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Soil Organic Matter Map of the European Communities 1 : 8 000 000

Explanatory Bulletin

D. Fraters and A.F. Bouwman

January 1993

Research carried out in the framework of the RIVM/RIZA contribution to the seminar on groundwater for EC ministers, hold 26-27 november 1991 in The Hague, the Netherlands. This work has been commissioned by the Dutch Ministry of Housing, Physical Planning and Environmental Protection (VROM), also on behalf of the Dutch Ministry of Public works and Transport and Water Management and the European Commission Directorate-General XI.

Errata

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Appendix I

Due to plotter problems we have not been able to make enough copies of the map on a scale of 1 : 8 000 000. Therefore we have enclosed a map - on A3 format - which has a somewhat smaller scale (about 1 : 11 000 000).

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PREFACE

At present several projects are ongoing at the Dutch National Institute of Public Health and Environmental Protection, some in cooperation with international institutes, for which derived maps are needed from available soil maps. Existing derived maps from the soil map of the European Communities are scarce and hard to find. Organic matter is an important soil characteristic which influences physical characteristics as bulk density, structure, and available moisture and chemical characteristics as nutrient availability and retardation of pollutants. As far as we know, no documented organic matter map for the EC exists and this is a first attempt to provide one. We are aware of the imperfection of the current map, but we hope that it will encourage others to support us to improve this map.
We like to thank Ir. A.M.A van der Linden and Ir. R. van den Berg for their comments on earlier drafts and Ir. T.J.M. Thewessen for preparing the enclosed organic matter map.

SUMMARY

This research was carried out in the framework of the RIVM contribution to the Seminar on Groundwater for EC ministers, hold 26-27 November 1991 in The Hague, the Netherlands. One of the threats to groundwater is leaching of pesticides. One of the major factors determining the migration of most pesticides in soil is the organic matter content of the soil. Using classification criteria, data on organic matter content in described European and American soil profiles, and common knowledge from textbooks, for each soil unit and subunit occurring on the EC Soil Map (CORINE, 1985) the organic matter content of the top soil (upper 30 cm) has been estimated. The assumptions, used to estimate the organic matter content for soil units and subunits and the data and references on which these assumptions are based are provided. The results are presented as the Soil Organic Matter Map of the EC on a scale of 1 : 8 000 000. In addition recommendations for future improvements are discussed.

SAMENVATTING

Dit onderzoek is uitgevoerd in het kader van de RIVM bijdrage aan het EG ministersseminar betreffende de grondwaterproblematiek, dat heeft plaatsgevonden op 26 en 27 november te Den Haag. Een van de bedreigingen van het grondwater is het uitspoelen van bestrijdingsmiddelen. De mate waarin bestrijdingsmiddelen uitspoelen uit de bodem is onder andere afhankelijk van het organische-stofgehalte van de bodem. Gebruik makend van de classificatiecriteria, de organische-stofgegevens van Europese en Amerikaanse bodemprofielen en algemeen bodemkundige kennis is voor elke bodemeenheid en subeenheid van de Europese Bodemkaart (CORINE, 1985) het organische-stofgehalte voor de bovenste 30 cm van de bodem geschat. De aannamen, welke gebruikt zijn om de organische-stofgehalten te schatten, en de gegevens en referenties waarop deze aannamen gebaseerd zijn, zijn opgenomen in de tekst. Tevens zijn enkele aanbevelingen gedaan voor toekomstige ontwikkeling van de Europese Organische-Stofkaart. Als bijlage is de Organische-Stofkaart, schaal 1 : 8 000 000 ingesloten.

1. Introduction

In June 1991 the Dutch Ministry of Housing, Physical Planning and Environmental Protection (VROM) invited - also on behalf of the Dutch Ministry of Public Works and Transport and Water Management and the European Commission Directorate-General XI - the Dutch National Institute for Public Health and Environmental Protection (RIVM) and the Institute for Inland Water Management and Waste Water Treatment (RIZA) to prepare a report on the actual threats to the groundwater systems in the European Communities (EC). The report should form a contribution to the seminar on groundwater for the EC ministers, to be held 26-27 November 1991 in The Hague, the Netherlands.

In order to estimate the threat to groundwater by pesticides a map of organic matter contents of soils in the EC was needed. Organic matter content is one of the major soil characteristics influencing the migration of pesticides in the soil. Since an organic matter map on European scale was not available or traceable within the time frame of the project, such a map had to be compiled. Basis of the assessment is the digitized Soil Map of the European Communities of CORINE and literature cited below. Organic matter contents for the upper 30 cm of the soil units and soil subunits occurring as dominant soil have been estimated. The limitations of this point of departure are discussed under future developments (chapter 3). Where relevant, estimates refer to arable land, which has usually a lower organic matter content than grassland and is more prone to leaching of solutes. It is stressed that - although an absolute value for the organic matter content of each soil (sub)unit is given - this value should be regarded as a tool to rank different soils on the basis of their organic matter content. Most of the estimated organic matter contents represent an average value for the soil (sub)unit considered. Ranges of occurring organic matter contents for different soil (sub)units often overlap.

Soil classification in the European Communities comprises three levels [6][1]. The highest level is formed by Major Soil Groups (MSGs). In fact MSGs are groups of Soil Units with a similar soil formation, e.g. Fluvisols: soils influenced by floodplain regime; Gleysols: soils dominated by hydromorphic soil-forming processes. The second level, the soil units, is based on soil formation, characteristics and distribution of the soils covering the earth's surface, e.g. Calcaric Fluvisol: Fluvisols that are calcareous, at least between 20 and 50 cm from the surface, Dystric Fluvisols: Fluvisols with a base saturation < 50 %, at least in some part of the soil between 20 and 50 cm from the surface. Some of the soil units are further subdivided into soil subunits on characteristics and distribution of the soils in the EC, e.g. Fluvi-Calcaric Fluvisols: Calcaric Fluvisols developed from river deposits, Gleyo-Calcaric Fluvisols: Calcaric Fluvisols showing hydromorphic properties within 50 cm of the surface.
The soil map of the European Communities shows map units and not soil units or soil subunits. The legend of the EC soil map comprises 312 different map units which consist of associations of soil units occúrring within the limits of a mappable physiographic entity. Each association is composed of a dominant soil and associated soils, the latter covering at

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[1] The number between [] refers to the reference used, in some cases a page number is provided as well, e.g. [8,p108] denotes reference 8 page 108.

least 10% of the area but less than 50%. Important soils which cover less than 10% of the area are added as inclusions.
A map unit is named after its dominant soil. Associations with the same dominant soil but differing in composition (associated soils and inclusions) have the same name but they have a different map code. E.g. a total of 111 associations of the Cambisols are differentiated. The associations of this MSG are numbered from 1 to 111. The Dystric Cambisol soil unit is the dominant soil in 31 associations (numbers 41 to 71). The numbers 66 to 71 are associations with as dominant soil the soil subunit Stagno-Dystric Cambisol, while the associations 41 to 65 have as dominant soil the other, not further specified, Dystric Cambisols.

In the next chapter estimations of organic matter contents are dealt with per MSG. The order in which the MSGs are presented is alphabetic. For each MSG a short description of the soil units and soil subunits occurring on the EC soil map is given[2]. The organic matter content of each soil unit and soil subunit occurring as dominant soil on the EC soil map is given, as well as the available data and information on which the estimations have been based.

The general rule to estimate the organic matter content of a soil (sub)unit is as follows: (1) The information included in the soil (sub)unit name has been used as a starting point. Estimations based on the soil name were also based on literature data, both profile data and reported general ranges. (2) Where the soil name does not give information on organic matter content, only literature data were used. (3) General knowledge about relationships between organic matter content and soil characteristics (e.g. wetness, clay content) and climatic conditions (temperature, precipitation) have been incorporated in the estimation. (4) In estimating the organic matter content of the upper 30 cm of the soil profile, the distribution of the organic matter in the profile has been considered as is discussed in chapter 3. (5) Knowledge about associated soils and inclusions occurring in the associations with the same dominant soil unit has been used to modify estimations. (6) Consistency of estimations of organic matter content for different soil units has been checked.

As stated above first information included in the soil name has been used. On MSG level organic soils have been differentiated from mineral soils.
Organic soils have a H-horizon of more than 40 cm thick within 80 cm of the soil surface. The H-horizon consists of organic material. Organic material contains more than 30 % organic matter if the mineral fraction contains more than 60 % clay, and more than 20 % organic matter if the mineral fraction contains no clay. For all organic soils an organic matter content of 30 % has been used (see §2.9 for argumentation).
For mineral soils for some soil units the presence of a certain type of upper horizon is mandatory or excluded. One type of H-horizon, a histic H, and three types of A-horizon, mollic, umbric and ochric, are described [3]. A histic H-horizon is more than 20 cm thick, but less than 40 cm and consists of organic material. Soils with an ochric A horizon have less than 1% organic matter, or 4% if finely divided lime is present. Exceptions to this

2 Not always the full description or definition of soil scientific terms used below is given, only most important characteristics are noted. For complete description see [3] and [6].

general rule exist. A surface horizon may be too light in colour, has too high a chroma[3], or is too thin to classify as mollic or umbric, or is both hard and massive when dry.
For all mineral soil units for which the type of A-horizon is given by the classification the following rules were applied. Mollic and umbric horizons were assigned an organic matter content of 4% in the upper 30 cm, and ochric horizons 1%.

These initial assumptions have been compared with available data in the second phase. An example of the correction of the initial assumption is discussed in §2.3. The A-horizon of the Andosols occurring in the EC is ochric, pointing at an organic matter content of 1 %. The 25 cm thick A-horizon of a described Ochric Andosol profile (To; [9; p186]) contains 14 % organic matter. This A-horizon has more than 1% organic matter, but does not classify as mollic because it has a colour value of 4. This is too light to classify as mollic (maximum allowed is 3.5; see footnote 3, page 2). The data used for testing the assumptions come from European [1,6,7,9] and American [2] sources, which give detailed descriptions of soil profiles. In Appendix IV the American data file derived from Soil Taxonomy [2] is presented. General textbooks soils science [4,5,8] have been used to find ranges of organic matter contents for different soil units.

Incorporation of knowledge about the relationship between organic matter content and climate has been used to improve estimates of organic matter content of for example Cambisols units (see §2.5). Knowledge about the relationship between wetness and organic matter content and about associated soils and inclusions has been used to estimate the organic matter content of for example the Placic Podzol (§2.15).

In appendix II the data file containing all estimations of organic matter contents is given. For each soil unit and subunit the abbreviation, full name and estimated organic matter content are given. The data file contains only those soil (sub)units occurring on the list in the manual accompanying the database. The order of the soil (sub)units as presented in the appendix is the same order as in the CORINE database manual. The incorporation of data file in the CORINE database has been done with the help of the ARC-INFO package. Appendix III contains a listing of the other files used to create the soil organic matter map.

At least two rather large areas on the digital EC Soil Map exist for which there is no information in the database provided by CORINE. For the larger one, occurring in France (South West of Rennes, ca. 2° W and 48° N), we have used the published EC Soil Map [6] to classify it. According to [6] soils in that area belong to association 5 of the Eutric Cambisols and have a lithic phase. For the smaller area occurring in the North-Eastern part of Scotland the position is not known exactly enough to classify it on basis of the published map [6].

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3 chroma (sometimes called saturation) is the relative purity or strength of the spectral colour and increases with decreasing greyness. Value refers to the relative lightness of colour [2;p464], a low value indicating dark colours and a high value indicating light colours.

2. Description of the Major Soil Groups

2.1 General

In this chapter the Major Soil Groups occurring in the CORINE database are discussed. For each Major Soil Group a description of the soil units and subunits is given as well as the estimated organic matter content of the upper 30 cm of the soil when used as agricultural land. The classification of soil units is based on the FAO-Unesco legend of 1974 [3], that of the soil subunits on the legend of the EC Soil Map of 1985 [6]. The revised legend of the FAO-Unesco of 1988 [10] could not be used since a number of significant changes have been made after compilation of the map.

As stated in chapter 1, the estimates refer to arable land. Arable land usually has a lower organic matter content than grassland and is is more prone to leaching of solutes. Estimates are presented as integers. They represent an average value for common ranges of the organic matter content. Eight possible values for the estimated organic matter content of the 82 soil (sub)units and 2 combined legend units are: 1, 2, 3, 4, 5, 7, 10, and 30.

Histic epipedons are included but litter layers are excluded in calculating the organic matter content of described profiles [1,2,6 and 9], because organic matter of the surface litter is assumed to degrade soon after forest clearing and conversion to agricultural land. Histic horizons are assumed to be related to excess wetness due to their physiographic position (groundwater) or soil characteristics (perched water table), rather than to vegetation type. Cultivation of these soils is assumed not to change organic matter contents drastically. When organic carbon content is given organic matter content is calculated using a factor 1.72 (an organic carbon content of the organic matter of 58%). This is the figure used in the Dutch evaluation studies on environmental impact of pesticides.

The data file had to be delivered in the first week of September, so only one month was available. During the preparations of this bulletin new information became available and other information was reinterpreted. If relevant, improvements are proposed at the end of the paragraph under *remarks*.

