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EuroGeoSurveys Geochemical mapping of agricultural and grazing land soil of Europe (GEMAS) - Field manual

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REPORT

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EuroGeoSurveys Geochemical mapping of agricultural and grazing land soil of Europe (GEMAS) - Field manual

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Summary:
REACH (Registration, Evaluation and Authorisation of Chemicals), the new European Chemicals Regulation was adopted in December 2006. It came into force on the 1st June 2007. REACH, as well as the pending EU Soil Protection Directive, require additional knowledge about "soil quality" at the European scale. The GEMAS (geochemical mapping of agricultural soils and grazing land of Europe) project aims at providing harmonized geochemical data of arable land and land under permanent grass cover at the continental, European scale. Geological Surveys in 34 European countries, covering an area of 5.6 million km^2, have agreed to sample their territory at a sample density of 1 site each, arable land (0-20 cm) and land under permanent grass cover (0-10 cm), per 2500 km^2. Sampling will take place during 2008, following a jointly agreed field protocol which is presented in this report. All samples will be prepared in just one laboratory, a strict quality control procedure has been established and all samples will always be jointly analyzed in just one laboratory for any one chemical element/parameter.

Keywords: geochemical mapping	agricultural soil	arable land
continental scale	international cooperation	grazing land
permanent grassland	field handbook	

CONTENTS

GEMAS SAMPLING IN SHORT

1 site each, agricultural soil (arable land) (Ap) and grasing land (land under permanent grass cover) (Gr) per 2500 km^2
Sample numbers: three digits country code, three digits sample number, 2 digits material
e.g., GER001Ap and GER001Gr for the first cell sampled in Germany.
Use the same sample number for each pair of arable and permanent grass land soils.
Take a DUPLICATE of each sample type at every 20^{th} sample site and clearly mark the duplicate with the same sample number and an additional "D" at the end.

ATTENTION: DO NOT WEAR ANY JEWELLERY DURING SAMPLING; NO GOLD RING!

SMOKING IS NOT PERMITTED DURING SAMPLING

Each sample is a composite of 5 subsamples (minimum).

Sample Materials:

- Ap horizon agricultural soils (arable land), 0-20 cm.
- TOP 10 cm on grazing land, only living vegetation removed

Sampling:

- use only the RILSAN bags
- use only black water resistant markers for writing on the bag
- write sample number also on the provided small tag, put it into a ziplock bag and put it on top of the sample in the RILSAN bags.
- close bags firmly with the provided stripes (ATTENTION, these bags cannot be opened again without destroying them).

Field documentation:

- fill out field sheets
- 3-4 photos each, ALWAYS start with a photo of the site number. Additional at least one photo of the soil profile (with scale), one photo of vegetation (with scale – permanent grass land), and one photo of general landscape.
- Coordinates: WGS 84, geographical coordinates in degrees, minutes, seconds (make sure that you GPS is turned to "WGS84").

Mark all sample sites also on geographical maps.

1. INTRODUCTION

The administration of REACH[1] (Registration, Evaluation and Authorisation of Chemicals), the new European Chemicals Regulation was adopted in December 2006, and came into force on the 1st June 2007, as well as the pending EU Soil Protection Directive, require additional knowledge about "soil quality" at the European scale. REACH specifies that industry must prove that it can produce and use its substances safely. Risks due to exposure to a substance during production and use at the local, regional and European scale all need to be assessed. In contrast to human-made organic substances that do not occur naturally in the environment, all industries dealing with natural resources will face a number of specific problems:

- Most of their "products" occur also naturally – the natural geochemical background variation needs to be established, therefore, in addition to a methodology to differentiate the industrial impact from the natural geogenic background.
- What is the "bioavailability" of metals and other chemical elements in soil?
- What is the long-term fate of metals and other chemical elements added to the soil?

