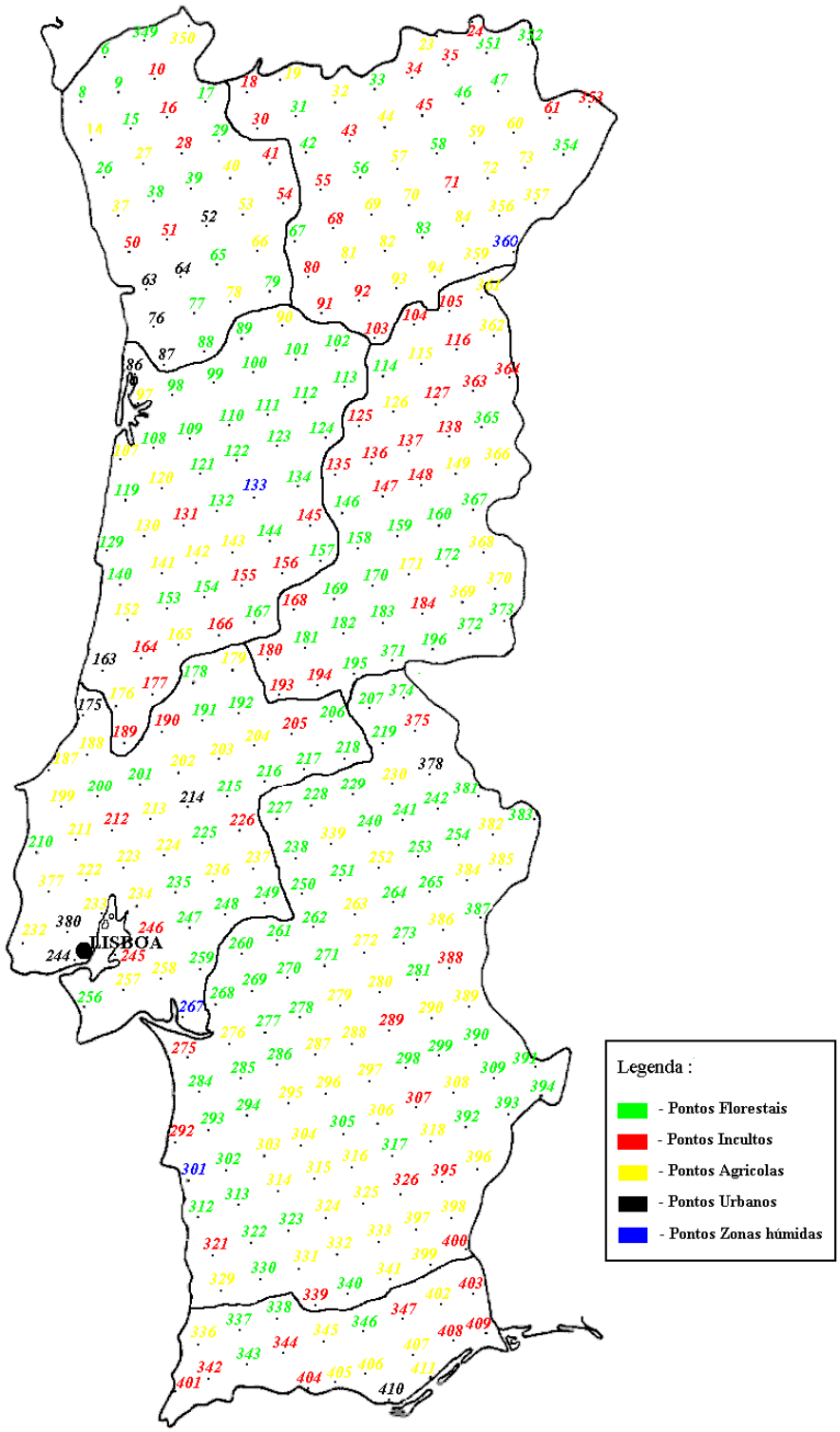
Any other comments: *The present data was obtained during the participation of Portugal in the 1st European Large Scale Forest Soil Survey. This survey took place between 1994 and 1996, under the Pan European Programme on the Intensive Monitoring of Forest Ecosystem (UN/ECE ICP-Forests and the European Commission), and aimed to access basic information on the chemical status and on other soil properties which determine the soil vulnerability to air pollution. The results were prepared by the Forest Soil Co-ordinating Centre (FSCC, c/o University of Gent, Laboratory of Soil Science) and published by Vanmechelen et al. (1997) Forest Soil Condition in Europe: results of a large scale soil survey. European Commission, United Nations Economic Commission for Europe and the Ministry of the Flemish Community: Brussels, Geneva, 259p. ISBN 90-76315-01-09. (*www.icp-forests.org*).*

In continental Portugal this survey involved 148 observation plots (Map 1). The work was carried out by Direcção Geral das Florestas (National Focal Centre of ICP-Forests) and Laboratório Químico Agrícola Rebelo da Silva. The following information was collected at each plot: altitude; slope; soil parent material; FAO soil classification name; forest dominant specie; chemical and physical data of the organic and mineral layers (pH, organic carbon, N-Kjeldhal, calcium carbonate, exchangeable basic cations, cation exchangeable capacity, base saturation, 'total'(aqua regia) concentrations of P, K, Ca, Mg, Na, Al, Fe, Mn, Zn, Cu, Cd, Cr, Pb and Ni).

As mentioned above, heavy metals were measured by flame AAS, as we hadn't yet bought the graphite furnace spectrophotometer. That technique, having high detection limits, is not sensitive to some elements, specially Cd, as this element is usually present in low concentrations in the soil. Therefore, data concerning Cd should be analysed with caution.

Having no GIS, to link our sample locations to Soil Parent Material Units provided in the CD ROM, but having the soil classification of each plot (FAO/UNESCO), the statistical analysis of Table set 1 was obtained after grouping the following parent materials:

1. *Mat 11 unit 1 – undifferentiated alluvial deposits – plot 383, originated form an ancient river terrace;*
2. *Mat 11 unit 2 – calcareous soils – parent material 'c' (see file PO Plot locations.doc;*
3. *Mat 11 unit 3 – clayey materials – parent material 'gb';*
4. *Mat 11 unit 4 – sandy materials – parent materials 't', 'k' and 'r';*
5. *Mat 11 unit 6 – detrital formations – no plots with that origin;*
6. *Mat 11 unit 7 – crystalline rocks and migmatites – parent materials 'x', 'q', 'n', 'g', 'qd', 'p' and 'vg'.*



Map 1 – Level I plots in Portugal and type of land use in 1997 (**green colour = forest soils**; red = uncultivated soils; yellow = arable and grassland; black = urban plots; blue = wet zones). From 1994 (date of the soil survey) till 1997, some places changed of land use. The forest plots sampled are mentioned in file PO Plot locations.doc.

Table set 1
Contents of trace elements related to soil parent material and land use
- Portugal -

Mat 11 unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest	**1**			1.5			
	other land use							
2	**calcareous rocks**							
land use	arable land							
	grassland							
	forest	**3**	<0.5					2.0
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest	**1**			3.2			
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland							
	forest	**42**	<0.5	<0.5	<0.5	<0.5	0.5	2.0
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest	**0**						
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest	**101**	<0.5	<0.5	0.5	1.5	2	4.6
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Portugal -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest	**1**			46			
	other land use							
2	**calcareous rocks**							
land use	arable land							
	grassland							
	forest	**3**	37		42			69
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest	**1**			65			
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland							
	forest	**42**	<3.7	11	19	30	44	199
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest	**0**						
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest	**101**	<3.7	19	34	56	99	391
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Portugal -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest	**1**			68			
	other land use							
2	**calcareous rocks**							
land use	arable land							
	grassland							
	forest	**3**	20		27			45
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest	**1**			84			
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland							
	forest	**42**	<1.8	<1.8	2	14	39	65
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest	**0**						
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest	**101**	<1.8	7	18	26	40	68
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Portugal -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest	**1**			34			
	other land use							
2	**calcareous rocks**							
land use	arable land							
	grassland							
	forest	**3**	30		35			54
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest	**1**			63			
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland							
	forest	**42**	<1.9	9	12	24	42	70
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest	**0**						
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest	**101**	<1.9	14	30	41	54	360
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Portugal -

Mat 11 unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest	**1**			34			
	other land use							
2	**calcareous rocks**							
land use	arable land							
	grassland							
	forest	**3**	7		37			68
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest	**1**			38			
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland							
	forest	**42**	<0.5	5	10	17	22	35
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest	**0**						
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest	**101**	5	22	27	39	52	67
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Portugal -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest	**1**			18			
	other land use							
2	**calcareous rocks**							
land use	arable land							
	grassland							
	forest	**3**	25		56			131
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest	**1**			27			
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland							
	forest	**42**	<1.6	4	6	10	25	70
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest	**0**						
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest	**101**	5	32	51	63	75	107
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Portugal -

Mat 11 unit	parent material	org. C [%] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest	**1**			1.7			
	other land use							
2	**calcareous rocks**							
land use	arable land							
	grassland							
	forest	**3**	4.0		5.6			5.7
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest	**1**			3.4			
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland							
	forest	**42**	0.5	1.1	1.5	2.4	4.6	11.6
	other land use							
6	**detrital formations**							
land use	arable land							
	grassland							
	forest	**0**						
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land							
	grassland							
	forest	**101**	0.6	2.4	3.8	5.9	9	14.2
	other land use							

Table set 2
Contents of trace elements related to soil pH
- Portugal -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	120	<0,5	<0,5	<0,5	1.0	1.5	3.0
> 5 - 6	24	<0,5	<0,5	0.5	1.5	2.0	3.5
> 6 - 7	2	<0,5					0.5
> 7	2	3.2					4.6

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	120	<3.7	15	26	44	61	199
> 5 - 6	24	10	27	43	85	147	391
> 6 - 7	2	16					42
> 7	2	65					137

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	120	<1.8	4	12	23	36	66
> 5 - 6	24	<1.8	15	26	45	66	68
> 6 - 7	2	1					20
> 7	2	68					84