The following abbreviations are used in the text below:

MSG for Major Soil Group
o.m. for organic matter.
U.S.(A.) for United States of America

2.2 Acrisols (A)

DESCRIPTION OF THE SOIL UNITS

This MSG is the acid counterpart of the Luvisols group (see §2.11) and Acrisols are characterised by a base saturation of less than 50% in at least some part of the illuvial B horizon. These soils only occur as associated soils or inclusions on the EC soil map. An

estimation is given, because the Ferric Acrisol (Af) soil unit occurs on the listing provided by CORINE. Other Acrisol units are Gleyic (Ag, hydromorphic properties within 50 cm of the surface), Humic (Ah, an umbric A or high o.m. content in B), Orthic (Ao, having non of the features of other Acrisols) and Plinthic (Ap, plinthite within 125 cm).
The Af unit has an ochric A-horizon [3].

code	Soil Unit	Main Criterion	Estimated o.m. %
Af	Ferric Acrisols	showing ferric properties, like Ferralsols	1

AVAILABLE DATA

Profile descriptions of European Acrisols are not available. Data from the U.S.A. on o.m. contents in Acrisols vary from 0.6 to 8.4% (average 3.2%); Af: 1.0%, Ag: 1.2, 2.7 and 6.0%, Ah: 8.4%, Ao: 0.6, 2.0, 2.5, 2.7, and 3.3%, Ap: 5.0% [2]. The Acrisols are described as poor soils [4], though they may have as much as 10% o.m. in the Ah horizon [8].

ACCOUNT OF ESTIMATION

The Af unit is regarded as an acid Luvisol with properties of the Ferralsols The latter are estimated to have 1% o.m. (see §2.6), the former between 1 and 3% (see §2.11). Because there is no indication that an ochric horizon of Acrisols contains more than 1%, this figure is used as estimate.

2.3 Andosols (T)

DESCRIPTION OF THE SOIL UNITS

Andosols are formed in volcanic material. All units of this MSG, occurring on the EC soil map, have an ochric A horizon [3]. As for Gleysols evidence exists that it is not correct to assign a percentage of 1% to these units, because soil colours of the A horizon are often too high to classify the A as mollic or umbric, although o.m. contents are relatively high [9, p186&p188]. The Mollic (Tm) and Humic Andosols (Th; having an umbric A) only occur as associated soils or inclusions. No estimation is given for these units, because they do not occur in the CORINE database.

code	Soil Unit	Main Criterion	Estimated o.m. %
To	Ochric Andosols	ochric A, smeary consistence and/or silt loam or finer texture	10
Tv	Vitric Andosols	ochric A, no characteristics of To	10

AVAILABLE DATA

European Andosols [9] have o.m. contents of 9.4 up to 19% (average 14%); Th: 19%, To: 14%, Tv: 9.4%. U.S. Andosols [2] have o.m. contents ranging from 4.5 to 26% (average 12%); Tm: 8.7 and 26%; Th: 6.1, 12, and 17%, Tv: 4.5%. [8] states that Th are high in o.m. content and commonly values of over 20% in the upper horizon occur.

ACCOUNT OF ESTIMATION

The fact that these soils have an ochric A is meaningless with regard to o.m. content. For both To and Tv units a percentage of 10% is used, equal to that of Placic Podzols (Pp) and Stagno-Dystric Gleysols (Gds), based on the available data. The average for all available Andosol profiles is 13%. We believe that andosols have o.m. contents not higher than the Placic Podzols (Pp) and Stagno-Dystric Gleysols (Gds).
Remark: Although the presented figures suggest a difference in o.m. contents between To and Tv units, at present it is preferred to not distinguish these units.

2.4 Arenosol (Q)

DESCRIPTION OF THE SOIL UNITS

Arenosols are soils from coarse textured unconsolidated materials, exclusive of recent alluvial deposits, consisting of albic material or showing characteristics of Luvisols, Cambisols or Ferralsols, however do not qualify because of textural requirements. These soils can only have, by definition [3], an ochric A horizon. Two units occur on the EC soil map and one subunit occurs as associated soil or inclusion (Calcaro-Cambic Arenosol Qcc, calcareous at least between 20 and 50 cm from the surface). The Albic (Qa, consisting of albic material) and Ferralic Arenosol (Qf, showing ferralic properties, c.q. resembling Ferralsols) do not occur on the EC legend.

code	Soil Unit	Main Criterion	Estimated o.m. %
Qc	Cambic Arenosols	not having the properties of Qa, Qf or Ql	1
Ql	Luvic Arenosols	showing lamellae of clay accumulation	1

AVAILABLE DATA

Three described European Arenosol profiles contain 0.2 (Qc), 0.6, and 1.6% o.m (both Ql) [6,9]. The average o.m. content is 0.8%. No U.S. data are available. According to [8,p190] the thin upper horizon of the Qc usually has an o.m. content of less than 2%.

ACCOUNT OF ESTIMATION

A percentage of 1% is assigned to the Arenosol units, since there is no reason to assume a higher content in the ochric A of these units.

2.5 Cambisol (B)

DESCRIPTION OF THE SOIL UNITS

Cambisols are soils with a development of the B horizon which is not strong enough to classify as an other MSG or with an umbric A horizon of more than 25 cm (e.g. Humic subgroup). Seven units and ten subunits occur on the EC soil map. Two units do not occur in the EC, the Gelic Cambisol (Bx, permafrost within 200 cm) and the Ferralic Cambisol (Bf, having properties of the Ferralsols). One subunit only occurs as associated soil or inclusion, the Ando-Dystric Cambisol (Bda, formed in volcanic material).

code	Soil Unit	Main Criterion	Estimated o.m. %
Bc	Chromic Cambisols	a strong brown to red B horizon	2
Bcc	Calcaro-Bc	Bc which is calcareous below 50 cm	2
Bd	Dystric Cambisols	a base saturation of < 50% in part of the B	3
Bds	Spodo- Bd	Bd showing properties of Podzols	10
Be	Eutric Cambisols	non of the properties mentioned by other B	3
Bea	Ando- Be	Be formed on volcanic material	5
Bec	Calcaro-Be	Be which is calcareous below 50 cm	3
Bef	Fluvi- Be	Be developed from alluvial deposits	3
Bg	Gleyic Cambisols	hydromorphic properties within 1 m	3
Bgc	Calcaro-Bg	Bg which is calcareous at least between 20-50 cm	3
Bgg	Stagno- Bg	Bg having water stagnation most of the year	3
Bh	Humic Cambisols	an umbric A thicker than 25 cm	5
Bk	Calcic Cambisols	a calcic or gypsic horizon or powdery lime	3
Bkf	Fluvi- Bk	Bk developed from alluvial deposits	5
Bv	Vertic Cambisols	vertic properties (like Vertisols)	3
Bvc	Calcaro-Bv	Bv which is calcareous at least between 20-50 cm	3
Bvg	Gleyo- Bv	Complex of Bv and Bg units with vertic properties	3

AVAILABLE DATA

European Cambisols contain between 1.8 and 10% o.m. with an average of 4.9% [6,9]; Bcc: 1.6%, Bd: 10 and 10% (Bds), Be: 2.7 (Bec), 3.1, 3.4 (Bef), and 6.9% (Bea), Bh: 8.0%, Bg: 3.1, 4.6 (Bgg), and 4.8% (Bgc), Bk: 1.8%, Bvc: 3.8 and 4.2%. The U.S. cambisols in [2] contain from 1.1 to 9.3% (average 3.4%); Be: 1.1, 2.1 (Bec), and 2.2%, Bh(a)/Bda: 3.1%, Bd: 2.7 and 9.3% (Bda). According to [8,p192] the o.m. content in the upper horizon of Bd profiles varies from 3 to 15%. In a generalized profile the o.m. content of the upper 30 cm is 7% [8,p196].

ACCOUNT OF ESTIMATION

To estimate o.m. contents for Cambisols, in addition to the figures presented above, information on associated soils [6, p40-p46], climatic region and physiographic position is relevant. Be soils in the EC have a mean o.m. content of 3.1% when the Bea soil is excluded. The Be-profiles in the U.S. are lower in o.m. (1.8%). In Be associations often Orthic or Chromic Luvisols occur which have an estimated o.m. content of 3 and 2%, respectively. The estimate for Be soils, including Bec and Bef is 3%, for Bea soils an o.m. content of 5% is used (related to Andosols, see §2.3). Although Bef is closely related to the Fluvisols (5% o.m., see §2.7), they only occur in north-eastern Italy where the

continental mediterranean climate [9, figure 9] is assumed to exclude high o.m. contents. In addition Vertisols occur as inclusions which have an estimated o.m. of 2%, therefore, only 3% o.m. is used for Bef associations. The Bd units are estimated to have the same o.m. content as the Be units (3%). An exception is the Bds unit occurring in the UK and Ireland in areas where Placic Podzols (Pp) and Dystric Histosols (Od) are common. This unit is presumed to have a high o.m. content which is supported by the above presented figure for a Bds profile. An o.m. content of 10% is assigned to the Bds unit. The Bh units mainly occur in the cool temperate areas of France and Spain and the cool marine and cool and temperate mediterranean zone of Spain. They have at least as much o.m. as the Fluvisols and a content of 5% is used on the map. The Bg units are estimated to have 3% o.m.; mean of data is 4.2% (see remark). For Bk units which occur in southern France and in Spain an o.m. content of 3% is used (the figure used for most Cambisol units). The Fluvi subunit (Bkf) occurring in the Netherlands are strongly related to the Fluvisols and for that reason a content of 5% o.m. is used. The Bc units which mainly occur in the southern part of Europe are assumed to have lower o.m. contents than the Cambisol units of northern Europe and, therefore, an o.m. content of 1% is adjudged. The Bv units mainly occur in north-eastern France, central Italy, and Sardinia. They probably have a higher o.m. then Vertisols (compare figures presented above with Vertisol data in §2.21), but there is no reason to give them a higher content than 3% as is done for "standard" Cambisols.
Remark: The Bgc and Bgg units mainly occurring in the UK are probably somewhat higher in o.m. content, a percentage of 4% would perhaps be more realistic. For other Bg units (with no third letter in the symbol) which mainly occur in north-eastern France and the mediterranean part of Spain 3% is believed to be a more reasonable estimate.

2.6 Ferralsols (F)

DESCRIPTION OF THE UNITS

Ferralsols are the strongly weathered soils of the tropics, but as a relict of ancient times they occur in certain parts of the EC as associated soils or inclusions. The only unit which occurs as associated soil or inclusion is the Orthic Ferralsol (Fo). An estimated is given because this unit occurs on the listing provide by CORINE. The classification gives no information on o.m. contents, but they probably have an ochric horizon. The Plinthic (Fp, plinthite within 125 cm), Humic (Fh, umbric A or high o.m. content in B), Acric (Fa, cation exchange capacity of clay less than 1.5 meq/100 g), Rhodic (Fr, red to dusky red B) and Xanthic Ferralsols (Fx, yellow to pale yellow B) do not occur on the EC soil map.

code	Soil Unit	Main Criterion	Estimated o.m. %
Fo	Orthic Ferralsols	non of the properties of other Ferralsols	1

AVAILABLE DATA AND ACCOUNT OF ESTIMATE

No data for European profiles are available. Data of several Ferralsol profiles from the U.S.A. have o.m. contents which vary from 2.0 to 10% (average 5.2%); Fa: 2.0, 4.4, and 10%, Fh: 6.5%, Fo: 6.7%, Fr: 3.4, 3.7, and 5.2%.
Although U.S. data suggest higher contents a value of 1% is used, because of the assumed ochric A.

2.7 Fluvisols (J)

DESCRIPTION OF SOIL UNITS

Fluvisols are soils developed from recent alluvial deposits. Fluvisols can have an ochric, umbric or histic horizon, so organic matter percentages can range from less than 1% up to 30% and even more in the upper 30 cm [3]. Three units and three subunits occur on the EC soil map. Characteristics and estimated o.m. contents are given below. The Thionic Fluvisol (Jt, having a sulfuric horizon or sulfidic material within 125 cm, soils liable to become acid on oxidation) does not occur on the map nor in associations or inclusions. The Gleyo-Dystric Fluvisol (Jdg, hydromorphic properties within 50 cm) only occurs as associated soil or inclusion.

code	Soil Unit	Main Criterion	Estimated o.m. %
Jc	Calcaric Fluvisols	calcareous, at least between 20 and 50 cm	5
Jcf	Fluvi- Jc	developed from river deposits	5
Jcg	Gleyo- Jc	hydromorphic properties within 50 cm	5
Jd	Dystric Fluvisols	base saturation of less than 50% between 20-50 cm	5
Je	Eutric Fluvisols	base saturation of more than 50% between 20-50 cm	5
Jeg	Gleyo- Je	hydromorphic properties within 50 cm	5

AVAILABLE DATA

Alluvial deposits in the Netherlands, mainly classified as Gleyo-Calcaric and Gleyo-Eutric Fluvisols, and Fluvi-Calcic Cambisols contain at average 3.5% o.m. under arable land and 16% under grassland [7]. European data on o.m. content in Fluvisols range from 1.3 to 10% (average 4.0%) [1,6,9]; Jc: 1.3, 1.7 (Jcg), 2.0, 2.0, 2.2, 3.3, 4.0, 4.1 (Jcf), and 4.9%, Jd: 2.7 and 8.6%, Je: 2.1, 8.6 (Jeg), and 10%. The mean content in Jc units under arable land is 2.4% (7 profiles), under grass 4.5% (2). In [2] two Jc profiles from the U.S.A. are described which have an o.m. content of 1.6%.