Geological Surveys have been documenting the natural geochemical background variation of chemical elements in a variety of sample materials for more than 40 years. However, the existing exposure data at the national and regional scales are often not comparable at the European scale (different sampling strategies, different materials and equipment used for sampling and sample preparation, different sample preparation protocols, different analytical protocols, *etc*.), and are not able to provide a harmonised pan-European geochemical "background". A reference network is, therefore, needed, where local data can be tied into European scale data. The EuroGeoSurveys Geochemical Atlas of Europe (FOREGS dataset, Salminen *et al*., 2005; De Vos *et al.*, 2006) has demonstrated that low-density geochemical mapping can provide the needed information about the geochemical background in natural soil, stream water, stream and floodplain sediments. Systematic geochemical data on agricultural soil at an internationally comparable level only exist for a few (10) countries in northern Europe (Reimann *et al.*, 2003), and data on grazing land soil are completely missing. Two older FAO studies attempted to provide values for a selection of elements in agricultural soils and agricultural products on an almost global scale (Sillanpää, 1982; Sillanpää and Jansson, 1992).

Food production and quality depend on the properties of arable and permanent grass land soil. It is widely neglected that on the continental scale the natural variability of chemical elements in soil spans several orders of magnitude (Reimann *et al.*, 2003; Salminen *et al.*, 2005; De Vos *et al.*, 2006; or refer to the soil geochemical maps of the Geochemical Atlas of Europe at: http://www.gtk.fi/publ/foregsatlas/). In agricultural sciences, the focus is on the major nutrients in soil, and soil functions for food production. In environmental sciences today, much of the political attention is focussed on "too high", toxic, element concentrations in soil. For a number of elements, maximum admissible concentrations have been defined for agricultural soil or sewage sludge used as fertiliser. It is not realised that often "too low", deficient element concentrations, will have a more severe influence on productivity, plant and animal, and last but not least, human health. A sound documentation of element concentrations and their variation in arable and permanent grass land soil at the pan-European

[1] http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm
http://ecb.jre.it/reach

scale is needed, before political actions are taken. Such data at the continental scale are also urgently needed in forensic chemistry. For example, regional differences can be used to trace the origin of food. The project will deliver good quality and comparable exposure data of metals in agricultural and grazing land soil, and of properties determining the bioavailability and toxicity of metals (and other elements) in soil at the European scale.

It is often argued that local variations in soil types, agricultural practice and chemistry are far too high to allow for geochemical mapping at the European scale. However, two recent projects of the European Geological Surveys have demonstrated the opposite. The EuroGeoSurveys Geochemical Atlas of Europe (EGAE - Salminen *et al.*, 2005; De Vos *et al.*, 2006) demonstrates that low-density geochemical mapping (1 sample site / 5000 km^2, *c*. 900 sample sites covering 4,500,000 km^2) at the European scale is possible for a variety of sample materials, including surface water, stream and floodplain sediments and soil (surface and subsurface). It has revealed important information about large-scale differences in the natural concentration, and variation, of chemical elements in the surface environment. The Baltic Soil Survey (BSS - Reimann *et al.*, 2003) samples were collected at a density twice as high as that used for the Geochemical Atlas of Europe (1 site / 2500 km^2, 1,800,000 km^2, *c*. 750 sample sites in 10 northern European countries). This project has revealed significant information even for agricultural soil, thus, geochemical mapping at the European scale can and should be carried out.

An important part of the project is the establishment of a "soil sample archive" showing the status of European agricultural and grazing land soil in the year of collection. Such an archive of samples at the European scale is invaluable in case of catastrophic events, or if industry has to provide evidence of "natural conditions" at a certain time. Many Geological Surveys have been in existence for more than 150 years, and they are among the few European organisations that can undertake a project at this scale, and guarantee the long-term storage and availability of such a sample archive.

2. FIELD SAMPLING METHODOLOGY

Two quite different sample materials in each 2500 km^2 cell at the European scale will be collected:

- The ploughing layer (Ap-horizon) on agricultural lands (arable lands), *i.e.*, a "TOP" soil sample, 0 - 20 cm (note that 20 - 25 cm is the most widely used ploughing depth in large parts of Europe), and
- The topmost part of soil on grazing land (permanent grassland): TOP 10 cm ATTENTION: this is really from TOP and **not** the soils scientists "0" with the organic layer removed.