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	120	<1.7	12	21	37	51	70
> 5 - 6	24	6	18	31	45	54	360
> 6 - 7	2	13					30
> 7	2	39					63

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	120	0.5	16	25	34	49	67
> 5 - 6	24	2	10	17	30	41	68
> 6 - 7	2	5					37
> 7	2	38					55

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	120	<1.6	11	39	60	71	107
> 5 - 6	24	3	14	28	62	72	131
> 6 - 7	2	6					56
> 7	2	27					33

Table set 3
Contents of trace elements related to soil texture classes
- Portugal -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**62**	<0.5	<0.5	<0.5	1.0	1.5	2.6
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**80**	<0.5	<0.5	<0.5	1.5	2.0	4.6
3	Medium fine	< 35% clay and < 15% sand							
4	Fine	35% ≤ clay < 60%	**6**	<0.5	<0.5	0.5	1.5	2.0	2.0
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**62**	<3.7	10	19	37	48	60
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**80**	<3.7	21	34	61	124	391
3	Medium fine	< 35% clay and < 15% sand							
4	Fine	35% ≤ clay < 60%	**6**	32	48	58	74	95	95
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**62**	<1.8	2	6	16	36	65
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**80**	<1.8	8	20	29	52	84
3	Medium fine	< 35% clay and < 15% sand							
4	Fine	35% ≤ clay < 60%	**6**	14	22	27	36	42	42
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**62**	<1.9	8	12	19	33	50
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**80**	6	21	32	44	58	360
3	Medium fine	< 35% clay and < 15% sand							
4	Fine	35% ≤ clay < 60%	**6**	32	37	43	61	81	81
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**62**	1	15	24	31	47	60
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**80**	2	14	25	34	50	68
3	Medium fine	< 35% clay and < 15% sand							
4	Fine	35% ≤ clay < 60%	**6**	10	10	25	30	56	56
5	Very fine	≥ 60% clay							

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**62**	<1.6	7	30	51	63	87
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**80**	2	18	40	61	73	131
3	Medium fine	< 35% clay and < 15% sand							
4	Fine	35% ≤ clay < 60%	**6**	34	55	69	85	89	89
5	Very fine	≥ 60% clay							

Estonia

Appendix 3 Documentation Sheet①

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: Geological Survey of Estonia Name: Valter Petersell Position in the Institute: Leader geologist of Department of Geochemical and Environmental Geology Address: 82 Kadaka tee, Tallinn 12618, Estonia Phone: (372) 6720093 Fax: (372) 6720091 e-mail: v.petersell@egk.ee

Description of the data set		
Geographical locations (co-ordinates)	Geographical locations deliverable: Yes x No Accuracy: ± 50m Co-ordinate system used e.g. national, UTM etc. Pulkovo 1942	
Sampling strategy	*Kind of sampling* Random: ☐ Grid: ■ grid distance: Nested Sampling ☐ Other ■ please specify: From the wall of the digging penetrating all soil horizons Area sample (m^2): 0.0025 – 0.0035 1 sample per 30-70km²	Soil horizon ■ please specify: T - topsoil (humus horizon): upper horizon (0 - (12-35) cm) C - subsoil (parent material): 20-30cm layer within a depth range of 50-120 cm Depth increment ☐ Single core digging ■ Mixed core ☐ Number of cores: 537 sampling points

① If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

Soil parameter	*Soil pH*	*Soil e particle size class*	*Soil organic matter*
☐ ■ ☐	Analytical result: (If other procedures other than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear indication of the chosen pH analytical method.) pH ($CaCl_2$) pH (H_2O) pH (KCl) Estimation: please specify (e.g. target pH-values, maps):	Analytical results ☐ Profile description ■ Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay) See explanatory text	Analytical results ■ analytical method: (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. Difference in weight between dry (105 °C) and ashed (450 °C) sample Profile description

Digestion method(s) for determination of trace elements	☐he analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18.g■l). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: ☐ther (please specify): Total concentration If other, were data transferred to aqua regia? Yes no

Detection limits	Please give information of the detection limits in [mg/kg dry mass]; As: 6 Cd: 0.05 Cr: Cu: 2 Hg: 0.002 Mo: 1 Ni: 1 Pb: 2 Se: Zn: 2

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes ☐ No ■ If Yes, are these samples eliminated before data evaluation? Yes ☐ No ☐ If Yes, please specify how contaminated samples were identified:

Any other comments:

Table set 1
Contents of trace elements related to soil parent material and land use
- Estonia -

Mat 11 unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**225**	0.05	0.29	0.41	0.56	0.73	16.42
	grassland	**64**	0.09	0.29	0.43	0.59	0.78	2.67
	forest	**123**	0.05	0.24	0.38	0.49	0.65	1.07
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Estonia -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**297**	10	40	49	60	69	100
	grassland	**79**	17	37	43	60	63	122
	forest	**161**	9	28	40	49	60	100
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Estonia -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**297**	2.0	8.0	11.0	15.0	25.0	160
	grassland	**79**	4.0	8.0	11.6	17.0	23.0	89
	forest	**161**	2.5	5.9	8.0	13.0	21.0	83
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Estonia -

Mat 11 unit	parent material	Hg [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**232**	0.003	0.029	0.040	0.055	0.077	0.304
	grassland	**67**	0.003	0.022	0.035	0.052	0.088	0.124
	forest	**130**	0.002	0.007	0.024	0.044	0.070	0.155
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Estonia -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**297**	7	19	24	29	35	75
	grassland	**79**	9	19	25	30	40	89
	forest	**161**	6	12	20	27	35	122
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Estonia -

Mat 11 unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**297**	2.0	14	18	22	27	220
	grassland	**79**	2.0	11	16	22	30	78
	forest	**161**	2.0	11	17	22	27	52
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Estonia -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**297**	5.0	36	46	59	72	345
	grassland	**79**	2.0	26	41	58	85	175
	forest	**161**	2.0	20	31	44	61	128
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Estonia -

Mat 11 unit	parent material	OM [%] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**297**	0.09	3.00	3.63	5.29	8.16	18.75
	grassland	**79**	0.08	2.71	3.04	6.28	11.72	22.19
	forest	**161**	0.04	0.78	3.00	5.41	10.06	27.76
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 2
Contents of trace elements related to soil pH
- Estonia -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	26	0.06	0.11	0.25	0.41	0.59	0.86
> 5 - 6	29	0.10	0.20	0.30	0.49	0.65	2.67
> 6 - 7	142	0.05	0.27	0.39	0.53	0.67	1.07
> 7	203	0.05	0.32	0.44	0.58	0.78	16.42

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	41	9	17	27	43	49	89
> 5 - 6	32	20	27	32	45	49	78
> 6 - 7	194	10	35	40	54	63	100
> 7	231	20	40	49	60	69	122

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	41	3.0	4.2	8.0	12.0	21.0	53.0
> 5 - 6	32	2.5	5.0	6.5	11.3	16.0	58.0
> 6 - 7	194	3.0	7.0	10.0	15.0	30.0	160.0
> 7	231	2.0	8.8	11.0	15.6	20.2	82.0

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	25	0.003	0.003	0.006	0.014	0.028	0.046
> 5 - 6	31	0.002	0.006	0.022	0.042	0.046	0.056
> 6 - 7	146	0.002	0.018	0.033	0.045	0.067	0.304
> 7	214	0.004	0.031	0.043	0.063	0.082	0.187

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	41	6	9	17	25	40	60
> 5 - 6	32	7	11	16	22	47	49
> 6 - 7	194	8	18	22	28	40	122
> 7	231	9	19	24	30	35	75

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	41	2	10	16	19	22	46
> 5 - 6	32	2	10.5	14	18	24	37
> 6 - 7	194	2	12	17	22	26	78
> 7	231	2	15	19	24	28	220

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	41	5	11	29	38	40	100
> 5 - 6	32	6	14	22	33.5	45	101
> 6 - 7	194	2	24	40	56	66	175
> 7	231	14	39	48	62	75	345

Table set 3
Contents of trace elements related to soil texture classes
- Estonia -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**60**	0.05	0.165	0.29	0.49	0.585	0.96
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**28**	0.05	0.265	0.445	0.545	0.77	16.42
3	Medium fine	< 35% clay and < 15% sand	**67**	0.15	0.30	0.44	0.59	0.96	1.51
4	Fine	35% ≤ clay < 60%	**207**	0.10	0.30	0.39	0.56	0.68	3.26
5	Very fine	≥ 60% clay	**50**	0.13	0.30	0.44	0.56	0.79	2.67

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**80**	9	23	35	42	60	80
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**39**	10	24	40	55	60	85
3	Medium fine	< 35% clay and < 15% sand	**95**	22	35	40	54	65	89
4	Fine	35% ≤ clay < 60%	**260**	14	40	49	60	69	122
5	Very fine	≥ 60% clay	**63**	19	40	49	60	70	89

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**80**	3.0	5.0	7.25	11.3	17.0	83.0
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**39**	2.5	6.0	10.0	20.0	40.0	88.0
3	Medium fine	< 35% clay and < 15% sand	**95**	4.0	7.6	11.0	14.0	20.0	41.0
4	Fine	35% ≤ clay < 60%	**260**	4.0	8.0	10.0	15.0	23.0	89.0
5	Very fine	≥ 60% clay	**63**	2.0	9.0	13.9	18.0	27.0	160.0

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**60**	0.002	0.007	0.020	0.040	0.054	0.124
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**29**	0.003	0.017	0.038	0.068	0.085	0.132
3	Medium fine	< 35% clay and < 15% sand	**74**	0.002	0.027	0.037	0.054	0.074	0.304
4	Fine	35% ≤ clay < 60%	**212**	0.002	0.029	0.040	0.054	0.076	0.155
5	Very fine	≥ 60% clay	**54**	0.002	0.008	0.030	0.044	0.085	0.187