ACCOUNT OF ESTIMATION

At this moment no information is available to distinguish between different soil units of the Fluvisol group. Therefore we use an o.m. content of 5% for all units. Fluvisols are considered to contain more o.m. than Podzols for which the estimated o.m. content is 4% (see §2.15), because they usually have a finer texture. [5,p64] state that under the same climatic conditions fine textured soils usually have a higher o.m. content the sandy soils or loess soils. This is supported by the results of a recent study [11].

Remarks:
Using data of [1], [2] and [7] and [9] an estimation for the "standard" Fluvisol would be in the order of 2 to 3% instead of 5%.
Using a similar argument as for Mollic and Humic Gleysols the Gleyo subunits of the Eutric and Calcaric Fluvisols may be adjudged a percentage of 7%. But for this moment there are no data to support this idea.

2.8 Gleysols (G)

DESCRIPTION OF THE SOIL UNITS

Gleysol are formed from unconsolidated materials exclusive of recent alluvial deposits (see [3] for definition of alluvial sediments). The Gleysol units occurring on the EC Soil Map have either a mollic, umbric or ochric A horizon. Soils with a histic H horizon belong to the same unit as either the soils with a mollic or umbric A. The units with an ochric horizon cannot be classified as having 1% o.m., because epipedons of these soils have too high a colour value to classify as mollic or umbric, e.g. [9; p120&p122]. Two units do not occur on the EC soil map: Gelic Gleysols (Gx, having permafrost within 200 cm of the surface) and Plinthic Gleysols (Gp, having plinthite within 125 cm). Three subunits only occur as associated soils or inclusions Stagno-Calcaric (Gcs), Fluvi-Humic (Ghf) and Thionic-Humic (Ght, having a sulphuric horizon or sulfidic material within 125 cm). No estimates are made for these units and subunits because they do not occur in the CORINE database.

code	Soil Unit	Main Criterion	Estimated o.m. %
Gc	Calceric Gleysols	calcic or gypsic horizon or calcareous at least between 20-50 cm	5
Gd	Dystric Gleysols	base saturation < 50% between 20-50 cm	5
Gds	Stagno- Gd	Gd with surface water stagnation most of the year	10
Ge	Eutric Gleysols	base saturation > 50% between 20-50 cm	4
Gef	Fluvi- Ge	Ge developed from alluvial deposits	5
Ges	Stagno- Ge	Ge with surface water stagnation most of the year	4
Gh	Humic Gleysols	umbric A or dystric histic H horizon	10
Gm	Mollic Gleysols	mollic A or eutric histic H horizon	4
Gmf	Fluvi- Gm	Gm developed from alluvial deposits	5

AVAILABLE DATA

European Gleysol profiles contain from 2.4 to 22% o.m. (average 9.4%); Gc: 4.9 and 5.6%, Gd: 10%, Ge: 4.8%, Gh: 11 and (with histic H) 21%, Gm: 2.4, 4.6, 7.7, and 22% (Gmf) [1,6,9]. Gleysol profiles from the U.S.A. [2] have an average o.m. content of circa 4% (2.5-50%); Gm: 2.5, 3.6, and 5.7%, Gh (with Histic H): 50%, Gd: 3.1%. [8] describes Humic Gleysols as having commonly a 10-20 cm thick layer of well decomposed o.m. (>50%) an Ah with 10% decreasing to < 1% in the Bg.

ACCOUNT OF ESTIMATION

The mean value of o.m. content for Gm is 4.4%, which is rounded to 4%. This value is used for both Ge and Ges. The latter often occurs in association with stagno-Gleyic Podzols (Pgs) which are adjudged the same percentage (see §2.15). The Gc and Gd units may have a higher o.m. content, and a percentage of 5 is used for these units. The Fluvi-sub units (Gef, Gmf) are closely related to the Fluvisols, and mainly for this reason an o.m. content of 5% was adjudged. The Gh has a relatively high o.m. content, especially when associated to Dystric Histosols (Od, see §2.9) and Placic Podzols (Pp, see §2.15), due to the presence of a Histic H. [6, p33]. For this reason they are classified as having the same o.m. contents as Pp units, i.e. 10%.

Remark: Perhaps stagno-Eutric Gleysols (Ges) and stagno-Gleyic Podzols (Pgs) should be assigned an o.m. content of 5 or even 7%. The argument is that waterlogging is prevalent in these soils; reducing circumstances hamper organic matter degradation.

2.9 Histosols (O)

DESCRIPTION OF THE SOIL UNITS

Histosols are soils with a high organic matter content, at least 40 cm of organic material in the upper 80 cm. Organic material contains at least 20% o.m. if the mineral fraction contains no clay and 30% organic matter if the mineral fraction contains 60% clay. The units occurring on the map are listed below. Gelic Histosols (Ox, having permafrost within 200 cm) do not occur on the EC map. The Placi-Dystric subunit (Odp, having a thin iron pan) only occurs as associated soil or inclusion. No estimate is given because the subunit was not included in the CORINE database.

code	Soil Unit	Main Criterion	Estimated o.m. %
Od	Dystric Histosols	a pH(H_2O,1:5) of less than 5.5 in some part of the soil between 20-50 cm from the surface	30
Oe	Eutric Histosols	not being Gelic or Dystric	30

AVAILABLE DATA AND ACCOUNT OF ESTIMATION

European profiles contain between 33 to 79% o.m. (average 61%)[1,6,9]; Od: 69, 70%, Oe: 33, 54, and 79%. No U.S. data are available.

An o.m. content in the upper 30 cm of 30% was arbitrarily assigned to the Histosols (minimum value occurring).

2.10 Lithosols (I)

DESCRIPTION OF THE SOIL UNITS

Lithosols are soils with a depth of less than 10 cm. They may contain high organic matter contents, but leaching of solutes from the upper layer is relatively easy because of their limited thickness. Three units are recognised and occur on the EC soil map.

AVAILABLE DATA AND ACCOUNT OF ESTIMATION

No example profile or o.m. content is given in [1], [2], [6], [8], or [9].

For agricultural purposes these soils are irrelevant. A content of 1% is used for these units, because of their limited depth.

code	Soil Unit	Main Criterion	Estimated o.m. %
Ic	Calcic Lithosols	developed over calcareous parent materials	1
Id	Dystric Lithosols	developed over acid parent material	1
Ie	Eutric Lithosols	developed over non-calcareous basic parent material	1

2.11 Luvisols (L)

DESCRIPTION OF THE SOIL UNITS

Luvisols are soils with a horizon containing illuvial clay and a base saturation of more than 50%. They may have an umbric or ochric A, so differentiation on unit level based on o.m. content is not easy. Seven units and six subunits occur on the EC soil map. The Plinthic Luvisol (Lp, having plinthite within 125 cm of the surface) and the Chromo-Vertic Luvisol (Lvc, with strong brown to red B horizon) only occur as associated soils or inclusions. The Albic Luvisol (La, having an albic E but no hydromorphic properties within 50 cm of the surface) does not occur on the EC map. No estimation is given for Lp, La and Lvc because they do not occur in the CORINE database.

code	Soil Unit	Main Criterion	Estimated o.m. %
Lc	Chromic Luvisols	strong brown to red B horizon	2
Lcr	Rhodo- Lc	red to dusky red B horizon	2
Lf	Ferric Luvisols	ferric properties (mottles, nodules or CEC[a]) less than 24 meq per 100 g)	2
Lg	Gleyic Luvisols	hydromorphic properties within 50 cm	3
Lga	Albo- Lg	Lg having an albic E horizon	3
Lgp	Plano- Lg	Lg showing an abrupt textural change	3
Lgs	Stagno- Lg	Lg with surface water stagnation most of the year	3
Lk	Calcic Luvisols	calcic horizon or soft powdery lime	1
Lkc	Chromo- Lk	a strong brown to red B horizon	1
Lo	Orthic Luvisols	non of the properties of other Luvisols	2
Lv	Vertic Luvisols	vertic properties (see Vertisols)	2
Lvk	Calci- Lv	Lv with calcic horizon or soft powdery lime	2

a) cation exchange capacity

AVAILABLE DATA

European data of o.m. contents in Luvisols vary from as low as 0.7% to 6.9% (average 2.1%); Lo: 1.3, 1.7 and 2.7%, Lg: 1.9, 2.1 (Lgs), 2.7, and 6.9% (Lga), Lc: 1.3, 2.2 (Lcr), and 2.7%, Lkc: 0.7 and 1.2%, Lv: 0.8%, Lf: 1.7%, Lp: 2.2% [1,6,9]. U.S. date range from 0.5 to 4.1% (average of 1.7%); La: 0.70, 1.1, and 1.2% (2), Lc: 0.5, 2.0, and 2.7% (Lcr), Lg: 1.7, 2.4, 4.1%, Lk:1.4%, Lo: 1.0, 1.1, 1.5, 1.8, 1.9 (2), and 2.0% [2]. According to [8,p235] the La unit has 5 to 10% o.m. in its upper mineral horizon and a very low o.m. content throughout the rest of the soil due to the advanced state of decomposition. In the generalised profile the o.m. content in the upper 30 cm is 4% [8,p238]. A Lo profile in [5,p372] contains 3.6% and a Lc around 5%. All examples in both [5] and [8] are under forest. The o.m. are much higher as in the example profiles in [1], [2], [6] and [9]. According to [4] the (decalcified) surface soils contain a few percent organic matter.

ACCOUNT OF ESTIMATION

The "standard" Luvisol is estimated to contain 2% o.m. in the upper 30 cm. The Lo profiles described have an average o.m. content of 1.7% (EC: 1.8%, U.S.A.: 1.6%). The standard estimate of 2% is therefore used for Lo. The average o.m. content of the Lg profiles is 3.1% (EC: 3.4%, U.S.A.: 2.7%). A somewhat higher o.m. content is expected, because less favourable circumstances for o.m. degradation exist in such hydromorphic soils. Hence, an o.m. content of 3% is adjudged to the Lg. The Lk profiles have a mean o.m. content of 1%. These soils mainly occur in central and southern Spain. Climatic condition in this area promote lower o.m. content and an estimate of 1% has been used for both Lk and Lkc units. For Lc units the same climatic argument could be used, but mean o.m. contents of the presented profiles are clearly higher (1.9%). Hence, the same estimate is used as for the standard Luvisol (2%). Very few data are available for Lf, Lv and Lp units. Although the presented Lv-profile contains only 0.8% o.m., an estimate of 2% is used for Lf and Lv units.

Remark: Climatic arguments could be used to support an estimate of 1% for the Lv unit. Earlier suppositions that the Lga and Lgp have a somewhat lower o.m. content (profiles show evidences of excessive leaching), based on data of La profiles, are redrawn (e.g. Lga has 6.9%).

2.12 Phaeozems (H)

DESCRIPTION OF THE SOIL UNITS

Phaeozems have a mollic A horizon like the Chernozems (which do not occur in the EC), but leaching in these soils is more advanced. The classification key doesn't provide tools to differentiate the soil units in this MSG. Three units occur on the soil map and in the manual. The Gleyic Phaeozem (Hg, hydromorphic properties within 50 cm of the surface) only occurs as associated soil or inclusion and is not on the list in the manual, so no estimate is given.

code	Soil Unit	Main Criterion	Estimated o.m. %
Hc	Calceric Phaeozems	calcareous at least between 20 and 50 cm	5
Hh	Haplic Phaeozems	non of the properties of the other Phaeozems	5
Hl	Luvic Phaeozems	an argillic B (clay illuviation)	5

AVAILABLE DATA

European profiles contain between 1.5 and 5.7% o.m. (average 3.8%); Hh: 2.9 and 3.6%, Hc: 2.7 and 5.7%, Hl: 1.5 and 3.2% [6,9]. U.S. Phaeozems [2] contain between 1.4 and 11% o.m. (average 3.8%); Hh: 2.3, 3.6, 3.8, 4.2 and 11%, Hg: 3.3 and 4.2%, Hl: 1.4 (2), 3.1, 3.5 and 3.8%. According to [5] the Phaeozems have around 5% o.m. in their top soil. According to [8] the o.m. steadily decreases from about 5% in the upper horizon to 1 to 2% in the lower part of the middle horizon which may contain 3% o.m. in its upper part.

ACCOUNT OF ESTIMATION

Although the presented figures from [6] and [2] have a mean of 3.8%, text books suggest that contents are around 5%. This latter figure is used in the map. This is justified, considering that the humus rich horizon is usually 40-60 cm thick.

Remark: The real belt with Phaeozems is located in Hungary [9]. Both Hh and Hl profiles occur in Germany and Poland on loess and are probably closely related to the Luvisols [6,9]. The Hc unit occurring in France on Marl just south of an extended Rendzina area surrounded by Calcic Cambisols [6] has an o.m. content comparable with that in Rendzinas. The lower figure of the Hc profiles is from a Hc in Rumania which is formed in alluvial deposits [9]. Given the figure presented above Hl and Hh units in the EC have probably around 4% o.m. and Hc around 5%.