These two soil types combined represent the substrate for the vast majority of agricultural food production in Europe – the grains and tubers, the meat and diary food chains.

Sample density will be the same as that used for the BSS-project, 1 site / 2500 km^2. The survey area with a 2500 km^2-grid is shown in Figure 1. At present 34 European countries, covering an area of 5.6 million km^2 have agreed to participate in the project. At complete coverage this results in 2240 sample sites per soil type. For quality control purposes at every 20th site a field duplicate sample will be taken and analytical duplicates will be produced from these field duplicate samples, furthermore a project standard and some international reference materials will be inserted, resulting in approximately 2700 samples per material or 5400 samples to be analysed for the project. The exact number of samples per country according to size is provided in Table 1. The samples should be as evenly placed within each country as possible. Consequently, this low density allows sample collection evenly spread over all of Europe, even in parts with little agriculture, because it will be possible to find suitable sample sites, even in the less utilised areas, in a 2500 km^2 grid cell. At this sample density, major geochemical patterns, and differences, at the European scale will be revealed, as has been demonstrated by the BSS and EGAE projects (Reimann *et al.*, 2003; Salminen *et al.*, 2005; De Vos *et al.*, 2006). At the same time this approach will supplement the EuroGeoSurveys geochemical database, and sample archive, with two "new" sample materials collected at doubled density.

Agricultural (arable land) and grazing land soils (soil under permanent grass cover) are easy to recognise and to collect at the European scale (road access). The collection of soil, according to land use and depth, does not necessarily require specialist soil science knowledge, although sampling by a trained geochemist or soil scientist is preferred. Site selection criteria and sample collection instructions can be kept simple. These are important considerations, influencing the quality and comparability of samples, when scientists from over 30 different European countries with many different languages, and a major diversity in scientific education, are carrying out the sampling for European scale geochemical mapping.

Country	C.-Code	Letter of Intent received	Area km^2	Required sample density 1/2500 km^2			Field days
				arable land	perma-nent grass cover	Field duplicates	(at 3 sites/ day)
Albania	ALB	YES	28,748	**11**	**11**	**0**	**4**
Austria	AUS	YES	83,859	**34**	**34**	**2+2**	**12**
Belarus	BRU	miss	207,595	**83**	**83**	**4+4**	**28**
Belgium	BEL	YES	30,518	**12**	**12**	**1+1**	**4**
Bosnia & Herzeg.	BOS	miss	51,209	**20**	**20**	**1+1**	**7**
Bulgaria	BUL	YES	111,002	**44**	**44**	**2+2**	**15**
Croatia	CRO	YES	56,538	**23**	**23**	**1+1**	**8**
Czech Rep.	CZR	YES	78,860	**32**	**32**	**1+1**	**11**
Cyprus	CYP	YES	9,251	**4**	**4**	**0**	**2**
Denmark	DEN	YES	43,094	**17**	**17**	**1+1**	**6**
Estonia	EST	miss	43,432	**17**	**17**	**1+1**	**6**
Finland	FIN	YES	304,530	**122**	**122**	**6+6**	**41**
France	FRA	YES	543,965	**218**	**218**	**11+11**	**73**
F.Y.R.O.M.	FOM	miss	25,713	**10**	**10**	**0**	**3**
Germany	GER	YES	357,027	**143**	**143**	**7+7**	**48**
Hellas	HEL	YES	131,626	**53**	**53**	**3+3**	**18**
Hungary	HUN	YES	93,029	**37**	**37**	**2+2**	**12**
Ireland	IRL	YES	70,273	**28**	**28**	**1+1**	**9**
Italy	ITA	YES	301,336	**121**	**121**	**6+6**	**40**
Latvia	LAV	miss	64,589	**26**	**26**	**1+1**	**9**
Lithuania	LIT	YES	65,300	**26**	**26**	**1+1**	**9**
Luxemburg	LUX	YES	2,586	**1**	**1**	**0**	**1**
Malta	MAL	not rel.	316	**0**	**0**	**0**	**0**
Moldova	MLD	miss	33,700	**13**	**13**	**0**	**4**
Montenegro	MON	YES	13,812	**6**	**6**	**0**	**2**
Norway	NOR	YES	386,308	**155**	**155**	**8+8**	**52**
Netherlands	NEL	miss	33,873	**14**	**14**	**1+1**	**5**
Poland	POL	YES	312,685	**125**	**125**	**6+6**	**42**
Portugal	PTG	YES	91,906	**37**	**37**	**2+2**	**12**
Romania	ROM	YES	238,391	**95**	**95**	**5+5**	**32**
Serbia	SRB	YES	88,361	**35**	**35**	**2+2**	**12**
Slovakia	SKA	YES	49,035	**20**	**20**	**1+1**	**7**
Slovenia	SLO	YES	20,173	**8**	**8**	**0**	**3**
Spain	SPA	YES	504,790	**202**	**202**	**10+10**	**67**
Sweden	SWE	YES	410,934	**164**	**164**	**8+8**	**55**
Switzerland	SIL	YES	41,285	**17**	**17**	**1+1**	**6**
U.K.	UNK	YES	343,820	**138**	**138**	**7+7**	**46**
Ukraine	UKR	YES	603,628	**241**	**241**	**12+12**	**80**
Total			***5,6 mill.***	***2441***	***2441***	***467***	***818***