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**80**	6	11	22	35	51	122
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**39**	7	15	22	29	40	49
3	Medium fine	< 35% clay and < 15% sand	**95**	8	17	22	28	38	75
4	Fine	35% ≤ clay < 60%	**260**	7	19	23	27	34	69
5	Very fine	≥ 60% clay	**63**	7	19	25	30	35	60

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**80**	2.0	7.5	12	19	26	59
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**39**	2.0	9.0	15	18	25	35
3	Medium fine	< 35% clay and < 15% sand	**95**	5.0	14	17	22	27	42
4	Fine	35% ≤ clay < 60%	**260**	3.0	15	19	23	27	78
5	Very fine	≥ 60% clay	**63**	6.0	13	17	23	31	220

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
1	Coarse	18% ≤ clay and ≥ 65% sand	**80**	2.0	12	28.5	40.5	57	80
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**39**	5.0	15	31	51	78	345
3	Medium fine	< 35% clay and < 15% sand	**95**	15	33	48	59	75	97
4	Fine	35% ≤ clay < 60%	**260**	6.0	36	44	59.5	70	175
5	Very fine	≥ 60% clay	**63**	9.2	22	40	57	82	131

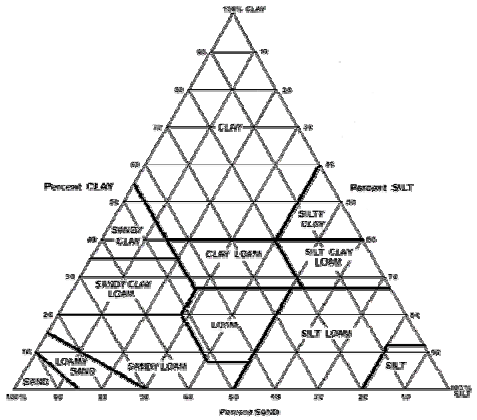
Lithuania

Documentation Sheet①

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: **Geological Survey of Lithuania, LITHUANIA** Name: Virgilija **GREGORAUSKIENE** Position in the Institute: **Head of the Geochemistry group** Address: **Department of Quaternary Geology, Geological Survey of Lithuania, S. Konarskio St. 35, LT-2600 Vilnius, LITHUANIA** Phone: +370 2 239055 Fax: +370 2 336156 E-mail: virgilija.gregorauskiene@lgt.lt

Description of the data set		
Geographical locations (co-ordinates)	Geographical locations deliverable: **Yes** ~~No~~ Accuracy**: DMS** Co-ordinate system used e.g. national, UTM etc. **national LKS 94**	
Sampling strategy	*Kind of sampling*	
	Random: Grid: **X** grid distance: **10x10 km** Nested Sampling Other please specify: Area sample (m^2): **10–25 m^2**	Soil horizon **X** please specify: **A or H** Depth increment please specify: **0-10 cm** Single core Mixed core **X** Number of cores: **5**

① If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

Soil parameter	Soil pH Analytical result: **X** (If other procedures other than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear indication of the chosen pH analytical method.) pH ($CaCl_2$) pH (H_2O) **X** pH (KCl) Estimation: please specify: **target pH-values**	*Soil e particle size class* Analytical results **X** Profile description **X** Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay) **after USDA 1987**  	*Soil organic matter* Analytical results **X** (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method. Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. analytical method: **OM – loss-on-ignition** Profile description **X**

Digestion method(s) for determination of trace elements	The analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18.g/ml). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: Other (please specify): **samples were not digested** If other, were data transferred to aqua regia? Yes no **X**
Detection limits	Please give information of the detection limits in [mg/kg dry mass]; As: 0.3 Cd: 2 Cr: 1 Cu: 1 Hg: Mo: 0.3 Ni: 1 Pb: 3 Se: 1.1 Zn: 10

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes No **X** If Yes, are these samples eliminated before data evaluation? Yes No If Yes, please specify how contaminated samples were identified:

Geographical location:
Spatial distribution of the sites of all soil samples has been sent as a separate ***LIT_sites.tif*** file.

The short-term action: has been sent a separate ***LIT_landuse.tif*** file, the Map of Lithuania showing the locations of all sampling points; *and* land-use of each point at the time of sampling (*shown by changing the colour at each point*):

- cultivated soils;
- (managed) grassland;
- forest;
- other.

Short description

Other comments: *Sampling.* The whole territory of Lithuania was divided into 10x10 km squares. The sampling sites were selected using 1:50 000 soil maps, and from four different soil groups according to the dominant soil texture (clay-loam, loamy sand, sand and peat) in 1995-1996 summer were sampled from each quadrant of the squares (***LIT_sites.tif*** file 'Lithuania – topsoil sampling sites').

Topsoil samples were taken by unpainted plastic spade from the 0-10 cm depth of horizon A or surface layer. Samples were composite of five sub samples collected according to the "envelope" principle. The length of "envelope" lines was 2–5 m. The samples were put into cotton bags the soil texture and land-use were described. In total 2700 soil samples have been collected, 6.7% – field duplicates.

Soil sample preparation and analysis: After the samples were transported to the laboratory, pH (water dilution) has been measured by the ionometer J-200. Later samples were dried at room temperature and sieved through a 1 mm nylon sieve. The fraction <1 mm after milling was analysed by *DC-Arc Emission Spectrometry* direct method (in compliance with ISO 5725) based on the indication of the used wavelength. The equipment was used: spectrograph DFS-13 and microdensitometer MD-1000. Real total content of 28 elements has been measured.

Detection limits of DC Arc ES analytical method in ppm: Cd–2, Cu–1, Cr–1, Ni–1, Pb–3, Zn–10. The samples were analysed by DC-Arc ES after burning at the temperature of 450^{o}C and the loss on ignition (LOI) was calculated. The following international reference materials were used for a quality control and assurance: OOKO 151, 152 and 153, SRM 2709 and 2711 ("Geostandards Newsletter, Vol. 18, Special Issue, July 1994, p.1 a - 158 (ISSN: 0150-5505). The concentrations of elements obtained by DC-Arc ES were recalculated to air-dry material. Laboratory of Spectral Analyses of the Institute of Geology, where soil samples were analysed, since year 1993 participates in the WEPAL' international calibration programme 'International Soil Analytical Exchange'. According to the permanent repeated quality inspection the general evaluation is positive (certificates VKI No. 403341, SNAS No. 004).

Table set 1
Contents of trace elements related to soil parent material and land use
- Lithuania -

Mat 11 unit	parent material	Cd [mg/kg] - lower than detection limits						
		n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest							
	other land use							
3	**clayey materials**							
land use	arable land							
	grassland							
	forest							
	other land use							
4	**sandy materials**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Lithuania -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated glacial deposits**							
land use	arable land	**789**	13.0	31.6	37.9	45.5	53.8	79.6
	grassland	**724**	5.0	29.2	36.0	43.6	52.0	81.9
	forest	**540**	7.6	18.3	24.1	31.7	41.0	62.3
	other land use							
3	**clayey materials**							
land use	arable land	**353**	15.2	36.0	42.3	51.2	58.6	129.2
	grassland	**275**	14.8	35.9	42.8	50.6	57.5	133.6
	forest	**50**	24.8	36.1	41.7	47.1	56.9	74.9
	other land use							
4	**sandy materials**							
land use	arable land	**91**	13.0	21.8	27.5	33.5	38.6	53.6
	grassland	**165**	10.2	22.4	27.6	33.0	37.2	57.7
	forest	**420**	7.6	17.4	22.2	27.5	33.8	85.7
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Lithuania -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated glacial deposits**							
land use	arable land	**789**	0.9	7.7	9.7	12.2	14.3	37.4
	grassland	**724**	0.9	7.4	9.5	11.7	14.6	45.4
	forest	**540**	1.0	4.6	6.5	8.6	11.5	18.7
	other land use							
3	**clayey materials**							
land use	arable land	**353**	2.8	9.2	11.3	12.8	15.1	23.7
	grassland	**275**	3.9	9.3	11.3	13.9	16.8	40.8
	forest	**50**	3.6	8.6	11.1	12.5	14.5	22.1
	other land use							
4	**sandy materials**							
land use	arable land	**91**	0.9	5.5	7.6	9.6	12.3	15.4
	grassland	**165**	1.0	5.7	7.5	9.4	10.9	30.5
	forest	**420**	1.0	3.9	5.8	7.7	9.8	23.4
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Lithuania -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated glacial deposits**							
land use	arable land	**789**	2.8	11.7	14.5	17.9	23.1	35.5
	grassland	**724**	3.3	10.7	13.8	17.4	21.3	40.0
	forest	**540**	1.9	7.0	9.1	12.1	15.8	31.2
	other land use							
3	**clayey materials**							
land use	arable land	**353**	4.0	13.8	16.9	20.5	25.8	51.7
	grassland	**275**	3.3	14.4	17.1	20.9	25.4	47.7
	forest	**50**	7.5	13.8	16.2	21.1	22.6	48.0
	other land use							
4	**sandy materials**							
land use	arable land	**91**	2.8	7.5	9.8	12.8	15.2	18.5
	grassland	**165**	4.1	8.3	10.1	13.2	14.4	21.4
	forest	**420**	3.0	6.6	8.2	10.5	12.8	18.7
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Lithuania -

Mat 11 unit	parent material	Pb [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated glacial deposits**							
land use	arable land	**789**	4.5	12.4	14.4	17.2	20.2	30.8
	grassland	**724**	4.7	12.5	14.6	17.2	20.5	52.7
	forest	**540**	5.5	12.2	14.8	18.3	21.5	26.4
	other land use							
3	**clayey materials**							
land use	arable land	**353**	4.5	12.5	14.6	17.4	20.5	33.5
	grassland	**275**	6.6	12.3	14.7	17.1	21.3	35.3
	forest	**50**	7.4	12.0	14.4	17.8	23.5	30.8
	other land use							
4	**sandy materials**							
land use	arable land	**91**	7.9	11.7	14.0	17.4	20.3	37.5
	grassland	**165**	4.7	12.5	14.9	17.5	21.4	31.2
	forest	**420**	5.5	12.3	15.1	18.4	21.6	38.9
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Lithuania -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated glacial deposits**							
land use	arable land	**789**	4.2	23.4	29.6	36.4	45.6	63.6
	grassland	**724**	6.2	21.8	29.4	36.7	48.6	163.3
	forest	**536**	5.4	14.6	21.6	29.0	36.0	98.5
	other land use							
3	**clayey materials**							
land use	arable land	**353**	6.7	26.9	32.7	40.2	53.6	104.3
	grassland	**275**	6.8	26.5	33.4	42.0	57.4	113.0
	forest	**50**	14.1	25.2	30.8	39.3	49.9	77.4
	other land use							
4	**sandy materials**							
land use	arable land	**91**	6.6	14.4	22.7	30.4	35.7	50.9
	grassland	**165**	6.6	14.8	23.5	31.0	37.2	69.1
	forest	**416**	5.4	14.4	19.3	27.0	33.9	88.0
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Lithuania -