2.13 Plaggenosols (PL)

Plaggenosols are the man made soils with a relatively thick A-horizon (50 cm or more) rich in o.m. They only occur as associated soils or inclusions. An estimation of organic matter content is given because the soil unit occurs on the listing provided by CORINE.

code	Soil Unit	Main Criterion	Estimated o.m. %
PL	Plaggenosols	manmade surface layer of 50 cm or more thick	7

Two example profiles contain 4.2 and 6.8% [1] and the depth of the humus rich A is 90 and 75 cm, respectively.

The organic matter content is estimated to be 7%. This estimate is based partly on the thickness of the A horizon.

2.14 Planosols (W)

DESCRIPTION OF THE SOIL UNITS

Planosols have a horizon from which clays and free iron oxides have been leached. The two soil units occurring on the EC soil map have an ochric A horizon. The Gelic (Wx, with permafrost), Solodic (Ws, >6% exchangeable sodium), Mollic (Wm, mollic A or eutric histic H) and Humic Planosol (Wh, umbric A or dystric histic H) do not occur on the EC soil map.

code	Soil Unit	Main Criterion	Estimated o.m. %
Wd	Dystric Planosols	base saturation less than 50%, non of the features other Planosols	1
We	Eutric Planosols	non of the features of other Planosols	1

AVAILABLE DATA AND ACCOUNT OF ESTIMATION

Two European Planosol profiles are described [6,9] and the mean o.m. content of the upper 30 cm is 1.8% (We) and 2.4% (Wd). The o.m. is concentrated in the upper 5-8 cm (oak wood). The lower part of the upper layer (5/8-30 cm) contains circa 1.2% o.m. Planosols described in [2] contain 2.0% o.m. (Wd) and 3.9% o.m. (Wm).

An o.m. content of 1% is used as is done for other soils with an ochric A and no indication of the presence of finely divided lime or too high a colour value or chroma (see chapter 1).

Remark: the available data indicate that the Wd unit may have a somewhat higher o.m. content, but it should be kept in mind that the present data are from profiles under forest.

2.15 Podzols (P)

DESCRIPTION OF THE SOIL UNITS

Podzols are soils with an illuvial horizon rich in organic matter and/or sesquioxides. It is not possible to differentiate the units of this MSG on o.m. content of the top soil by using the classification key [3]. Subdivision of the MSG is based on characteristics of the spodic B horizon. Five units and two subunits occur on the EC soil map and are listed below. The Ferric Podzol (Pf, ratio free iron/carbon > 6) does not occur on the EC map. The Ferro-Orthic (Pof, ratio free iron/carbon between 0.3 and 6) and Humo-Placic Podzol (Pph, B lacks sufficient free iron to turn redder on ignition) appear only as associated soil or inclusion.

code	Soil Unit	Main Criterion	Estimated o.m. %
Pg	Gleyic Podzols	hydromorphic properties within 50 cm	4
Pgs	Stagno-Pg	surface water stagnation most of the year	4
Ph	Humic Podzols	lacking enough free iron in B horizon	4
Phf	Ferro- Ph	ratio free iron - carbon in B horizon > 6	4
Pl	Leptic Podzols	very thin eluvial E horizon	4
Po	Orthic Podzols	not one of the properties of other Podzol-units	4
Pp	Placic Podzols	a thin iron pan over spodic B horizon	10

AVAILABLE DATA

The litter layer and O horizon were not included in the calculations of the o.m. contents. Often the profile descriptions were incomplete and contents are estimated. For the available European Podzol profiles the o.m. content varies from 0.9 to over 30%; Po: 0.9 (with O horizon 9.4%), 1.2 (with O horizon 7.8%), and < 5% (with F and H layer 38%), Pl: 4.2 and 6.3%, Ph: 2.5, 4.7, 9.5, 41, and 42%, Pp: 32%, Pg: 4.3 (Pgs), circa 4 (with O horizon circa 5%), 8.4, and 26%. All profiles from [6] and [9] are under forest or heather. Most of the profiles described in [1] are used as agricultural land. On the EC soil map most of the Dutch sandy soils are Podzols. From [7] it is calculated that the mean o.m. content of arable sandy soils is 3.9% and of sandy grasslands 9.7%. U.S. data on o.m. vary from 0.6 to 25% (average 6.7%); Po: 3.1, 3.3, and 5.3%, Pl: 1.9%, Ph: 13%, Pp: 1.8 and 25%, Pg: 0.6% [2]. The generalised Podzol profile in [8,p251] contains around 16% o.m. in the upper mineral horizons. The o.m. profiles of the P(o) units have two maxima; the greater occurs at the surface and the lesser in the middle horizon where it has accumulated through leaching from above [8,p249].

ACCOUNT OF ESTIMATION

The o.m. content of agricultural used Podzols is estimated to be 4%, although it should be stressed that grasslands may have much higher contents. This is not only due to the fact that grassland promotes a higher o.m. content, but also to the fact that soils under wetter conditions have higher o.m. contents and are less suitable as arable land. Only for Pp units an estimate of 10% is used. These soils occur mostly in association with Dystric Histosols (Od) and Spodo-Dystric Histosols (Odp; see §2.9) and usually have a Histic H which is too thin to classify as Histosol.

Remark: Study of the associated soil units in the same polygon may provide a basis for a better estimate of the organic matter content of the other Podzol units.

2.16 Podzoluvisols (D)

DESCRIPTION OF THE SOIL UNITS

Podzoluvisols are characterized by deep tonguing of an eluvial E horizon into the argillic B horizon. Three units and one subunit are recognised to occur in Europe. The Eutric (De, non of the features of other D-soils), Gleyic (Dg, hydromorphic properties within 40 cm of the surface) and Stagno-Gleyic Podzoluvisols (Dgs, surface water stagnation most of the year) only occur as associated soils or inclusions. No estimation is given because they are not included in the CORINE database. An estimate of non-Dd soil is given because some of the polygons in the database are marked as D without unit identification code.

code	Soil Unit	Main Criterion	Estimated o.m. %
D	other Podzoluvisols	not a Dystric Podzoluvisol	2
Dd	Dystric Podzoluvisols	base saturation < 50% in part of B horizon	2

AVAILABLE DATA

European data of o.m. contents in Podzoluvisol vary from 1.1 to 2.6% (average 1.7%); Dd: 1.5%, De: 2.6%, Dg: 1.1% [9]. The Dg units in the U.S.A. contain circa 4% o.m.; Dg: 3.8 and 3.9% [2]. In [8,p257] a Dg is described. The ochric A contains usually less than 10% o.m. and the content decreases sharply to about 2 to 3% in the albic E horizon.

ACCOUNT OF ESTIMATION

The estimate used for the organic matter map is 2% for D and Dd units. They are assumed to be comparable with the Luvisols (see §2.11) and the available data support this assumption.

2.17 Rankers (U)

Rankers are usually shallow soils [8]. Rankers developed over siliceous materials. This MSG contains only one unit. This soil unit has an umbric A horizon.

code	Soil Unit	Main Criterion	Estimated o.m. %
U	Rankers	thin umbric A, no other diagnostic horizons	3

Few profile descriptions exist. In [6] a U(h) contains 26% o.m. in the 20 cm of soil underlain by shattered rock. Rankers may show wide ranges in o.m. content to a great extent [8]. The Ranker associations occurring on the EC soil map always contain Dystric Lithosols (Id) as associated soil or inclusion. Rankers form associations with, among others, Humic Cambisols (Bh; in Spain) and Dystric Cambisols (Bd; Britain and France). An o.m. content of 3% is adjudged to Rankers, because they are thought to contain less o.m. than Bh (5%) and be comparable in o.m. content with Bd soils (3%, see §2.5).

2.18 Regosols (R)

DESCRIPTION OF THE SOIL UNITS

Regosols are soils from unconsolidated materials, exclusive of recent alluvial deposits, having no diagnostic horizon other than an ochric A. Three units occur on the EC soil map. The Gelic Regosol (Rx, having permafrost within 200 cm) does not occur on the map.

code	Soil Unit	Main Criterion	Estimated o.m. %
Rc	Calceric Regosols	calcareous at least between 20-50 cm	1
Rd	Dystric Regosols	base saturation of < 50% between 20-50 cm	1
Re	Eutric Regosols	non of the features of other Regosols	1

AVAILABLE DATA AND ACCOUNT OF ESTIMATION

In European Regosols [6;9] o.m. contents occur of 0.3 up to 1.8% (too high a colour, see page 3); Re: 0.3, Rc: 1.8, Rd: 0.9. In Regosols from the U.S.A. [2] o.m. contents range from 0.3 (two Re profiles) up to 1.2 (a Rc).

The average o.m. content of the given profiles is 0.8%. Because of their ochric A an o.m. percentage of 1% is assigned to the Regosol units.

2.19 Rendzinas (E)

Rendzinas are relatively shallow soils which are developed in calcareous materials with a calcium carbonate content of more than 40%. The MSG contains one unit only, the Orthic Rendzinas. This soil unit has a mollic A horizon.

code	Soil Unit	Main Criterion	Estimated o.m. %
Eo	Orthic Rendzinas	mollic A, over calcareous material	5

Few profile descriptions exist. The European Eo profiles contain 5.0 and 6.1% o.m. [1;9]. An Eo profile from the U.S.A. contains 2.3%. Rendzinas have o.m. contents ranging from 5 to 15% [8]. An o.m. is of 5% is, therefore, used for Rendzinas.

2.20 Solonchaks (Z)

DESCRIPTION OF THE SOIL UNITS

The soils of the Solonchak group have a high salinity. Solonchaks are subdivided only partly on the basis of type of A horizon. Two units occur on the EC soil map. The Orthic Solonchak (Zo, none of the characteristics of other Solonchaks) appears in the legend only as associated soil or inclusion, although the saline soils in the delta of the Rhone belong to this unit [6]. The Takyric (Zt, crack into polygonal elements) and Mollic Solonchaks (Zm, a mollic A) do not appear in the legend. The Gleyic Solonchak (Zg) may have any type of A horizon [3].

code	Soil Unit	Main Criterion	Estimated o.m. %
Zg	Gleyic Solonchaks	hydromorphic properties within 50 cm	3

AVAILABLE DATA AND ACCOUNT OF ESTIMATION

Two European soil profiles are described: a Zo with 1.0% o.m. and a Zg with 4.5%. Two Zo profiles in the U.S.A. contain 0.3 and 1.0% o.m. According to [8; p267] Solonchaks contain between 2 and 3% o.m..

An o.m. content of 3% is used for the gleyic Solonchaks. This figure is somewhat higher than the literature data (average o.m. content 1.7%). Because of the wetness and accompanying decreased decomposition rate of o.m., related to conditions which cause gleyic features, the Zg unit is believed to have a higher o.m. content than other Solonchaks. The presented figure for the Zg soil supports this assumption.

2.21 Vertisols (V)

DESCRIPTION OF THE SOIL UNITS

Vertisols are (clayey) smectite rich soils, developing cracks to a depth of at least 50 cm when dry. They are not classified on organic matter content of the A horizon [3]. Two units and two subunits occur on the EC soil map and characteristics are given below.

code	Soil Unit	Main Criterion	Estimated o.m. %
Vc	Chromic Vertisols	non Pellic Vertisols	2
Vcc	Calcaro-Vc	Vc which is calcareous at least between 20-50 cm	2
Vp	Pellic Vertisols	moist chroma[a)] of less than 1.5 in soil matrix	2
Pvc	Calcaro-Vp	Vp which is calcareous at least between 20-50 cm	2

a) see footnote 3 page 3

AVAILABLE DATA AND ACCOUNT OF ESTIMATION

European Vertisol have o.m. contents ranging from 0.7 to 2.8% (average 2.0%); Vc: 0.9, 2.8%, Vp: 0.7, 2.2 (Vpc), 2.4, and 2.7%. Data from the U.S.A. [2] are comparable with European data: the average content of the top soil is 1.9% (0.7-2.8%); Vc: 1.9 (Vcc), 2.6, and 2.8%, Vp: 0.7 (Vpc), 1.5 (Vpc), 1.7, and 2.1%. According to [8; p276] Vertisols may have as much as 5% o.m., but usually contain 1-2% o.m.

For this study there are not enough data available to differentiate Vertisols further with respect to o.m. content. For all (sub)units a value is used of 2% o.m. in the upper 30 cm.

2.22 Xerosols (X)

DESCRIPTION OF THE SOIL UNITS

Xerosols are soils heaving a weak ochric A, depending on the ratio sand/clay this means more than 0.5-1% o.m. but less than 1 or 4%, the latter in case of the presence of finely divided lime. Two units appear in the legend of the EC soil map. The Luvic (Xl, having a clay illuviation B horizon) and Haplic Xerosols (Xh, non of the features of other Xerosols) do not occur on the map.

code	Soil Unit	Main Criterion	Estimated o.m. %
Xk	Calcic Xerosols	a calcic horizon within 125 cm, not Luvic	1
Xy	Gypsic Xerosols	a gypsic horizon within 125 cm, not Luvic	1

AVAILABLE DATA AND ACCOUNT OF ESTIMATION

Two European Xerosols are described containing 1.6 and 2.1% o.m. (both Xk). No examples of Xerosols are given in [2]. According to [8] the o.m. content in the ochric horizon of Xerosols varies from 1 to 2%.