Table 1. Countries invited to participate in the project, size of each country in km^2, number of samples per material and estimated field days needed for sampling. Countries that have formally agreed to participate in the project have sent an official letter of intent to do the sampling in their territory (some countries have only promised to take the samples, the letter of intent is still missing (miss).

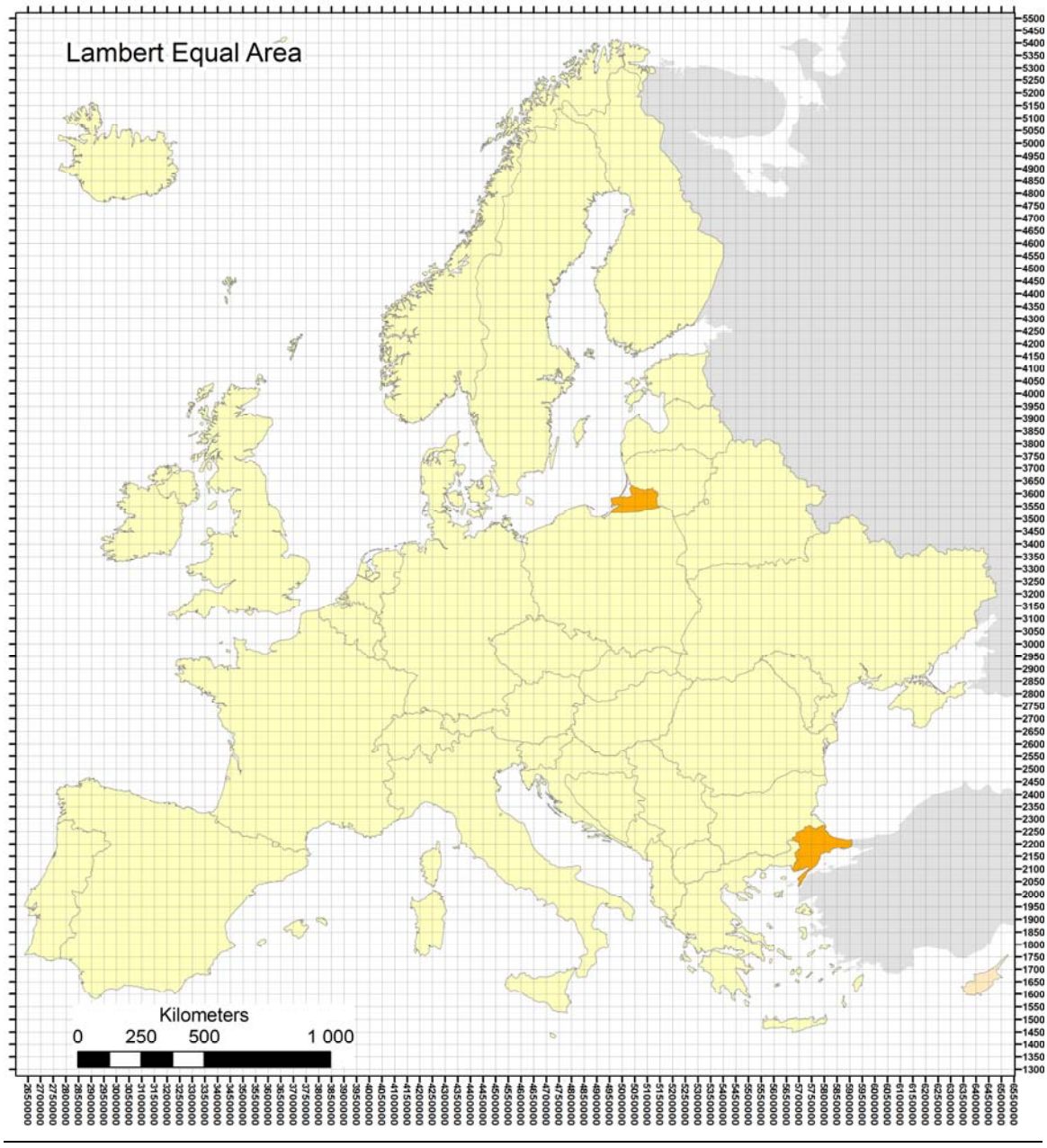


Figure 1. GEMAS survey area and 2500 km^2 grid cells.

All samples will be taken as rather large (2 - 2.5 kg) composite samples from one large field (meadow); minimum size of field should be about 25 x 50 m. At each sample site, GPS coordinates and field observations will be recorded. Sample sites will be also documented by a set of high resolution digital photographs; at least one showing the general landscape, and a second a close-up of a soil profile at the sample site. All field teams will be provided with the same sampling bags, purchased from the same source to avoid any sample contamination issues. The samples will be placed directly in clear plastic Rilsan® bags, which are trace element free, and even suitable for taking samples for the analysis of organic pollutants.

All soil samples will be air dried and sieved to <2 mm (the standard fraction used in soil sciences) prior to analysis at the same central preparation laboratory. Most of the subsequent analyses will be carried out on this size fraction. Organic matter (LOI as proxy, total C preferred; H, N-analyses, grain size distribution) and pH will be determined on all soil samples. All samples will also be analysed using mid infrared spectroscopy (MIR), which is a

cost-effective technique to predict a wide range of chemical and physical soil properties quickly and easily.