Mat 11 unit	parent material	OM [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated glacial deposits**							
land use	arable land	**749**	0.2	3.6	4.8	6.2	8.0	25.4
	grassland	**680**	0.5	3.6	4.9	6.7	9.1	18.0
	forest	**521**	0.3	2.6	4.0	6.0	9.1	19.0
	other land use							
3	**clayey materials**							
land use	arable land	**341**	1.2	3.9	5.1	6.6	8.5	21.5
	grassland	**254**	0.5	4.2	5.4	7.3	10.0	25.7
	forest	**46**	2.0	4.1	5.4	6.7	10.8	22.1
	other land use							
4	**sandy materials**							
land use	arable land	**88**	0.2	2.4	3.8	5.6	7.4	17.1
	grassland	**158**	0.5	2.2	3.8	5.7	8.3	23.6
	forest	**407**	0.3	2.4	3.6	5.4	8.5	28.6
	other land use							

Table set 2
Contents of trace elements related to soil pH
- Lithuania -

soil pH	Cd [mg/kg] - lower than detection limits						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	118	1.2	4.2	9.3	19.2	25.8	47.9
> 5 - 6	248	2.7	15.2	20.6	28.6	39.2	85.7
> 6 - 7	771	0.6	18.3	25.4	35.3	42.8	75.9
> 7	1401	8.4	28.9	36.4	44.0	52.7	133.6

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	118	0.4	3.0	4.7	6.3	8.4	21.9
> 5 - 6	248	0.9	3.9	6.5	8.8	11.9	26.1
> 6 - 7	771	0.8	5.5	7.8	11.1	15.9	33.1
> 7	1401	1.0	7.6	9.6	12.3	15.0	45.4

soil pH	Hg [mg/kg] – no data						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	118	0.8	3.7	5.4	7.5	10.7	16.0
> 5 - 6	248	1.7	6.3	8.4	12.2	16.7	25.3
> 6 - 7	771	1.2	7.9	10.7	15.0	19.3	48.0
> 7	1401	3.8	11.4	14.4	18.0	23.1	51.7

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	118	1.5	14.1	20.4	36.5	57.3	101.2
> 5 - 6	248	1.8	13.4	16.3	21.4	30.5	80.2
> 6 - 7	771	0.6	12.6	15.3	19.1	24.6	50.9
> 7	1401	4.7	12.6	15.0	17.8	21.2	96.3

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	118	2.7	9.1	20.8	35.0	58.5	376.6
> 5 - 6	247	0.9	13.0	21.1	32.3	50.1	874.8
> 6 - 7	771	1.5	16.2	26.5	37.8	57.1	376.3
> 7	1398	5.1	22.6	29.5	37.8	50.5	163.3

Table set 3
Contents of trace elements related to soil texture classes
- Lithuania -

texture classes (< 2 mm)			Cd [mg/kg] - lower than detection limits						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							
	sand								
	silt/loam								
	clay								

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	630	0.6	11.9	20.5	29.6	38.3	62.8
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	≥ 60% clay							
1	sand		676	7.6	18.5	24.2	30.4	36.6	85.7
2-3	silt/loam		699	5.0	29.5	35.5	41.4	47.5	81.9
4-5	clay		678	14.8	36.0	42.5	50.6	57.9	133.6

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	630	0.4	5.1	8.7	13.0	20.6	26.1
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	≥ 60% clay							
1	sand		676	0.9	4.6	6.5	8.0	10.3	30.5
2-3	silt/loam		699	0.9	7.4	9.4	11.3	13.5	45.4
4-5	clay		678	2.8	9.2	11.3	13.3	15.7	40.8

texture classes (< 2 mm)			Hg [mg/kg] - no data						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
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	≥ 60% clay							
1	sand								
2-3	silt/loam								
4-5	clay								

Table set 3(cont'd)
Contents of trace elements related to soil texture classes
- Lithuania -

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	630	0.8	6.7	10.9	16.3	22.6	39.0
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	≥ 60% clay							
1	sand		676	0.9	4.6	6.5	8.0	10.3	30.5
2-3	silt/loam		699	0.9	7.4	9.4	11.3	13.5	45.4
4-5	clay		678	3.3	14.1	16.9	20.8	25.6	51.7

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	630	0.6	13.3	18.1	25.4	36.4	101.2
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	≥ 60% clay							
	sand		676	7.6	18.5	24.2	30.4	36.6	85.7
	silt/loam		699	5.0	29.5	35.5	41.4	47.5	81.9
	clay		678	4.5	12.4	14.6	17.3	20.9	35.3

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	630	0.9	15.2	29.4	51.6	79.0	874.8
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	≥ 60% clay							
1	sand		672	5.4	14.6	20.7	29.0	35.5	88.0
2-3	silt/loam		699	4.2	21.7	28.4	34.5	41.5	163.3
4-5	clay		678	6.7	26.7	32.9	41.1	54.4	113.0

Norway

Documentation Sheet[1]

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: Norwegian Institute of Land Inventory, Norway Name: Arnold Arnoldussen Position in the Institute: Head Soil Information Section Address: PB 115, 1431 Aas, Norway Phone: +47 64949780 Fax: +47 6494 9786 e-mail: aha@nijos.no

Description of the data set

Geographical locations (co-ordinates) ☐	Geographical locations deliverable*:* Yes X No Accuracy: good Co-ordinate system used e.g. national, UTM etc. UTM and NGO	
Sampling strategy	*Kind of sampling* Random: Grid: X grid distance: for coniferous forest 9x9 km; for birch forest 18 x 18 km Nested Sampling ☐ Other X please specify: single profile descriptions related to soil mapping of agricultural areas Area sample (m^2) 250 m^2 for forest areas	Soil horizon X please specify: Soil Taxonomy Depth increment X please specify: cm Single core Mixed core X Number of cores: for forest areas depending on situation in the field, most soil from the soil pit. For agricultural areas 1 sample per horizon

[1] If your data are originating from different sources/data holders and/or are referring to different land uses, analytical methods and sampling strategies, please make copies of the documentation sheet for each data set (pp. 1 to 3 "description of the data set").

Soil parameter	*Soil pH*	*Soil e particle size class*	*Soil organic matter*
☐ ☐	Analytical result: X (If other procedures other than $CaCl_2$ are applied, please try to transform the pH values to a $CaCl_2$ basis and/or indicate the method used. In any other cases please give a clear indication of the chosen pH analytical method.) pH ($CaCl_2$) X pH (H_2O) pH (KCl) Estimation: please specify (e.g. target pH-values, maps):	Analytical results X Profile description X Please specify the nomenclature for classifying particle size data into soil texture: (If soil texture is classified according to national nomenclature please attach a soil texture diagram or give information about the ranges of mass contents for the three main components sand, silt and clay) Texture based on Norwegian system: Clay: < 0,002 mm Silt: 0,002 – 0,06 mm Sand: 0,06 – 2 mm	Analytical results X analytical method: (The content of organic matter should be determined using elemental analyser or by wet oxidation (e.g. dichromate ox.). In any case please give a clear indication of the analytical method.) Please specify whether you record organic matter OR organic carbon AND if you correct your data for inorganic carbonate content. Used method: Burning in a Perkin-Elmer 2400 CHN Elemental Analyzer. Because of low values of pH and no free chalk expected assumption that total C = org C% Profile description X

Digestion method(s) for determination of trace elements	The analyses of heavy metals should be based on or be transposed to an aqua regia basis if possible. Where the data are transposed from other digestion procedures the respective transposition rules should be specified. In any other cases a clear indication of the chosen digestion method should be given. By aqua regia we mean a mixture of 1 part nitric acid (d=1.40 g/ml) and 3 parts hydrochloric acid (d=1.18.g/ml). If you use a different 'recipe' please state what it is. If you use a published standard method, please state what it is, e.g. ISO 11466. Aqua regia: Other (please specify): X For ZN: 10 gr. Mineral soil or 2,5 organic material was added to 50 ml 1 M NH4NO3. Shaking and staying over night and shaking again. Filtering through S&S White Ribbon 589 ash free filter paper. Washing with 1M NH4NO3 to 250 ml. extract If other, were data transferred to aqua regia? No transformation Yes no X
Detection limits	Please give information of the detection limits in [mg/kg dry mass]; As: Cd: Cr: Cu: Hg: Mo: Ni: Pb: Se: Zn: ca. 0,1 ppm

Harmonisation of the data sets	Do the data sets include samples from contaminated sites? Yes ☐ No X If Yes, are these samples eliminated before data evaluation? Yes ☐ No ☐ If Yes, please specify how contaminated samples were identified:

Any other comments:
For forests both information is available about Zn and organic matter.
For agricultural areas only information is available for organic matter

Table set 1
Contents of trace elements related to soil parent material and land use
- Norway -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land							
	grassland							
	forest	**1374**	0	0.5	1.4	4.95	24.6	115.9
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 1
Contents of trace elements related to soil parent material and land use
- Norway -

Mat 11 unit	parent material	org. C [%] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**563**	0.3	2.6	5.9	29.5	50	57.4
	grassland							
	forest	**1076**	0.1	1.5	3.5	8.45	48.32	58.5
	other land use							
9	**other rocks**							
land use	arable land							
	grassland							
	forest							
	other land use							