The available data have a mean of 1.9%, but considering the hot and dry climatic conditions, a content of only 1% for the Xerosols is considered more realistic. This also differentiates these soils from e.g. the Luvisols, Vertisols and some Cambisols, which are assumed to have a higher o.m. contents.

2.23 Combined Legend units

On the map two combined legend units appear. For both units an o.m. content is adjudged equal to the o.m. content of the soil unit with the lowest content.

DYSTRIC LITHOSOLS/RANKERS (IDU)
The Legend unit Lithosols/Rankers are representing areas where somewhat deeper soils with an Umbric A-horizon interchange with very shallow soils. For agricultural purposes these soils are irrelevant. A percentage of 1% is adjudged to these units.

PLACIC PODZOLS/DYSTRIC HISTOSOLS (ODPP):
This legend unit is an association of low permeable Podzols and Organic soils probably formed on a Podzol. The Podzols in this unit probably have a Histic H horizon. The estimated o.m. content of these Podzols is 10% (but is probably much higher). The worst case approach is used, therefore, an o.m. content of 10% is used.

3. Future developments

3.1 Minor accommodations

The available literature to make generalizations as in this report is scarce. In future more literature will be reviewed, e.g. national soil maps and reports.
Another line of approach is to relate the organic matter content of the main soil unit in the legend unit within a polygon to the estimated organic matter contents of the associated and/or included soil units, as suggested in the text and practised for some major soil groups and soil units.

3.2 Major accommodations

In the current organic matter map an estimation of the organic matter content of the upper 30 cm is given. Implicitly it was assumed that the organic matter content of that layer was the most important factor in controlling leaching of pesticides to groundwater reservoirs and that content and distribution below 30 cm have a negligible influence.
Because large differences exist in organic matter distribution in profiles of different soil units the approach used in Soil Taxonomy [2] offer an interesting alternative. Not the percentage of a layer is estimated but the total amount of organic matter in kg per square metre over the depth of the profile. In Soil Taxonomy the maximum depth usually is 100 to 150 cm including a part of the C-horizon.
Note that for Lithosols and Phaeozems this approach was explicitly used when estimating the organic matter content of the upper 30 cm. For other MSGs is was implicitly used.

References

CORINE (1985), digital soil map of the European Communities (available on tape)

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[3] **FAO-Unesco** (1974), Soil map of the world 1:5 000 000, Volume I Legend; Paris: Unesco.

[4] **Driessen, P.M and R. Dudal** (1989), Lecture notes on the geography, formation, properties and use of the major soils of the world; Wageningen/Leuven: LUW & KUL.

[5] **Schachtschabel, P., H.P. Blume, K.H. Hartge und U. Schwertmann** (1982), Lehrbuch der Bodenkunde; Stuttgart: Enke Verlag.

[6] **Commission of the European Communities** (1985), Soil map of the European Communities 1 : 1 000 000; Luxembourg: Directorate_General for Agriculture Coordination of Agricultural Research.

[7] **Institute for Soil Fertility Research** (1991), Database of soil quality parameters; Bilthoven: RIVM (IBTOTAAL.WR1, Symphony spreadsheet).

[8] **FitzPatrick, E.A.** (1983), Soils their formation, classification and distribution; London: Longman.

[9] **FAO-Unesco** (1981), Soil map of the world 1 : 5 000 000, Volume V Europe; Paris: Unesco.

[10] **FAO-Unesco** (1989), Soil Map of the World, revised legend, Technical Paper 20; Wageningen: ISRIC (Reprint of World Soil Resources Report 60, Rome: FAO (1988).

[11] **Buschiazzo, D.E., A.R. Quiroga, and K. Stahr** (1991), Pattern of organic matter accumulation in soils of the semiarid Argentinian Pampas; *Z. Planzenernähr. Bodenk., 154:437-441.*

APPENDIX II

Content of records in file SLORG21.DAT
(Soil Code),(Generic Name),(Org.Matter percentage; only for units and subunits)

Remarks:
The provided manual of CORINE contained some deviations from the digital database.

1) Polygons exist with Podzoluvisols for which it is not indicated whether it are Dystric Podzoluvisols or Eutric Podzoluvisols.
2) The Dystric Podzoluvisol code used in the database is Dd and not D(d) as is given in the manual
3) The Gleyo-Vertic Cambisol code used in the database is Bvg and not Bv(g) as is given in the manual
4) The code for the map unit Dystric Histosols/Placic Podzols is OdPp and not PpOd as is given in the manual

Database used to make the Organic Matter Map fo the EC

J,Fluvisols,
Je,Eutric Fluvisol,5
Jeg,Gleyo-Eutric Fluvisol,5
Jc,Calcaric Fluvisol,5
Jcf,Fluvi-Calcaric Fluvisol,5
Jcg,Gleyo-Calcaric Fluvisol,5
Jd,Dystric Fluvisol,5
G,Gleysols,
Ge,Eutric Gleysol,4
Ges,Stagno-Eutric Gleysol,4
Gef,Fluvi-Eutric Gleysol,5
Gc,Calcaric Gleysol,5
Gd,Dystric Gleysol,5
Gds,Stagno-Dystric Gleysol,10
Gm,Mollic Gleysol,4
Gmf,Fluvi-Mollic Gleysol,5
Gh,Humic Gleysol,10
R,Regosols,
Re,Eutric Regosol,1
Rc,Calcaric Regosol,1
Rd,Dystric Regosol,1
I,Lithosols,
Ie,Eutric Lithosol,1
Ic,Calcaric Lithosol,1
Id,Dystric Lithosol,1
Q,Arenosols,
Qc,Cambic Arenosol,1
Ql,Luvic Arenosol,1
E,Rendzinas,

Eo,Orthic Rendzina,5
U,Rankers,3
T,Andosols,
To,Ochric Andosol,10
Tv,Vitric Andosol,10
V,Vertisols,
Vp,Pellic Vertisol,2
Vpc,Calcaro-Pellic Vertisol,2
Vc,Chromic Vertisol,2
Vcc,Calcaro-Chromic Vertisol,2
Z,Solonchaks,
Zg,Gleyic Solonchak,3
X,Xerosols,
Xk,Calcic Xerosol,1
Xy,Gypsic Xerosol,1
H,Phaeozems,
Hh,Haplic Phaeozem,5
Hc,Calcaric Phaeozem,5
Hl,Luvic Phaeozem,5
IdU,Dystric Lithosol/Ranker,1
B,Cambisols,
Be,Eutric Cambisol,3
Bec,Calcaro-Eutric Cambisol,3
Bea,Ando-Eutric Cambisol,5
Bef,Fluvi-Eutric Cambisol,3
Bd,Dystric Cambisol,3
Bds,Spodo-Dystric Cambisol,10
Bh,Humic Cambisol,5
Bg,Gleyic Cambisol,3
Bgc,Calcaro-Gleyic Cambisol,3
Bgg,Stagno-Gleyic Cambisol,3
Bk,Calcic Cambisol,3
Bkf,Fluvi-Calcic Cambisol,5
Bc,Chromic Cambisol,2
Bcc,Calcaro-Chromic Cambisol,2
Bv,Vertic Cambisol,3
Bvc,Calcaro-Vertic Cambisol,3
Bvg,(Gleyo-)Vertic Cambisol,3
L,Luvisols,
Lo,Ortic Luvisol,2
Lc,Chromic Luvisol,2
Lcr,Rhodo-Chromic Luvisol,2
Lk,Calcic Luvisol,1
Lkc,Chromo-Calcic Luvisol,1
Lv,Vertic Luvisol,2
Lvk,Calci-Vertic Luvisol,2
Lf,Ferric Luvisol,2
Lg,Gleyic Luvisol,3

Lgs,Stagno-Gleyic Luvisol,3
Lga,Albo-Gleyic Luvisol,3
Lgp,Plano-Gleyic Luvisol,3
D,Podzoluvisols,2
Dd,(Dystric) Podzoluvisol,2
P,Podzols,
Po,Orthic Podzol,4
Pl,Leptic Podzol,4
Ph,Humic Podzol,4
Phf,Ferro-Humic Podzol,4
Pp,Placic Podzol,10
Pg,Gleyic Podzol,4
Pgs,Stagno-Gleyic Podzol,4
W,Planosols,
We,Eutric Planosol,1
Wd,Dystric Planosol,1
O,Histosols,
Oe,Eutric Histosol,30
Od,Dystric Histosol,30
OdPp,Placic Podzol/Dystric Histosol,10,
N,No Color or Code,
Urb,Urban,
F,Fresh Water,
S,Sea,
NEEC,Non EEC,
Gla,Glaciers,
Glac,Glaciers,
RO,Rocky Outcrops,
PL,Plaggenosols,7
F,Ferralsols,
Fo,Ortic Ferralsol,1
A,Acrisols,
Af,Ferric Acrisol,1

APENDIX III

Three files are used to produce the map: orgmatter.lay, orgmatter.krt and orgmatter.key. Using Arc Info software and these files changes in lay out can be achieved easely.

Content of records in file ORGMATTER.LAY (comments in Dutch; original file: LAYOUT.AML written by Hans Verlouw, revised by Theo Tewessen)

```
/************************************************ BEGIN DOCUMENTATION
/* LAYOUT.AML
/*
/* Algemene AML voor layout van de kaarten voor EG ministers seminar
/*
/*--------------------------------------------------------------------------
/*
/* Ontwikkeld door       : Hans Verlouw
/* Datum                 : 30 Sep 1989
/* Datum laatste update : 14 oct 1991; Revised: January 1992, by: Theo Tewessen
/*                        variabele "coverpad" ingevoerd: dit is een workspace waar
/*                        de coverages, key-file en lut tables staan. Verandering
/*                        aangebracht i.v.m. het centraal opslaan van de kaarten.
/*                        Daarnaast ".kaart" vervangen door "ccoverage" en ".lijnenkaart"
/*                        door ".lijnencover" om geen
/*                        verwarring te krijgen over "kaarten" en "coverages"
/*                        (TT, datum)
/*                        15 oct 1991
/*                        variabelen "commando1" tot en met "commando4" zijn toegevoegd.
/*                        hiermee kunnen nog vier extra arcplot commando's worden gegeven
/*                        (TT, datum)
/*                        18 oct 1991
/*                        variabelen text1 t/m text7 zijn toegevoegd, en vervangen alle
/*                        booleans die textrandinformatie genereren. Dit om zo groot moge-
/*                        lijke vrijheid te verkrijgen bij kaartopmaak en sheets.
/*                        (TT, datum)
/* Copyright              : RIVM Bilthoven
/* Aangeroepen door       : Specifieke AML voor kaart
/* Aangeroepen routines : Geen
/* Opmerkingen            :
/*                      Hersteld of veranderd door Gerard Nienhuis:
/*                      regel 21 "uitgezet" met slash sterretje...
/*
/*
/*
/*--------------------------------------------------------------------------
/*
/* Global variables:
/*
```

```
/* .titel                     : titel van kaart
/* .ccoverage                  : te tekenen coverage
/* .selectie                  : selectie-commando alvorens te tekenen
/* .shadeitem                  : item dat geshade moet worden
/* .luttabel                  : te gebruiken look-up-table
/* .keyfile                   : te gebruiken legenda-file
/* .grijs                     : niet-landbouw-gebied erovereen (boolean)
/* .lijnencover
/* .datum                      : datum schrijven (boolean)
/* .draft                     : 'draft' schrijven (boolean)
/* .corinelogo                 : corinelogo tekenen (boolean)
/* .corinebron                 : 'Bron: corine' schrijven (boolean)
/* .rivmcomp                    : 'Computations: RIVM' schrijven (boolean)
/* .coverpad                   : ai workspace waar coverage, lut en key staan
/*
/*-----------------------------------------------------------------------------
/*
/* Local variables:
/*
/* allesgezet                  : geeft aan of alle benodigde variabelen zijn gezet
/*
/*-----------------------------------------------------------------------------
/* PRE:  "&STATION ws" is gedraaid en ARCPLOT is gestart
/* POST: allesgezet ==> kaart is getekend op huidige DISPLAY
/*
/************************************************* END DOCUMENTATION

/* ================== INITIALISATIE

&args size
&severity &error &routine bailing_out

&if [null %size%] &then &do
  &type usage lay_a <a3|a0>
  &return
&end

&if %size% eq a0 &then &do
  &s factor 1.0
  &s greycolor 347
&end
&if %size% eq a3 &then &do
  &s factor [calc 24.0 / 40.0]
  &s greycolor 175
&end

clear
clearselect
```

```
pageunits cm
pagesize [calc %factor% * 50] [calc %factor% * 40]
weedtolerance 0.02
linesymbol 1
box 0 0 [calc %factor% * 50] [calc %factor% * 40]
box [calc %factor% * 1] [calc %factor% * 1] [calc %factor% * 49] [calc %factor% * 39]

textfont 17
textquality proportional
textcolor 350
textsize [calc %factor% * 1]
textslant 10
textfit %.titel% ~
  [calc %factor% * 2] [calc %factor% * 37] [calc %factor% * 48] [calc %factor% * 37]

shdset
maplimits 0 [calc %factor% * 2] [calc %factor% * 50] [calc %factor% * 36]
mapextent -1735000 -1325000 1764000 1466000
mapposition cen cen

/* =================== LEGENDA
textsize [calc %factor% * 0.4]
keyposition [calc %factor% * 32] [calc %factor% * 29]
keybox [calc %factor% * 0.5] [calc %factor% * 0.5]
keyseparation [calc %factor% * 0.25] [calc %factor% * 0.25]
keyshade %.keyfile%

/* =================== MAIN PLOT
%.selectie%
polygonshades %.ccoverage% %.shadeitem% %.luttabel%

/* ====================== user defined commando's (max 4)
%.command1%
%.command2%
%.command3%
%.command4%
%.command5%
%.command6%
%.command7%
%.command8%
%.command9%
%.command10%

/* =================== BACKGROUND COVER
&if %.grijs% &then
&do
  &if [extract 1 [show display]] = 1039 and %size% = a0 &THEN
  &do
```

```
      setlevel 1 2
      newlevel 1
    &end
    polygonshades %.basispad%overig/grijs1.cov %greycolor%
    polygonshades %.basispad%overig/grijs2.cov %greycolor%

&end
arcs %.lijnencover%
&if %.oostdld% &then arcs %.basispad%overig/oostdld.cov

/* ================== LOGO's e.d.
plot %.element%logo.ca0.e.plt box ~
  [calc %factor% * 32] [calc %factor% * 11] [calc %factor% * 37] [calc %factor% * 16]
textfont 17
textslant 5
/*textsize [calc %factor% * .5]
textsize [calc %factor% * .3]

/* ================== begeleidende teksten
&do i = 1 &to 7
  move [calc %factor% * 32] [calc [calc %factor% * 21] - %i% * [calc %factor% * 0.8]]
  &if ^ [null [value .text%i%]] &then &do
    text [value .text%i%]
  &end
&end

/* ================== naam
move [calc %factor% * 46] [calc %factor% * 1.5]
textsize [calc %factor% * 0.3]
textslant 0
text [before %.stuurfile% .]

&return

&routine bailing_out
&s .error -1
&return; &return
```