As the next laboratory step, all samples should undergo an aqua regia digestion, followed by a standard ICP-AES/ICP-MS multi-element analysis package. The next analytical step is the measurement of total element concentrations on milled samples (XRF or multi-acid-extraction). For forensic chemistry, analysis of some of the more important isotope systems (Sr, Pb, Cu, Fe, Zn) would add valuable information (multi-collector ICP-MS work). K_d-values for the most important metals need to be determined and mapped at the European scale, however the determination of K_d-values is very costly and can thus only be carried out on a subset of all samples. The selection of samples for this very costly technique will be based on the MIR results.

For the preparation of a homogeneous and harmonised database, all analyses for a certain set of parameters MUST be carried out in one laboratory only. External quality control, independent of the laboratories, and consisting of randomising all samples, insertion of field and analytical duplicates, a project reference sample and some international reference materials, all un-recognisable by the laboratories, will be an important part of the project. All analyses will have to pass quality criteria, agreed upon by contract with the laboratories, before being accepted (and paid for).

2.1 Sample Materials

(a) **Agricultural soil (arable land)**: Ap-horizon, 0 - 20 cm.

(b) **Grazing land soil (permanent grassland)**: TOP 10 cm.

Composite soil samples shall be taken of 2 - 2.5 kg each, and packed in a Rilsan® bag (centrally provided). Every country is of course free to collect additional samples, *e.g.*, complete soil profiles, but only the two samples above will represent the "official" project samples.