Table set 2
Contents of trace elements related to soil pH
- Norway -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Cr [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Cu [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Hg [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Ni [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Pb [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5							
> 5 - 6							
> 6 - 7							
> 7							

soil pH	Zn [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	**1314**	0	0.5	1, 4	5.5	25.3	109.7
> 5 - 6	**39**	0	0	0.2	0.5	2.2	8.8
> 6 - 7	**8**	0	0	0.25	1.55	115.9	115.9
> 7	**0**						

Table set 3
Contents of trace elements related to soil texture classes
- Norway -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Hg [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**157**	0	5.65	16.4	34	61.52	95.9
1	Coarse	18% ≤ clay and ≥ 65% sand	**174**	0	0.3	0.9	2.2	11.5	90.7
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**4**	0.8	0.88	1.2	2.35	2.7	2.7
3	Medium fine	< 35% clay and < 15% sand	**2**	0.4	0.4	1.55	2.7	2.7	2.7
4	Fine	35% ≤ clay < 60%	**0**						
5	Very fine	≥ 60% clay	**0**						

Slovak Republic

Documentation Sheet

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: Soil Science and Conservation Research Institute, Bratislava, Slovakia Name: Dr. J. Curlik Position in the Institute: Head of the department Address: Gagarinova 10, 827 13 Bratislava, Slovakia Phone: +421/2/43 420 866 Fax: +421/2/43 295 487 e-mail:

Meta-information and results are described in detail in the national report 'Heavy metals and organic matter in Slovakian soils' (Čurlík, J. & Šefčik, P. 2001). The succeeding tables derive from the report.

Table set 1: Contents of trace elements related to soil parent material and land use - Slovakia

Parent material	Cd ($mg.kg^{-1}$)						
	n	min	25p	50p	75p	90p	max
undifferentiated alluvial deposits							
arable land	818	<0.1	0.2	0.3	0.4	0.5	7.3
forest	30	<0.1	0.3	0.4	0.575	0.72	2.3
calcareous rocks							
arable land	80	<0.1	0.3	0.5	0.6	0.9	2
forest	205	<0.1	0.6	0.9	1.4	1.96	6.9
sandy materials							
arable land	29	0.1	0.2	0.2	0.3	0.4	0.8
forest	35	<0.1	0.2	0.3	0.5	0.56	1.5
loamy materials							
arable land	329	<0.1	0.2	0.2	0.3	0.32	1
forest	-	-	-	-	-	-	-
detrital formations							
arable land	76	<0.1	0.2	0.3	0.425	0.55	0.9
forest	283	<0.1	0.2	0.4	0.5	0.7	2.3
crystalline rocks and migmatites							
arable land	283	<0.1	0.2	0.2	0.3	0.4	3.1
forest	539	<0.1	0.2	0.3	0.5	0.7	8.5
volcanic rocks							
arable land	-	-	-	-	-	-	-
forest	109	<0.1	0.2	0.4	0.5	0.8	5.6

Parent material	Cr ($mg.kg^{-1}$)						
	n	min	25p	50p	75p	90p	max
undifferentiated alluvial deposits							
arable land	818	25	71.25	89	103	121	349
forest	30	13	52	76	94	129.8	432
calcareous rocks							
arable land	80	29	71.5	85.5	102.25	122.1	6096
forest	205	12	48	66	82	113	665
sandy materials							
arable land	29	28	59	83	101	115.6	183
forest	35	31	44	56	67.5	87.6	97
loamy materials							
arable land	329	23	78	87	93	103	134
forest	-	-	-	-	-	-	-
detrital formations							
arable land	76	65	88.5	104	125.25	183.5	217
forest	283	19	74	89	114	172.6	650
crystalline rocks and migmatites							
arable land	283	11	60	81	102.5	135.6	258
forest	539	8	41.5	63	90	123	393
Volcanic rocks							
arable land	-	-	-	-	-	-	-
forest	109	14	32	43	56	75.2	141

Parent material	Cu ($mg.kg^{-1}$)						
	n	min	25p	50p	75p	90p	max
undifferentiated alluvial deposits							
arable land	818	3	18	22	29	38	1240
forest	30	6	13.75	19.5	28.5	34.4	65
calcareous rocks							
arable land	80	4	17.75	23	28	36	87
forest	205	6	13	17	25	34.6	141
sandy materials							
arable land	29	5	8	12	17	23.2	237
forest	35	<1	6	8	10	11.6	14
loamy materials							
arable land	329	3	18	19	22	25.2	91
forest	-	-		-	-	-	-
detrital formations							
arable land	76	6	14.75	21	28.25	36	59
forest	283	3	10	14	22	29	54
crystalline rocks and migmatites							
arable land	283	3	14	18	26	34	323
forest	539	2	9	13	22	48.2	22360
volcanic rocks							
arable land	-	-	-	-	-	-	-
forest	109	3	10	12	16	19.2	32

Parent material	Hg ($mg.kg^{-1}$)						
	n	min	25p	50p	75p	90p	max
undifferentiated alluvial deposits							
arable land	818	<0.01	0.04	0.06	0.09	0.14	7.96
forest	30	0.01	0.063	0.12	0.175	0.27	0.61
calcareous rocks							
arable land	80	0.02	0.05	0.07	0.1	0.191	0.58
forest	205	0.02	0.1	0.16	0.25	0.51	5.74
sandy materials							
arable land	29	<0.01	0.02	0.06	0.07	0.11	0.21
forest	35	0.02	0.08	0.12	0.245	0.33	1.27
loamy materials							
arable land	329	0.01	0.03	0.04	0.06	0.08	1.27
forest	-	-	-	-	-	-	-
detrital formations							
arable land	76	0.02	0.08	0.1	0.13	0.17	0.25
forest	283	0.02	0.07	0.11	0.165	0.248	0.61
crystalline rocks and migmatites							
arable land	283	0.01	0.05	0.09	0.14	0.286	88
forest	539	0.02	0.12	0.2	0.33	0.964	50.33
Volcanic rocks							
arable land	-	-	-	-	-	-	-
forest	109	0.01	0.07	0.11	0.18	0.28	1.32

Parent material	Ni ($mg.kg^{-1}$)						
	n	min	25p	50p	75p	90p	max
undifferentiated alluvial deposits							
arable land	818	2.5	24	31.5	41	49.3	200
forest	30	7	21	28	38	50.2	160
calcareous rocks							
arable land	80	2.5	27	37	47.5	60.7	2066
forest	205	2.5	15	23	32	58	242
sandy materials							
arable land	29	2.5	11	15	21	27.4	37
forest	35	2.5	8	11	13	15.6	19
loamy materials							
arable land	329	2.5	24	27	30	33	58
forest	-	-	-	-	-	-	-
detrital formations							
arable land	76	9	24.75	32.5	42	56	125
forest	283	2.5	15	22	32	48.8	238
crystalline rocks and migmatites							
arable land	283	2.5	15	23	34	45.8	107
forest	539	2.5	10	15	27	39	124
Volcanic rocks							
arable land	-	-	-	-	-	-	-
forest	109	2.5	6	9	14	19.2	33

Parent material	Pb ($mg.kg^{-1}$)						
	n	min	25p	50p	75p	90p	max
undifferentiated alluvial deposits							
arable land	818	5	15	18	23	29.3	1572
forest	30	5	15.5	22	28.75	40.1	64
calcareous rocks							
arable land	80	11	18	25.5	40.25	59	125
forest	205	8	33	45	65	92.2	317
sandy materials							
arable land	29	10	12	15	20	30.2	73
forest	35	3	24	44	54	66.8	86
loamy materials							
arable land	329	4	14	16	17	19	72
forest	-	-	-	-	-	-	-
detrital formations							
arable land	76	11	17	22.5	28	31	38
forest	283	7	23	30	43	62	165
crystalline rocks and migmatites							
arable land	283	7	16	20	27	37.8	231
forest	539	6	22	31	49	77	810
Volcanic rocks							
arable land	-	-	-	-	-	-	-
forest	109	9	24	32	50	78.4	393

Parent material	Zn ($mg.kg^{-1}$)						
	n	min	25p	50p	75p	90p	max
undifferentiated alluvial deposits							
arable land	818	10	55.25	70	84.75	104	2160
forest	30	17	50.5	66.5	72	105.6	243
calcareous rocks							
arable land	80	29	65	76	97.25	120.5	274
forest	205	17	65	89	123	161.2	363
sandy materials							
arable land	29	19	36	44	63	67.8	175
forest	35	3	30.5	45	59.5	75.8	118
loamy materials							
arable land	329	8	49	55	62	68	272
forest	-	-	-	-	-	-	-
detrital formations							
arable land	76	32	55	73	88.5	96.6	131
forest	283	9	48	64	80	98.8	191
crystalline rocks and migmatites							
arable land	283	13	50	65	86	112	303
forest	539	12	46	64	85	110.2	1865
Volcanic rocks							
arable land	-	-	-	-	-	-	-
forest	109	26	52	68	81	92.6	131