Content of records in file ORGMATTER.KRT
Author : Theo Thewessen, RIVM-LBG/IS

```
/* .titel              : titel van kaart
/* .ccoverage          : te tekenen coverage
/* .selectie           : selectie-commando alvorens te tekenen
/* .shadeitem          : item dat geshade moet worden
/* .luttabel           : te gebruiken look-up-table
/* .keyfile            : te gebruiken legenda-file
/* .grijs              : niet-landbouw-gebied erovereen (boolean)
/* .lijnencover
/* .datum              : datum schrijven (boolean)
/* .draft              : 'draft' schrijven (boolean)
/* .corinelogo         : corinelogo tekenen (boolean)
/* .corinebron         : 'Bron: corine' schrijven (boolean)
/* .rivmcomp           : 'Computations: RIVM' schrijven (boolean)
/* .coverpad           : ai workspace waar coverage, lut en key staan
/* .command1           : user commando1
/* .command2           : user commando2
/* .command3           : user commando3
/* .command4           : user commando4


&setvar .titel       := 'Soil Organic Matter Map of the European Communities'
&setvar .coverpad    := %.basispad%/pesticide1
&setvar .ccoverage   := pestleach.cov
&setvar .selectie    := reselect pestleach.cov poly orgmat.cov-id ne 0 and orgmatter ne 0
&setvar .shadeitem   := orgmatter
&setvar .luttabel    := orgmatter.lut
&setvar .keyfile     := orgmatter.key
&setvar .grijs       := .false.
&setvar .lijnencover := %.basispad%overig/landen.cov
&setvar .datum       := .TRUE.
&setvar .draft       := .TRUE.
&setvar .corinelogo  := .false.
&setvar .text1
&setvar .text2
&setvar .text3 'Scale  1 : 8 000 000'
&setvar .text4
&setvar .text5 'Compilation: RIVM'
&setvar .text6 [quote [date -vfull]]
&setvar .text7 'Source: Soil Map of the EC, Corine'
&setvar .sheettitel1 %.titel%
&setvar .sheettitel2
&setvar .command1
&setvar .command2
&setvar .command3
&setvar .command4
```

Content of records in file ORGMATTER.KEY
Author : Theo Thewessen, RIVM-LBG/IS

```
/* .titel              : titel van kaart
/* .ccoverage          : te tekenen coverage
/* .selectie           : selectie-commando alvorens te tekenen
/* .shadeitem          : item dat geshade moet worden
/* .luttabel           : te gebruiken look-up-table
/* .keyfile            : te gebruiken legenda-file
/* .grijs              : niet-landbouw-gebied erovereen (boolean)
/* .lijnencover
/* .datum              : datum schrijven (boolean)
/* .draft              : 'draft' schrijven (boolean)
/* .corinelogo         : corinelogo tekenen (boolean)
/* .corinebron         : 'Bron: corine' schrijven (boolean)
/* .rivmcomp           : 'Computations: RIVM' schrijven (boolean)
/* .coverpad           : ai workspace waar coverage, lut en key staan
/* .command1           : user commando1
/* .command2           : user commando2
/* .command3           : user commando3
/* .command4           : user commando4


&setvar .titel        := 'Soil Organic Matter Map of the European Communities'
&setvar .coverpad     := %.basispad%/pesticide1
&setvar .ccoverage    := pestleach.cov
&setvar .selectie     := reselect pestleach.cov poly orgmat.cov-id ne 0 and orgmatter ne 0
&setvar .shadeitem    := orgmatter
&setvar .luttabel     := orgmatter.lut
&setvar .keyfile      := orgmatter.key
&setvar .grijs        := .false.
&setvar .lijnencover  := %.basispad%overig/landen.cov
&setvar .datum        := .TRUE.
&setvar .draft        := .TRUE.
&setvar .corinelogo   := .false.
&setvar .text1
&setvar .text2
&setvar .text3 'Scale  1 : 80 000 000'
&setvar .text4
&setvar .text5 'Compilation: RIVM'
&setvar .text6 [quote [date -vfull]]
&setvar .text7 'Source: Soil Map of the EC, Corine'
&setvar .sheettitel1 %.titel%
&setvar .sheettitel2
&setvar .command1
&setvar .command2
&setvar .command3
&setvar .command4
```

APPENDIX IV

Calculations of organic matter content of the upper 30 cm of the profiles described in Soil Taxonomy [2], including their classification according to the FAO/Unesco legend [3]. Classification has been carried out in two steps: (1) an initial classification based on the translation key provided in [3;p14-20, (2) a final classification using profile description [2] and the classification key to the soil units of the FAO\Unesco [3,p43-53] and the key to sub-unit level of the European Communities [6,p5-6].

Table headings

Soil Taxonomy:	classification of pedon according to Soil Taxonomy [2]
FAO/Unesco:	classification of pedon using the FAO/Unesco legend [3]
code:	classification code of FAO/Unesco legend [3]
Landuse:	type of land use as given by [2]
Parentmat:	parent material in which pedon developed [2]
Depth:	depth of described soil layer in cm
OC:	organic carbon content of horizon [2]
OM:	organic matter content of horizon, calculated using factor 1.72
Pedon:	pedon number [2]
Layer:	layer/horizon number
OM-cont:	organic matter content of upper 30 cm of pedon, litter layers excluded.

Soil Taxonomy	**FAO/UNESCO**	**code**	**Landuse**	**parentmat**	**depth**	**OC**	**OM**	**Pedon**	**layer**	**OM-cont 0-30 cm**
Typic Haplustult	Ochric Acrisol	Ao	arable	?	0-23	1.64	2.83	121	1	2.49
		Ao			23-46	0.8	1.38	121	2	
Typic Haploxerult	Ochric Acrisol	Ao	forest	schist	0- 5	4.22	7.28	122	1	3.28
		Ao			5-23	1.71	2.95	122	2	
		Ao			23-56	0.75	1.29	122	3	
Oxic Plinthaquult	Plinthic Acrisol	Ap	arable	coastal	0-25	3.25	5.60	114	1	5.01
		Ap			25-33	1.18	2.03	114	2	
Typic Dystrochrept	Dystric Cambisol	Bd	forest	siltstone	0- 5	5.48	9.45	29	1	2.65
		Bd			5-18	1.13	1.95	29	2	
		Bd			18-33	0.33	0.57	29	3	
Andic Dystrochrept	Ando-Dystric Cambisol	Bda	forest	fluvial	0-15	8.05	13.88	10	1	9.25
		Bda			15-38	2.68	4.62	10	2	
Typic Xerochrept	Eutric Cambisol	Be	grass	tonalite	0- 8	0.96	1.66	79	1	1.06
		Be			8-23	0.56	0.97	79	2	
		Be			23-48	0.34	0.59	79	3	
Typic Eutropept	Eutric Cambisol	Be	bush	andesite	0- 3	2.26	3.90	81	1	2.24
		Be			3-15	1.77	3.05	81	2	
		Be			15-33	0.73	1.26	81	3	
Typic Eutrochrept	Calcaro-Eutric Cambisol	Bec	grass	glacial	0-23	1.46	2.52	78	1	2.05
		Bec			23-38	0.29	0.50	78	2	
Typic Dystropept	Ando-Humic Cambisol *1	Bha	grass	volcanic	0-15	2.28	3.93	80	1	3.13
		Bha			15-33	1.35	2.33	80	2	

Soil Taxonomy	FAO/UNESCO	code	Landuse	parentmat	depth	OC	OM	Pedon	layer	OM-cont 0-30 cm
Typic Haploboroll	Haplic Chernozem	Ch	grass	alluvium	0-10	1.24	2.14	86	1	1.57
		Ch			10-30	0.75	1.29	86	2	
Entic Haplustoll	Haplic Chernozem	Ch	grass	alluvium	0-15	1.43	2.47	94	1	2.11
		Ch			15-38	1.02	1.76	94	2	
Aridic Calcixeroll	Calcic Chernozem	Ck	bush	alluvium	0-10	3.69	6.36	37	1	5.99
		Ck			10-18	3.46	5.97	37	2	
		Ck			18-38	3.31	5.71	37	3	
Typic Calciustoll	Calcic Chernozem	Ck	grass	Loess?	0-20	1.56	2.69	93	1	2.40
		Ck			20-56	1.05	1.81	93	2	
Pachic Calcixeroll	Calcic Chernozem	Ck	grass	shale	0-10	3.9	6.72	97	1	3.57
		Ck			10-41	1.16	2.00	97	2	
Udic Argiustoll	Luvic Chernozem	Cl	grass	limestone	0-08	4.35	7.50	4	1	6.56
		Cl			8-33	3.61	6.22	4	2	
Typic Argiboroll	Luvic Chernozem	Cl	grass	glacial	0-04	4.68	8.07	18	1	2.95
		Cl			4-08	2.6	4.48	18	2	
		Cl			8-20	1.26	2.17	18	3	
		Cl			20-28	1.2	2.07	18	4	
		Cl			28-58	0.77	1.33	18	5	
Typic Palexeroll	Luvic Chernozem	Cl	brush	loess	0-18	4.35	7.50	101	1	5.47
		Cl			18-33	1.41	2.43	101	2	
Aeric Glossaqualf	Gleyic Podzoluvisol	Dg	Forest	loess	0-10	5.54	9.55	11	1	3.80
		Dg			10-23	0.76	1.31	11	2	
		Dg			23-36	0.13	0.22	11	3	
Aeric Glossaqualf	Gleyic Podzoluvisol	Dg	grass	silt	0- 8	7.2	12.41	45	1	3.89
		Dg			8-15	0.89	1.53	45	2	
		Dg			15-25	0.3	0.52	45	3	
		Dg			25-36	0.18	0.31	45	4	
Typic Rendoll	Orthic Rendzina	Eo	brush	limestone	0-15	2.16	3.72	88	1	2.28
		Eo			15-23	0.9	1.55	88	2	
		Eo			23-58	0.022	0.04	89	3	
Typic Acrutox	Acric Ferralsol	Fa	cerrado	slates	0-10	3.42	5.90	32	1	4.38
		Fa			10-30	2.1	3.62	32	2	
Typic Acrorthox	Acric Ferralsol	Fa	bush	serpentin	0-28	6.04	10.41	102	1	9.95
		Fa			28-46	2.04	3.52	102	2	
Haplic Acrorthox	Acric Ferralsol	Fa	forest	clayey	0- 4	2.76	4.76	103	1	1.98
		Fa			4-19	1.13	1.95	103	2	
		Fa			19-87	0.58	1.00	103	3	
Tropeptic Umbriorthox	Humic Ferralsol	Fh	grass	basalt	0-23	4.39	7.57	106	1	6.49
		Fh			23-53	1.72	2.97	106	2	
Typic Gibbsiorthox	Orthic Ferralsol	Fo	grass	igneous	0-38	3.88	6.69	105	1	6.69
Tropeptic Haplorthox	Rhodic Ferralsol	Fr	grass	andesite	0-15	4.3	7.41	33	1	5.22
		Fr			15-33	1.75	3.02	33	2	
Tropepric Eutrorthox	Rhodic Ferralsol	Fr	grass	colluvium	0-20	2.73	4.71	104	1	3.68
		Fr			20-46	0.94	1.62	104	2	

Soil Taxonomy	FAO/UNESCO	code	Landuse	parentmat	depth	OC	OM-cont OM	Pedon	layer	0-30 cm
Typic Torrox	Rhodic Ferralsol	Fr	arable	igneous	0-15	1.92	3.31	107	1	3.35
		Fr			15-38	1.97	3.40	107	2	
Typic Fragiaquept	Dystric Gleysol	Gd	grass	glacial	0-15	3.5	6.03	77	1	3.10
		Gd			15-36	0.1	0.17	77	2	
Histic Humaquept	Humic Gleysol	Gh	gr/for	marine	30-00	29	50.00	8	1	0.28
		Gh			0-10	0.27	0.47	8	2	
		Gh			10-25	0.13	0.22	8	3	
		Gh			25-58	0.06	0.10	8	4	
Typic Haplaquoll	Mollic Gleysol	Gm	arable	alluvium	0-15	1.51	2.60	28	1	2.53
		Gm			15-30	1.42	2.45	28	2	
Typic Calciaquoll	Mollic Gleysol	Gm	?	?				38	1	
Typic Haplaquoll	Mollic Gleysol	Gm	arable	glacial	0-15	4.2	7.24	84	1	5.72
		Gm			15-33	2.44	4.21	84	2	
Mollic Andaquept	Ando-Mollic Gleysol	Gma	grass	alluvium	0- 4	7.71	13.29	76	1	3.61
		Gma			4-13	2.6	4.48	76	2	
		Gma			13-23	0.88	1.52	76	3	
		Gma			23-38	0.34	0.59	76	4	
Typic Argiaquoll	Gleyic Phaeozem	Hg	arable	glacial	0-18	2.09	3.60	17	1	3.29
		Hg			18-25	2.04	3.52	17	2	
		Hg			25-41	1.08	1.86	17	3	
Typic Argiaquoll	Gleyic Phaeozem	Hg	grass	loess	0-18	2.78	4.79	83	1	4.17
		Hg			18-33	1.88	3.24	83	2	
Typic Hapludoll	Haplic Phaeozem	Hh	gr/for	loess	0-20	2.86	4.93	30	1	3.78
		Hh			20-41	0.85	1.47	30	2	
Typic Cryoboroll	Haplic Phaeozem	Hh	bush	sandstone	0-13	10	17.24	85	1	11.18
		Hh			13-23	4.93	8.50	85	2	
		Hh			23-38	2.18	3.76	85	3	
Typic Hapludoll	Haplic Phaeozem	Hh	arable	loess	0-18	2.2	3.79	90	1	3.57
		Hh			18-33	1.87	3.22	90	2	
Pachic Haploxeroll	Haplic Phaeozem	Hh	grass	glacial	0-10	1.55	2.67	99	1	2.34
		Hh			10-25	1.37	2.36	99	2	
		Hh			25-61	0.92	1.59	99	3	
Typic Haploxeroll	Haplic Phaeozem	Hh	brush	limestone	0- 8	2.99	5.16	130	1	4.24
		Hh			8-23	2.36	4.07	130	2	
		Hh			23-41	2.06	3.55	130	3	
Aquic Argiudoll	Luvic Phaeozem	Hl	arable	loess	0-18	2.17	3.74	2	1	3.08
		Hl			18-38	1.21	2.09	2	2	
Typic Argiudoll	Luvic Phaeozem	Hl	arable	loess	0-18	2.35	4.05	89	1	3.71
		Hl			18-28	1.95	3.36	89	2	
		Hl			28-43	1.42	2.45	89	3	
Typic Paleudoll	Luvic Phaeozem	Hl	arable	limestone	0-15	0.87	1.50	91	1	1.41
		Hl			15-23	0.82	1.41	91	2	
		Hl			23-46	0.7	1.21	91	3	

Soil Taxonomy	FAO/UNESCO	code	Landuse	parentmat	depth	OC	OM	Pedon	layer	OM-cont 0-30 cm
Pachic Argiustoll	Luvic Phaeozem	Hl	grass	loess	0-13	2.54	4.38	92	1	3.50
		Hl			13-25	1.8	3.10	92	2	
		Hl			25-41	1.24	2.14	92	3	
Typic Argixeroll	Luvic Phaeozem	Hl	arab_irr	alluvium	0-18	0.89	1.53	96	1	1.40
		Hl			18-53	0.7	1.21	96	2	
Typic Udifluvent	Calcic Fluvisol	Jc	?	alluvium	0-14	1.28	2.21	66	1	1.55
		Jc			14-31	0.57	0.98	66	2	
Typic Torrifluvent	Calcic Fluvisol	Jc	arable	alluvium	0-30	0.92	1.59	67	1	1.59
Typic Argiustoll	Luvic Kastanozem	Kl	arable	loess	0-15	1.17	2.02	1	1	1.72
		Kl			15-30	0.83	1.43	1	2	
Aridic Argiboroll	Luvic Kastanozem	Kl	grass	glacial	0-05	2.06	3.55	3	1	2.04
		Kl			5-13	1.29	2.22	3	2	
		Kl			13-23	0.97	1.67	3	3	
		Kl			23-33	0.74	1.28	3	4	
Aridic Durixeroll	Luvic Kastanozem	Kl	brush	alluvium	0- 5	2.24	3.86	98	1	1.71
		Kl			5-10	1.05	1.81	98	2	
		Kl			10-20	0.75	1.29	98	3	
		Kl			20-30	0.58	1.00	98	4	
Ultic Hapludalf	Albic Luvisol	La	grass	loess	0-13	0.96	1.66	9	1	1.20
		La			13-23	0.64	1.10	9	2	
		La			23-33	0.28	0.48	9	3	
Ultic Hapludalf	Albic Luvisol	La	arable	loess	0-15	0.86	1.48	14	1	1.15
		La			15-23	0.85	1.47	14	2	
		La			23-33	0.046	0.08	14	3	
Typic Cryoboralf	Albic Luvisol	La	forest	alluvium	0-18	0.84	1.45	48	1	1.11
		La			18-30	0.35	0.60	48	2	
Typic Eutroboralf	Albic Luvisol	La	forest	till	5- 0			49	1	0.70
		La			0-13	0.47	0.81	49	2	
		La			13-25	0.38	0.66	49	3	
		La			25-38	0.3	0.52	49	4	
Mollic Haploxeralf	Chromic Luvisol	Lc	grass	tonalite	0-08	2.1	3.62	12	1	2.01
		Lc			8-33	0.83	1.43	12	2	
Typic Durixeralf	Chromic Luvisol	Lc	grass	granitic	0-28	0.3	0.52	53	1	0.50
		Lc			28-38	0.16	0.28	53	2	
Typic Rhodoxeralf	Rhodo-Chromic Luvisol	Lcr	arable	limestone	0-15	1.68	2.90	13	1	2.71
		Lcr			15-23	1.57	2.71	13	2	
		Lcr			23-41	1.34	2.31	13	3	
Typic Albaqualf	Dystric Planosols *2	Lg	forest	clay till	0- 8	6.5	11.21	20	1	4.10
		Lg			8-19	1.11	1.91	20	2	
		Lg			19-28	0.63	1.09	20	3	
		Lg			28-43	0.69	1.19	20	4	

Soil Taxonomy	FAO/UNESCO	code	Landuse	parentmat	depth	OC	OM	Pedon	layer	OM-cont 0-30 cm
Typic Ochraqualf	Gleyic Luvisol	Lg	grass	loess	0-10	1.82	3.14	46	1	1.67
		Lg			10-28	0.57	0.98	46	2	
		Lg			28-38	0.29	0.50	46	3	
Aeric Tropaqualf	Gleyic Luvisol	Lg	grass	alluvium	0-18	1.48	2.55	47	1	2.35
		Lg			18-30	1.19	2.05	47	2	
Typic Paleustalf	Calcic Luvisol	Lk	?	?	0-18	0.87	1.50	52	1	1.42
		Lk			18-41	0.75	1.29	52	2	
Typic Hapludalf	Orthic Luvisol	Lo	grass	glacial	0-18	1.25	2.16	16	1	1.86
		Lo			18-25	1.08	1.86	16	2	
		Lo			25-36	0.45	0.78	16	3	
Psammentic Hapludalf	Orthic Luvisol	Lo	orchard	delta	0-23	1.42	2.45	19	1	2.00
		Lo			23-38	0.31	0.53	19	2	
Typic Agrudalf	Orthic Luvisol	Lo	arable	loess	0-23	1.02	1.76	22	1	1.50
		Lo			23-43	0.37	0.64	22	2	
Glossic Fragiudalf	Orthic Luvisol?	Lo	grass	loess	0-15	0.96	1.66	34	1	1.06
		Lo			15-33	0.27	0.47	34	2	
Typic Hapludalf	Orthic Luvisol	Lo	grass	loess?	0-10	1.74	3.00	50	1	1.80
		Lo			10-28	0.74	1.28	50	2	
		Lo			28-36	0.31	0.53	50	3	
Typic Paleudalf	Orthic Luvisol	Lo	grass	limestone	0-13	1.79	3.09	51	1	1.93
		Lo			13-36	0.61	1.05	51	2	
Typic Palexeralf	Orthic Luvisol	Lo	arable	alluvium	0-18	0.69	1.19	55	1	0.96
		Lo			18-36	0.36	0.62	55	2	
Typic Rhodudult	Dystric Nitosol	Nd	forest	sandstone	0-13	3.36	5.79	119	1	3.22
		Nd			13-23	0.92	1.59	119	2	
		Nd			23-41	0.44	0.76	119	3	
Typic Tropudult	Dystric Nitosol	Nd	grass	volcanic	0-15	2.4	4.14	120	1	2.65
		Nd			15-41	0.67	1.16	120	2	
Typic Tropohumult	Humic Nitosol	Nh	grass	andesite	0-15	5.2	8.97	116	1	6.14
		Nh			15-28	2.01	3.47	116	2	
		Nh			28-48	1.34	2.31	116	3	
Aeric Haplaquod	Gleyic Podzol	Pg	forest	sandy col	0- 8	1.12	1.93	108	1	0.55
		Pg			8-41	0.03	0.05	108	2	
Typic Cryohumod	Humic Podzol	Ph	forest	volcanic	10- 0	42.52	73.31	109	1	12.63
		Ph			0- 5	9.98	17.21	109	2	
		Ph			5-13	11.77	20.29	109	3	
		Ph			13-23	6.66	11.48	109	4	
		Ph			23-33	1.31	2.26	109	5	
Typic Cryorthod	Leptic Podzol	Pl	forest	volcanic	0- 1	5.31	9.16	111	1	1.89
		Pl			1-20	1.22	2.10	111	2	
		Pl			20-43	0.44	0.76	111	3	