Table set 2: Heavy metals contents in Slovakian soils-referred to the soil pH

soil pH/H_2O	Cd ($mg.kg^{-1}$)						
	n	min	max	25p	50p	75p	90p
pH≤ 5	1319	< 0.1	5.6	0.2	0.3	0.4	0.6
5 < pH ≤ 6	1070	< 0.1	8.9	0.2	0.3	0.4	0.6
6 < pH ≤ 7	973	< 0.1	7.3	0.2	0.2	0.4	0.6
7 < pH	1771	< 0.1	5	0.2	0.2	0.4	0.6

soil pH/H_2O	Cr ($mg.kg^{-1}$)						
	n	min	max	25p	50p	75p	90p
pH≤ 5	1319	< 5	531	52	74	93	124.6
5 < pH ≤ 6	1070	9	1241	67	87	107	129
6 < pH ≤ 7	973	11	1030	75	89	106	128
7 < pH	1771	11	6096	72	88	101	120

soil pH/H_2O	Cu ($mg.kg^{-1}$)						
	n	min	max	25p	50p	75p	90p
pH≤ 5	1319	2	496	9	13	19	27
5 < pH ≤ 6	1070	< 1	22360	12	16	23	31
6 < pH ≤ 7	973	1	310	14	18	24	32
7 < pH	1771	3	1240	16	20	26	35

soil pH/H_2O	Hg ($mg.kg^{-1}$)						
	n	min	max	25p	50p	75p	90p
pH≤ 5	1319	0.01	17.39	0.08	0.13	0.24	0.42
5 < pH ≤ 6	1070	< 0.01	50.33	0.05	0.08	0.13	0.23
6 < pH ≤ 7	973	< 0.01	88	0.04	0.07	0.12	0.2
7 < pH	1771	< 0.01	98	0.04	0.06	0.09	0.15

soil pH/H_2O	Ni ($mg.kg^{-1}$)						
	n	min	max	25p	50p	75p	90p
pH≤ 5	1319	2.5	238	10	16	25	37
5 < pH ≤ 6	1070	2.5	275	16	24	34	46
6 < pH ≤ 7	973	2.5	216	19	26	36	29
7 < pH	1771	2.5	2066	23	29	36	47

soil pH/H_2O	Pb ($mg.kg^{-1}$)						
	n	min	max	25p	50p	75p	90p
pH≤ 5	1319	4	1572	21	29	43	69.6
5 < pH ≤ 6	1070	3	2122	16	20	29	44
6 < pH ≤ 7	973	3	789	16	18	25	38.8
7 < pH	1771	4	1480	14	17	22	36

soil pH/H_2O	Zn ($mg.kg^{-1}$)						
	n	min	max	25p	50p	75p	90p
pH≤ 5	1319	9	1074	43	60	78	97
5 < pH ≤ 6	1070	3	2160	48	62	79	100
6 < pH ≤ 7	973	3	967	49	61	80	103
7 < pH	1771	8	14925	51	62	77	101

Table set 3: Heavy metals contents in Slovakian soils-referred to the soil texture (<2mm)

Cd ($mg.kg^{-1}$)

Soil texture	n	min	25p	50p	75p	90p	max
Coarse	108	<0.1	0.2	0.3	0.5	0.6	1.5
Medium	1284	<0.1	0.2	0.3	0.4	0.7	7.3
Medium fine	2256	<0.1	0.2	0.2	0.4	0.6	8.9
Fine	1177	<0.1	0.2	0.3	0.4	0.6	5.6
Very fine	335	<0.1	0.2	0.3	0.4	0.6	2.8

Cr ($mg.kg^{-1}$)

Soil texture	N	min	25p	50p	75p	90p	max
Coarse	108	11	47.75	69	88	128.5	244
Medium	1284	<5	60	79	101	128.7	665
Medium fine	2256	8	69	86	100	122	6096
Fine	1177	9	73	89	102	125	550
Very fine	335	8	66.5	91	110	127.8	259

Cu ($mg.kg^{-1}$)

Soil texture	n	min	25p	50p	75p	90p	max
Coarse	108	2	7	11	16	25.6	90
Medium	1284	0.5	11	15	21	29	22360
Medium fine	2256	1	13	17	22	29	1240
Fine	1177	4	16	20	26	34	270
Very fine	335	3	15	23	33	39	198

Hg ($mg.kg^{-1}$)

Soil texture	n	min	25p	50p	75p	90p	max
Coarse	108	0.01	0.05	0.1	0.15	0.27	2.41
Medium	1284	<0.01	0.06	0.09	0.15	0.27	98
Medium fine	2256	0.01	0.04	0.07	0.13	0.24	20
Fine	1177	<0.01	0.04	0.07	0.13	0.25	32.8
Very fine	335	0.02	0.06	0.09	0.155	0.27	9.56

Ni ($mg.kg^{-1}$)

Soil texture	n	min	25p	50p	75p	90p	max
Coarse	108	2.5	10	14	22.25	36.5	200
Medium	1284	2.5	14	21	29	39	242
Medium fine	2256	2.5	17	24	31	42	2066
Fine	1177	2.5	21	29	38	48	237
Very fine	335	2.5	17.5	35	47	58.6	125

Pb ($mg.kg^{-1}$)

Soil texture	n	min	25p	50p	75p	90p	max
Coarse	108	4	14	22	39.25	53	94
Medium	1284	3	16	21	33	51.7	1572
Medium fine	2256	3	15	18	28	47	2122
Fine	1177	6	16	19	28	45	636
Very fine	335	6	19	23	32.5	57	266

Zn ($mg.kg^{-1}$)

Soil texture	n	min	25p	50p	75p	90p	max
Coarse	108	7	34.75	50.5	70	90	150
Medium	1284	3	47	59	78	105	2160
Medium fine	2256	3	47	58	74	96	1865
Fine	1177	17	55	67	81	98	14925
Very fine	335	20	58	76	93	108	299

Table set 4: Humus contents (%) in Slovakian agricultural soils

Soil type	Humus (%)							
	n	min	max	mean	25p	50p	75p	90p
Chernozems	1716	0.17	46.90	2.32	1.81	2.17	2.59	3.15
Fluvic Phaozems	1750	0.28	54.82	3.38	2.24	2.91	3.79	4.98
Gleysols	114	0.16	93.58	10.47	3.33	5.05	9.54	27.39
Cambisols	5347	0.14	59.50	2.93	1.90	2.55	3.41	4.71
Orthic Luvisols	1939	0.19	19.72	1.67	1.34	1.59	1.86	2.17
Albic Luvisols	1152	0.16	18.12	1.86	1.45	1.71	2.07	2.52
Fluvisols	2625	0.02	44.48	2.72	1.79	2.40	3.17	4.19
Pararendzinas	319	0.19	4.91	1.72	1.20	1.60	2.08	2.64
Podzols	80	1.86	35.34	12.47	8.07	11.64	14.71	19.93
Planosols	179	0.38	14.12	2.79	1.83	2.34	3.29	4.39
Rankers	33	0.62	12.21	5.07	2.38	3.69	7.59	9.21
Histosols	28	4.14	99.65	36.22	20.84	30.68	40.53	79.83
Regosols	296	0.05	9.26	1.21	0.69	1.05	1.48	1.97
Rendzinas	740	0.34	69.36	3.78	2.31	3.21	4.41	6.11
Solonetz	28	0.48	5.97	2.01	1.24	1.81	2.31	3.07

Romania

Documentation Sheet – ROMANIA

Heavy Metal (Trace Elements) and Organic Carbon Contents in European Soils
Details of the person who filled in the documentation sheet: Institute/Country: **Research Institute for Soil Science & Agrochemistry (RISSA) – ROMANIA** Name: **Alexandrina Manea** Position in the Institute: **Scientific researcher** Address: **RISSA, Bd. Mărăşti 61, Bucharest 71331** Phone: **+40-21-2241790 Fax: 40-21-2225979 e-mail: munteanu@icpa.ro**

Description of the data set			
Geographical locations (co-ordinates)	Geographical locations deliverable: Yes Accuracy: ± 400 m Co-ordinate system used : Geographical (sent by ICP –Forest Hamburg)		
Sampling strategy	Kind of sampling Grid: x grid distance: 16x16km Other please specify: punctual (profile)	Soil horizon x Depth increment x Single core x	please specify: A (top horizon) please specify: 5-10 cm forest soils 20-25 cm others
Soil parameter	<u>Soil pH</u> Analytical result: x pH (H_2O) x	<u>Soil e particle size class</u> Analytical results x	Soil organic matter Analytical results x analytical method: wet oxidation - Walkley-Black method
Digestion method (s) for determination of trace elements	Other (please specify): x	Acid mixture digestion (nitric acid, perchloric acid, sulphuric acid 2:1:0.2) and atomic absorption–spectrometric determination	
Detection limits	Please give information of the detection limits in (mg/kg dry mass); as: Cd: 0.1 Cr:0.5 Cu: 0.5 Mo 0.5 Ni: 0.5 Pb:0.5 Se: 0.5 Zn: 0.5		
Harmonisation of the data sets	Do the data sets include samples from contaminated sites ? Yes, but only one site originates from contaminated areas, but the values of heavy metals content are below the maximum allowed limit		

Any other comments: No.

Table set 1
Contents of trace elements related to soil parent material and land use
- Romania -

Mat 11 unit	parent material	Cd [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**113**	0.0	0.5	1.0	1.0	1.5	2.3
	grassland	**47**	0.0	0.5	0.9	1.0	1.5	5.0
	forest	**24**	0.4	0.8	1.0	1.4	1.7	1.9
	other land use	**10**	0.0	0.5	1.0	1.0	2.0	2.0
2	**calcareous rocks**							
land use	arable land	**19**	0.5	1.0	1.5	1.5	2.0	2.0
	grassland	**13**	0.5	1.0	1.4	1.5	2.0	2.0
	forest	**9**	0.5	0.9	1.4	1.5	2.1	2.7
	other land use	**3**	0.8					1.5
3	**clayey materials**							
land use	arable land	**30**	0.0	0.5	0.5	1.0	1.5	1.5
	grassland	**13**	0.5	0.5	1.0	1.0	1.9	2.0
	forest	**8**	0.5	0.9	1.2	1.3	1.6	1.9
	other land use	**2**						1.0
4	**sandy materials**							
land use	arable land	**3**	0.0					1.0
	grassland	**3**	0.0					1.0
	forest	**2**	0.4					0.5
	other land use	**1**	0.5					
5	**loamy materials**							
land use	arable land	**203**	0.0	0.5	0.5	1.0	1.5	2.5
	grassland	**15**	0.3	0.5	1.0	1.2	1.8	2.0
	forest	**15**	0.6	1.0	1.1	1.4	1.5	1.9
	other land use	**11**	0.0	0.5	0.5	1.0	1.0	1.0
6	**detrital formations**							
land use	arable land	**2**	0.5					1.0
	grassland	**10**	0.5	0.6	1.0	1.0	1.5	1.5
	forest	**30**	0.3	1.0	1.5	2.0	2.1	2.9
	other land use	**0**						
7	**crystalline rocks and migmatites**							
land use	arable land	**3**	1.0					1.5
	grassland	**22**	0.0	1.0	1.0	1.0	1.5	1.6
	forest	**79**	0.1	1.0	1.2	1.6	2.0	3.0
	other land use	**0**						
8	**volcanic rocks**							
land use	arable land	**0**						
	grassland	**10**	0.5	1.5	1.8	2.0	2.0	2.0
	forest	**12**	0.7	0.9	1.1	1.6	1.8	2.0
	other land use	**0**						
9	**other rocks**							
land use	arable land	**63**	0.0	0.5	1.0	1.5	2.0	2.0
	grassland	**66**	0.0	0.6	1.0	1.5	1.5	3.0
	forest	**85**	0.3	0.8	1.0	1.5	1.8	2.5
	other land use	**7**	0.8	1.0	1.0	1.5	1.7	2.0

Table set 1
Contents of trace elements related to soil parent material and land use
- Romania -

Mat 11 unit	parent material	Cr [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**113**	10	40	50	65	83	165
	grassland	**47**	14	37	45	60	69	120
	forest	**24**	9	53	70	125	158	165
	other land use	**10**	30	40	50	65	81	103
2	**calcareous rocks**							
land use	arable land	**19**	26	42	50	55	60	97
	grassland	**13**	10	25	50	60	76	430
	forest	**9**	55	96	125	142	165	190
	other land use	**3**	37					96
3	**clayey materials**							
land use	arable land	**30**	26	35	48	54	56	193
	grassland	**13**	15	30	44	55	60	92
	forest	**8**	45	68	111	137	164	170
	other land use	**2**	30					60
4	**sandy materials**							
land use	arable land	**3**	45					85
	grassland	**3**	50					45
	forest	**2**	20					40
	other land use	**1**	30					
5	**loamy materials**							
land use	arable land	**203**	25	45	50	65	75	119
	grassland	**15**	30	46	45	70	106	154
	forest	**15**	28	38	102	114	129	140
	other land use	**11**	15	45	50	65	75	70
6	**detrital formations**							
land use	arable land	**2**	30					40
	grassland	**10**	15	26	38	40	43	65
	forest	**30**	30	71	110	131	144	213
	other land use	**0**						
7	**crystalline rocks and migmatites**							
land use	arable land	**3**	30					41
	grassland	**22**	15	25	36	42	56	148
	forest	**79**	30	40	82	126	149	246
	other land use	**0**						
8	**volcanic rocks**							
land use	arable land	**0**						
	grassland	**10**	15	16	25	59	93	116
	forest	**12**	11	72	85	96	113	145
	other land use	**0**						
9	**other rocks**							
land use	arable land	**63**	15	35	46	60	75	98
	grassland	**66**	15	35	50	45	85	150
	forest	**85**	9	41	70	114	131	186
	other land use	**7**	45	50	60	73	84	98

Table set 1
Contents of trace elements related to soil parent material and land use
- Romania -

Mat 11 unit	parent material	Cu [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**113**	8	17	20	28	35	115
	grassland	**47**	5	15	20	25	37	68
	forest	**24**	7	14	20	30	42	49
	other land use	**10**	15	17	20	28	36	42
2	**calcareous rocks**							
land use	arable land	**19**	10	20	25	25	30	30
	grassland	**13**	15	20	25	30	40	50
	forest	**9**	15	17	22	25	33	54
	other land use	**3**	15					27
3	**clayey materials**							
land use	arable land	**30**	10	15	20	27	31	110
	grassland	**13**	7	10	20	33	35	35
	forest	**8**	9	15	20	27	48	84
	other land use	**2**	20					25
4	**sandy materials**							
land use	arable land	**3**	10					20
	grassland	**3**	5					10
	forest	**2**	5					8
	other land use	**1**	10					
5	**loamy materials**							
land use	arable land	**203**	10	15	20	25	34	220
	grassland	**15**	15	18	21	26	29	35
	forest	**15**	7	15	22	25	32	38
	other land use	**11**	15	15	20	25	36	125
6	**detrital formations**							
land use	arable land	**2**	20					22
	grassland	**10**	5	13	25	34	36	40
	forest	**30**	4	18	23	35	41	100
	other land use	**0**						
7	**crystalline rocks and migmatites**							
land use	arable land	**3**	13	14	15	19	21	22
	grassland	**22**	10	10	15	28	35	75
	forest	**79**	5	14	19	25	42	80
	other land use	**0**						
8	**volcanic rocks**							
land use	arable land	**0**						
	grassland	**10**	13	16	20	25	25	25
	forest	**12**	8	17	20	24	28	43
	other land use	**0**						
9	**other rocks**							
land use	arable land	**63**	10	15	20	25	30	55
	grassland	**66**	5	15	20	30	35	80
	forest	**85**	5	12	17	22	29	114
	other land use	**7**	12	28	30	40	49	55

Table set 1
Contents of trace elements related to soil parent material and land use
- Romania -

Mat 11 unit	parent material	Ni [mg/kg] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**113**	7	25	35	45	60	85
	grassland	**47**	11	23	30	38	52	75
	forest	**24**	13	23	34	53	60	70
	other land use	**10**	21	30	40	45	60	55
2	**calcareous rocks**							
land use	arable land	**19**	12	30	35	45	46	65
	grassland	**13**	13	30	44	45	59	75
	forest	**9**	22	29	35	40	62	66
	other land use	**3**	13					45
3	**clayey materials**							
land use	arable land	**30**	11	25	30	35	40	45
	grassland	**13**	7	20	30	31	40	65
	forest	**8**	21	24	34	47	52	54
	other land use	**2**	30					45
4	**sandy materials**							
land use	arable land	**3**	15					30
	grassland	**3**	5					25
	forest	**2**	15					32
	other land use	**1**	20					
5	**loamy materials**							
land use	arable land	**203**	10	30	35	40	40	80
	grassland	**15**	20	26	30	43	51	60
	forest	**15**	11	15	31	35	43	59
	other land use	**11**	15	30	35	40	45	45
6	**detrital formations**							
land use	arable land	**2**	20					30
	grassland	**10**	15	15	25	30	40	85
	forest	**30**	10	28	38	60	93	101
	other land use	**0**						
7	**crystalline rocks and migmatites**							
land use	arable land	**3**	19					35
	grassland	**22**	10	20	25	33	40	45
	forest	**79**	1	15	25	35	56	192
	other land use	**0**						
8	**volcanic rocks**							
land use	arable land	**0**						
	grassland	**10**	20	21	25	27	36	40
	forest	**12**	10	15	17	22	25	37
	other land use	**0**						
9	**other rocks**							
land use	arable land	**63**	15	25	30	40	50	70
	grassland	**66**	10	21	35	50	56	105
	forest	**85**	3	19	24	35	44	80
	other land use	**7**	25	34	40	45	54	60

Table set 1
Contents of trace elements related to soil parent material and land use
- Romania -

Mat 11 unit	parent material	Pb [mg/kg]						
		n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**112**	7	25	30	35	44	54
	grassland	**47**	6	20	26	35	42	170
	forest	**24**	6	23	34	47	61	87
	other land use	**10**	10	21	30	36	44	40
2	**calcareous rocks**							
land use	arable land	**19**	16	20	25	30	40	45
	grassland	**13**	17	25	30	34	55	65
	forest	**9**	14	18	24	40	87	98
	other land use	**3**	26					35
3	**clayey materials**							
land use	arable land	**30**	11	21	28	35	38	50
	grassland	**13**	9	20	30	35	40	40
	forest	**8**	25	29	42	51	64	54
	other land use	**2**	15					45
4	**sandy materials**							
land use	arable land	**3**	15					25
	grassland	**3**	10					15
	forest	**2**	22					22
	other land use	**1**	35					
5	**loamy materials**							
land use	arable land	**203**	10	20	25	30	35	59
	grassland	**15**	13	20	31	35	43	45
	forest	**15**	15	26	30	48	55	102
	other land use	**11**	10	20	25	30	35	45
6	**detrital formations**							
land use	arable land	**2**	30					35
	grassland	**10**	15	31	35	40	50	50
	forest	**30**	15	31	51	71	84	111
	other land use	**0**						
7	**crystalline rocks and migmatites**							
land use	arable land	**3**	7					75
	grassland	**22**	20	30	32	39	41	67
	forest	**79**	13	30	42	60	73	145
	other land use	**0**						
8	**volcanic rocks**							
land use	arable land	**0**						
	grassland	**10**	25	30	35	39	42	64
	forest	**12**	16	51	52	68	81	84
	other land use	**0**						
9	**other rocks**							
land use	arable land	**63**	11	24	30	36	42	92
	grassland	**65**	10	25	30	35	44	50
	forest	**85**	1	29	35	48	61	102
	other land use	**7**	25	33	39	40	42	45

Table set 1
Contents of trace elements related to soil parent material and land use
- Romania -

Mat 11 unit	parent material	Zn [mg/kg] n	min	25, P,	50, P,	75, P,	90, P,	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**113**	23	50	70	93	204	500
	grassland	**47**	30	50	63	111	206	360
	forest	**24**	23	41	85	131	165	181
	other land use	**10**	45	50	70	95	208	385
2	**calcareous rocks**							
land use	arable land	**19**	39	50	61	90	235	50
	grassland	**13**	38	50	82	120	207	270
	forest	**9**	40	64	92	133	144	161
	other land use	**3**	48					69
3	**clayey materials**							
land use	arable land	**30**	30	50	70	117	271	340
	grassland	**13**	30	35	63	75	109	200
	forest	**8**	31	37	46	55	79	135
	other land use	**2**	60					180
4	**sandy materials**							
land use	arable land	**3**	32					235
	grassland	**3**	10					115
	forest	**2**	34					74
	other land use	**1**	45					
5	**loamy materials**							
land use	arable land	**203**	34	45	55	77	145	465
	grassland	**15**	38	52	64	91	122	200
	forest	**15**	25	49	58	75	93	405
	other land use	**11**	66	46	60	89	170	250
6	**detrital formations**							
land use	arable land	**2**	40					300
	grassland	**10**	35	51	98	158	198	265
	forest	**30**	20	53	87	122	173	270
	other land use							
7	**crystalline rocks and migmatites**							
land use	arable land	**3**	45					73
	grassland	**22**	33	48	51	78	239	475
	forest	**79**	15	51	69	106	156	540
	other land use							
8	**volcanic rocks**							
land use	arable land	**0**						
	grassland	**10**	55	70	88	296	331	340
	forest	**12**	49	59	68	95	149	189
	other land use	**0**						
9	**other rocks**							
land use	arable land	**63**	30	50	60	85	181	320
	grassland	**66**	20	50	68	97	213	360
	forest	**85**	23	44	60	74	95	205
	other land use	**7**	53	57	66	160	331	460