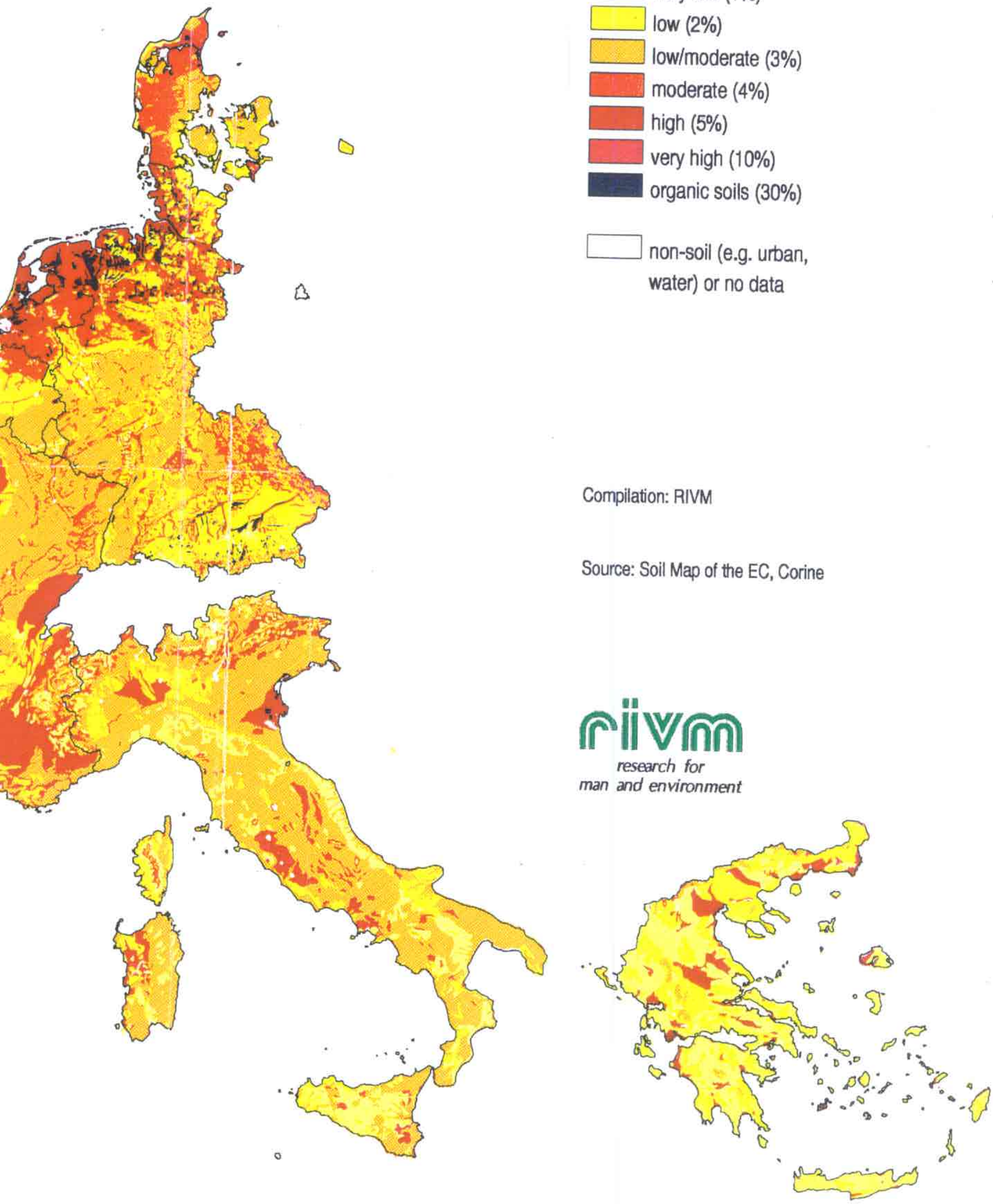
Soil Taxonomy	FAO/UNESCO	code	Landuse	parentmat	depth	OC	OM	Pedon	layer	OM-cont 0-30 cm
Typic Haplorthod	Orthic Podzol	Po	grass	glacial	0-20	3.54	6.10	25	1	5.25
		Po			20-25	3.34	5.76	25	2	
		Po			25-36	0.76	1.31	25	3	
Typic Fragiorthod	Orthic Podzol	Po	forest	glacial	4-00	23	39.66	26	1	3.14
		Po			0- 4	2.16	3.72	26	2	
		Po			4-18	2.34	4.03	26	3	
		Po			18-33	1.5	2.59	26	4	
Alfic Haplorthod	Orthic Podzol	Po	forest	glacial	0-20	2.08	3.59	44	1	3.28
		Po			20-36	1.55	2.67	44	2	
Cryic Placohumod	Placic Podzol	Pp	forest	volcanic	25- 8	50.69	87.40	27	1	25.08
		Pp			8- 0	49.03	84.53	27	2	
		Pp			0- 5	5.11	8.81	27	3	
		Pp			5- 8	6.86	11.83	27	4	
		Pp			8-20	18.12	31.24	27	5	
		Pp			20-30	17.28	29.79	27	6	
Typic Placohumod	Placic Podzol	Pp	bush	aeolian	0-23	0.32	0.55	110	1	1.75
		Pp			23-28	3.46	5.97	110	2	
		Pp			28-33	1.75	3.02	110	3	
Typic Udorthent	Calcaric Regosol	Rc	bush	loess	0- 5	1.16	2.00	68	1	1.20
		Rc			5-25	0.68	1.17	68	2	
		Rc			25-61	0.29	0.50	68	3	
Typic Torripsamment	Eutric Regosol	Re	bush	eolian	0-28	0.15	0.26	69	1	0.26
		Re			28-58	0.15	0.26	69	2	
Typic Ustipsamment	Eutric Regosol	Re	bush	?	0-13	0.3	0.52	70	1	0.32
		Re			13-25	0.11	0.19	70	2	
		Re			25-61	0.07	0.12	70	3	
Typic Natraqualf	Gleyic Solonetz	Sg	arable	loess	0-25	0.51	0.88	24	1	0.90
		Sg			25-36	0.57	0.98	24	2	
Aquic Natrixeroll	Gleyic Solonetz	Sg	brush	alluvium	0- 8	0.77	1.33	100	1	1.20
		Sg			8-20	0.98	1.69	100	2	
		Sg			20-43	0.29	0.50	100	3	
Udic Natriboroll	Mollic Solonetz	Sm	arable	lacutrine	0-15	2.71	4.67	5	1	3.51
		Sm			15-18	2.11	3.64	5	2	
		Sm			18-24	1.25	2.16	5	3	
		Sm			24-30	1.09	1.88	5	4	
Typic Natriboroll	Mollic Solonetz	Sm	grass	alluvium	0- 8	1.82	3.14	87	1	1.78
		Sm			8-18	0.93	1.60	87	2	
		Sm			18-25	0.68	1.17	87	3	
		Sm			25-30	0.47	0.81	87	4	
Typic Natrustoll	Mollic Solonetz	Sm	grass	Loess?	0-13	3.27	5.64	95	1	3.84
		Sm			13-36	1.43	2.47	95	2	

Soil Taxonomy	FAO/UNESCO	code	Landuse	parentmat	depth	OC	OM	Pedon	layer	OM-cont 0-30 cm
Borollic Natrargid	Orthic Solonetz	So	grass	glacial	0- 8	2.82	4.86	23	1	2.12
		So			8-13	0.97	1.67	23	2	
		So			13-18	0.92	1.59	23	3	
		So			18-23	0.54	0.93	23	4	
		So			23-43	0.31	0.53	23	5	
Typic Natrixeralf	Orthic Solonetz	So	grass	alluvium	0-15	1.13	1.95	54	1	1.33
		So			15-36	0.41	0.71	54	2	
Typic Natrargid	Orthic Solonetz	So	grass	alluvium	0- 5	0.4	0.69	58	1	0.59
		So			5-13	0.29	0.50	58	2	
		So			13-28	0.38	0.66	58	3	
		So			28-61	0.13	0.22	58	4	
Typic Cryandept	Humic Andosol	Th	bush	volcanic	0-12	3.56	6.14	71	1	6.10
		Th			12-23	3.68	6.34	71	2	
		Th			23-32	3.28	5.66	71	3	
Oxic Dystrandept	Humic Andosol	Th	grass	volcanic	0-20	8.87	15.29	72	1	12.21
		Th			20-41	3.51	6.05	72	2	
Typic Hydrandept	Humic Andosol	Th	forest	volcanic	0-18	11.7	20.17	74	1	16.62
		Th			18-36	6.55	11.29	74	2	
Hydric Dystrandept	Humic Andosol	Tm	grass	volcanic	0-10	15.43	26.60	6	1	25.84
		Tm			10-30	14.77	25.47	6	2	
Typic Eutrandept	Mollic Andosol	Tm	grass	volcanic	0-23	5.81	10.02	73	1	8.71
		Tm			23-41	2.55	4.40	73	2	
Typic Vitrandept	Vitric Andosol	Tv	forest	volcanic	0-10	5.27	9.09	75	1	4.51
		Tv			10-20	2.12	3.66	75	2	
		Tv			20-41	0.46	0.79	75	3	
Aquentic Chromudert	Chromic Vertisol	Vc	orchard	alluvial	0-18	1.96	3.38	124	1	2.83
		Vc			18-38	1.17	2.02	124	2	
Udic Chromustert	Chromic Vertisol	Vc	grass	alluvial	0-18	1.64	2.83	126	1	2.59
		Vc			18-36	1.29	2.22	126	2	
Typic Chromoxerert	Chromic Vertisol	Vcc	brush	sandstone	0-10	1.85	3.19	128	1	1.91
		Vcc			10-25	0.78	1.34	128	2	
		Vcc			25-36	0.59	1.02	128	3	
Entic Pelludert	Pellic Vertisol	Vp	grass	coastal?	0-18	1.44	2.48	125	1	2.12
		Vp			18-33	0.91	1.57	125	2	
Udic Pellustert	Pellic Vertisol	Vp	arable	alluvial	0-15	1.05	1.81	127	1	1.66
		Vp			15-56	0.87	1.50	127	2	
Typic Torrert	Pellic Vertisol	Vpc	grass	igneous	0- 5	0.58	1.00	123	1	0.74
		Vpc			5-23	0.45	0.78	123	2	
		Vpc			23-48	0.26	0.45	123	3	
Chromic Pelloxerert	Pellic Vertisol	Vpc	grass	tonalite	0-10	1.59	2.74	129	1	1.53
		Vpc			10-46	0.54	0.93	129	2	

Soil Taxonomy	FAO/UNESCO	code	Landuse	parentmat	depth	OC	OM	Pedon	layer	OM-cont 0-30 cm
Typic Albaquult	Dystric Planosol	Wd	forest	?	0-10	2.2	3.79	112	1	2.08
		Wd			10-18	1.17	2.02	112	2	
		Wd			18-25	0.54	0.93	112	3	
		Wd			25-38	0.22	0.38	112	4	
Typic Argialboll	Mollic Planosol	Wm	grass	loess	0-18	2.69	4.64	82	1	3.90
		Wm			18-30	1.62	2.79	82	2	
Typic Camborthid	Haplic Yermosol	Yh	grass	alluvium	0- 8	0.33	0.57	31	1	0.60
		Yh			8-25	0.35	0.60	31	2	
		Yh			25-43	0.38	0.66	31	3	
Typic Camborthid	Haplic Yermosol	Yh	bush	alluvium	0- 3	0.18	0.31	62	1	0.42
		Yh			3-10	0.3	0.52	62	2	
		Yh			10-20	0.26	0.45	62	3	
		Yh			20-28	0.22	0.38	62	4	
		Yh			28-58	0.19	0.33	62	5	
Typic Durorhtid	Haplic Yermosol	Yh	bush	alluvium	0- 3	0.11	0.19	63	1	0.22
		Yh			3-10	0.08	0.14	63	2	
		Yh			10-41	0.15	0.26	63	3	
Typic Calciorthid	Calcic Yermosol	Yk	bush	alluvium	0- 5	0.19	0.33	36	1	0.37
		Yk			5-10	0.23	0.40	36	2	
		Yk			10-23	0.23	0.40	36	3	
		Yk			23-36	0.2	0.34	36	4	
Typic Calciorthid	Calcic Yermosol	Yk	bush	aeolian	0-15	0.02	0.03	61	1	0.07
		Yk			15-41	0.06	0.10	61	2	
Typic Paleorthid	Calcic Yermosol	Yk	bush	alluvium	0- 3	0.12	0.21	64	1	0.18
		Yk			3-10	0.09	0.16	64	2	
		Yk			10-23	0.1	0.17	64	3	
		Yk			23-36	0.12	0.21	64	4	
Petrocalcic Paleargid	Luvic Yermosols	Yl	bush	alluvium	0- 1	0.44	0.76	40	1	0.87
		Yl			1- 5	0.29	0.50	40	2	
		Yl			5-15	0.37	0.64	40	3	
		Yl			15-28	0.74	1.28	40	4	
		Yl			28-30	0.15	0.26	40	5	
Typic Durargid	Luvic Yermosols	Yl	grass	alluvium	0- 5	0.35	0.60	56	1	0.49
		Yl			5-15	0.29	0.50	56	2	
		Yl			15-23	0.26	0.45	56	3	
		Yl			23-30	0.26	0.45	56	4	
Typic Haplargid	Luvic Yermosols	Yl	bush	colluvium	0- 3	0.98	1.69	57	1	0.57
		Yl			3-12	0.26	0.45	57	2	
		Yl			12-23	?		57	3	
Typic Paleargid	Luvic Yermosols	Yl	grass	alluvium	0- 5	0.25	0.43	59	1	0.62
		Yl			5-15	0.33	0.57	59	2	
		Yl			15-28	0.43	0.74	59	3	
		Yl			28-53	0.34	0.59	59	4	

Soil Taxonomy	FAO/UNESCO	code	Landuse	parentmat	depth	OC	OM	Pedon	layer	OM-cont 0-30 cm
Petrocalcic Paleargid	Luvic Yermosols	Yl	bush	fluvial	0- 5	0.25	0.43	60	1	0.28
		Yl			5-18	0.13	0.22	60	2	
		Yl			18-25	0.17	0.29	60	3	
		Yl			25-36	0.14	0.24	60	4	
Typic Gypsiorthid	Gypsic Yermosol	Yy	bush	alluvium	0-0.5	1.27	2.19	39	1	1.33
		Yy			0.5-5	0.96	1.66	39	2	
		Yy			5-13	0.93	1.60	39	3	
		Yy			13-33	0.63	1.09	39	4	
Typic Salorthid	Orthic Solonchak	Zo	grass	alluvium	0- 5	0.1	0.17	41	1	0.29
		Zo			5-15	0.17	0.29	41	2	
		Zo			15-25	0.2	0.34	41	3	
		Zo			25-58	0.16	0.28	41	4	
Typic Salorthid	Orthic Solonchak	Zo	bush	alluvium	0-11	0.69	1.19	65	1	0.95
		Zo			11-15	0.38	0.66	65	2	
		Zo			15-20	0.6	1.03	65	3	
		Zo			20-36	0.44	0.76	65	4	

uropean Communities



Soil Organic Matter Map of the European Communitie