Table set 1
Contents of trace elements related to soil parent material and land use
- Romania -

Mat 11 unit	parent material	org. C [%] n	min	25. P.	50. P.	75. P.	90. P.	max
1	**undifferentiated alluvial deposits (or glacial deposits)**							
land use	arable land	**113**	0.17	0.93	1.28	1.62	2.23	7.8
	grassland	**47**	0.17	0.82	1.17	1.61	2.35	3.6
	forest	**27**	0.46	0.84	1.16	2.03	2.75	5.3
	other land use	**10**	0.60	0.82	1.06	1.47	2.28	2.4
2	**calcareous rocks**							
land use	arable land	**20**	0.84	1.23	1.57	2.05	2.40	2.9
	grassland	**13**	0.41	1.41	2.15	3.42	4.83	12.6
	forest	**9**	0.46	1.33	2.90	9.51	10.99	11.5
	other land use	**3**	0.87					1.0
3	**clayey materials**							
land use	arable land	**30**	0.50	1.11	1.39	1.58	2.50	18.0
	grassland	**13**	0.58	0.81	1.51	2.44	2.97	3.7
	forest	**8**	0.87	1.06	1.54	2.04	2.21	2.5
	other land use	**2**	0.76					1.6
4	**sandy materials**							
land use	arable land	**3**	0.12					0.6
	grassland	**3**	0.17					0.5
	forest	**2**	0.23					0.2
	other land use	**1**	1.05					
5	**loamy materials**							
land use	arable land	**202**	0.00	1.22	1.45	1.80	2.12	3.5
	grassland	**15**	0.49	0.93	1.22	1.60	1.93	2.4
	forest	**18**	0.70	1.17	2.00	2.99	3.66	5.3
	other land use	**11**	0.74	1.22	1.50	1.53	1.73	1.8
6	**detrital formations**							
land use	arable land	**2**	1.80					1.9
	grassland	**10**	0.59	1.32	1.83	2.86	4.07	5.2
	forest	**31**	0.46	1.48	2.32	3.16	7.02	21.3
	other land use	**0**						
7	**crystalline rocks and migmatites**							
land use	arable land	**3**	1.27					8.2
	grassland	**22**	0.86	2.10	2.42	3.10	3.62	6.9
	forest	**79**	0.41	2.06	4.12	6.33	9.88	26.6
	other land use	**0**						
8	**volcanic rocks**							
land use	arable land	**0**						
	grassland	**10**	1.39	1.58	2.29	5.96	7.17	14.3
	forest	**12**	1.86	2.52	4.06	5.76	5.97	6.4
	other land use	**0**						
9	**other rocks**							
land use	arable land	**63**	0.32	0.77	1.22	1.57	2.42	4.1
	grassland	**66**	0.29	1.04	1.38	1.86	2.35	3.9
	forest	**85**	0.29	0.87	1.16	1.65	2.96	7.1
	other land use	**7**	0.29	0.25	1.10	1.52	1.86	1.9

Table set 2
Contents of trace elements related to soil pH
- Romania -

soil pH	Cd [mg/kg]						
	n	min	25. P.	50. P.	75. P.	90. P.	max
<5	209	0.0	0.9	1.0	1.5	1.9	3.0
>5-6	276	0.0	0.5	1.0	1.5	1.6	2.9
>6-7	180	0.0	0.5	1.0	1.3	1.5	5.0
>7	269	0.0	0.5	1.0	1.0	1.5	2.5

soil pH	Cr (mg/kg)						
	n	min	25.P	50.P	75.P	90.P	max
<5	209	5	35	61	107	134	246
>5-6	276	5	35	45	65	119	430
>6-7	180	15	40	50	55	92	176
>7	269	9	45	55	70	96	231

soil pH	Cu (mg/kg)						
	n	min	25.P	50.P	75.P	90.P	max
<5	209	4	12	16	22	33	100
>5-6	276	5	15	20	25	35	220
>6-7	180	8	18	20	25	35	125
>7	269	5	15	24	30	40	88

soil pH	Hg (mg/kg) – no data						
	n	min	25.P	50.P	75.P	90.P	max
<5							
>5-6							
>6-7							
>7							

soil pH	Ni (mg/kg)						
	n	min	25.P	50.P	75.P	90.P	max
<5	209	1	16	23	30	45	192
>5-6	276	5	20	30	35	48	105
>6-7	180	10	27	35	40	47	95
>7	269	4	30	35	45	58	85

soil pH	Pb (mg/kg)						
	n	min	25.P	50.P	75.P	90.P	max
<5	209	1	27	40	53	70	145
>5-6	275	7	25	30	37	50	111
>6-7	180	8	20	30	35	40	102
>7	269	6	20	25	35	41	170

soil pH	Zn (mg/kg)						
	n	min	25.P	50.P	75.P	90.P	max
<5	209	15	45	58	90	157	540
>5-6	276	20	48	64	94	185	500
>6-7	180	31	50	65	100	201	500
>7	269	10	50	65	105	180	348

Table set 3
Contents of trace elements related to soil texture classes
- Romania -

texture classes (< 2 mm)			Cd [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**0**						
1	Coarse	18% ≤ clay and ≥ 65% sand	**85**	0.0	0.5	1.0	1.2	1.8	2.7
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**319**	0.0	0.5	1.0	1.4	1.7	5.0
3	Medium fine	< 35% clay and < 15% sand	**310**	0.0	0.5	1.0	1.0	1.5	2.2
4	Fine	35% ≤ clay < 60%	**213**	0.0	0.8	1.0	1.5	2.0	3.0
5	Very fine	≥ 60% clay	**7**	0.5	0.7	1.0	1.8	2.0	2.0

texture classes (< 2 mm)			Cr [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**0**						
1	Coarse	18% ≤ clay and ≥ 65% sand	**85**	5	30	46	81	129	202
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**319**	80	35	50	85	124	430
3	Medium fine	< 35% clay and < 15% sand	**310**	10	42	50	70	103	183
4	Fine	35% ≤ clay < 60%	**213**	10	45	55	65	119	193
5	Very fine	≥ 60% clay	**7**	55	55	60	64	71	80

texture classes (< 2 mm)			Cu [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**0**						
1	Coarse	18% ≤ clay and ≥ 65% sand	**85**	4	10	15	25	50	100
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**319**	5	15	20	25	35	220
3	Medium fine	< 35% clay and < 15% sand	**310**	5	15	20	25	30	105
4	Fine	35% ≤ clay < 60%	**213**	7	45	55	65	119	115
5	Very fine	≥ 60% clay	**7**	20	55	60	64	71	50

texture classes (< 2 mm)			Hg [mg/kg] - no data-						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils							
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	≥ 60% clay							

texture classes (< 2 mm)			Ni [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**0**						
1	Coarse	18% ≤ clay and ≥ 65% sand	**85**	1	15	25	33	49	85
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**319**	2	20	27	35	45	192
3	Medium fine	< 35% clay and < 15% sand	**310**	7	25	30	36	45	101
4	Fine	35% ≤ clay < 60%	**213**	11	30	40	50	60	105
5	Very fine	≥ 60% clay	**7**	40	43	55	60	60	60

texture classes (< 2 mm)			Pb [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**0**						
1	Coarse	18% ≤ clay and ≥ 65% sand	**85**	2	20	30	40	61	91
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**319**	1	25	31	42	63	170
3	Medium fine	< 35% clay and < 15% sand	**310**	6	25	30	36	45	102
4	Fine	35% ≤ clay < 60%	**213**	7	25	30	36	45	102
5	Very fine	≥ 60% clay	**7**	2	28	35	37	39	40

texture classes (< 2 mm)			Zn [mg/kg]						
Class	Description		n	min	25. P.	50. P.	75. P.	90. P.	max
0	No texture	peat soils	**0**						
1	Coarse	18% ≤ clay and ≥ 65% sand	**85**	50	45	68	106	155	230
2	Medium	18% ≤ clay < 35% and 15% sand, or 18% ≤ clay and 15% ≤ sand < 65%	**319**	15	48	62	97	190	540
3	Medium fine	< 35% clay and < 15% sand	**310**	30	45	58	78	144	500
4	Fine	35% ≤ clay < 60%	**213**	23	55	75	117	228	500
5	Very fine	≥ 60% clay	**7**	50	70	85	118	164	230

European Commission

EUR 22265 EN – DG Joint Research Centre, Institute for the Environment and Sustainability
Luxembourg: Office for Official Publications of the European Communities
2006 – 275 pp. – 21.0 x 29.7 cm
Scientific and Technical Research series
ISBN 92-79-02121-4
ISSN 1018-5593

Abstract

The report is intended as an input for discussion concerning the necessity to regulate organic micro-pollutants in the revision of the European Sludge Directive 86/278/EEC.
In part 2 of this report it was attempted to compile a Europe-wide evaluation of heavy metal and organic matter contents of European top soils. The evaluation programme was accomplished thereby in several steps. In summary, it can be concluded that some progress towards a Europe-wide data harmonisation was achieved, which allows some conclusions for the aforementioned legislative purpose. Problems to be solved include particularly standardisation aspects.

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

LB-NB-22265-EN-C

ISBN 92-79-02121-4

Publications Office
Publications.eu.int