2.2 Sample site selection

The whole project area can be covered by a grid of 50 x 50 km with an area of 2500 km^2 per grid cell as shown in Figure 1. The grid cells are only used for field planning purposes to provide an impression how an even spacing of sample sites over Europe could look like. Do not stick too closely to any grid, the grid is just shown as a demonstration of an even coverage at the selected density. For sampling the main task is to fill each country's territory as even as practically possible with the necessary number of sites as provided in Table 1. The number of sites per material is each country's territory divided by 2500. It does not really matter where exactly a sample is taken when taking 1 site per 2500 km^2! Samples need to be taken where there is arable land (and/or land under permanent grass cover), whatever the grid. This is a very practical approach where every country decides how to best spread the number of samples over its territory. “Clusters of samples” with big gaps in between should be avoided, the samples should be “well spread”. Whether a country uses a grid or not is up to the country coordinator. In Norway the grid is only used as a first approximation for “spreading” the

samples evenly over Norway. Countries with a long coastline or many islands may have to take some additional samples for a better coverage. One sample of agricultural soil (0-20 cm), and a soil sample from grazing land (TOP 10 cm) shall be taken per 2500 km^2. The coordinates of the grid cells shown in Figure 1 were provided to all project participants for planning purposes.

Within each 2500 km^2-cell, the people in the field are free to decide where to take the samples. There are, however, certain requirements that should be taken into account when selecting a suitable site:

(a) Arable land (Agricultural land) soil sample site

Minimum size of plot: 25 x 50 m, regularly ploughed agricultural field (arable land). The field shoild NOT be in a landscape depression, and it should in general be as flat as possible.

The main aim of the project is to detect and to map the natural element variation at the European scale. Soil samples should, thus, NEVER be taken:

- ✖ At known contaminated sites,
- ✖ In the immediate vicinity of industry or power plants (minimum distance 2000 m),
- ✖ Directly besides a railway line or a major road (minimum distance 200 m),
- ✖ Directly below high power electric lines or near to pylons (minimum distance 100 m).

In addition, the plot should NOT have been recently (within the last few weeks prior to sampling) fertilised (general rule: *if you still smell it, do not take it*!).

Remember that at this scale, and with the given low sample density, every single contaminated site will seriously influence the resulting geochemical map. <u>In general, the aim of the project is to collect the "most representative" sample per 2500 km^2 cell, and not the "most unusual" sample or anything "special".</u>

(b) Land under permanent grass cover (Grazing land) soil sample site

A sizeable plot of grazing land (land under permanent grass cover) is selected, preferably with NO cattle on it at the time of sampling. *Note that agricultural fields (regularly ploughed) where the crop is grass do NOT count as "grazing land" (no permanent grass cover, such a field would qualify as "arable land")*. The plot of land should not be in a landscape depression, and preferably not on a steep slope. If no "real" grazing land is available within the 2500 km^2 cell, then any plot with an undisturbed permanent grass (vegetation) cover is acceptable, provided that for more than the last 10 years ploughing shall not have disturbed the soil at this particular site.

Also these soil samples should NEVER be taken:

- ✖ At known contaminated sites,
- ✖ In the immediate vicinity of industry or power plants (minimum distance 2000 m),
- ✖ Directly besides a railway line or a major road (minimum distance 200 m),
- ✖ Directly below high power electric lines or near to pylons (minimum distance 100 m).

In Mediterranean countries, most of the grazing land is for sheep and goats. This type of grazing land is characterised by bushes, and grass-covered areas are patchy. An attempt

should, therefore, be made to collect samples from such permanently grass (vegetation)-covered areas.

In karstic terrain the grass-covered grazing land occurs in depressions, where soil accumulates. This is an exceptional case where grazing land soil from depressions could be sampled.

2.3 Sample equipment

The following sample equipment will be needed in the field:

- Steel spade, if painted the paint must be removed by sandblasting prior to sampling
- Stainless steel saw knife
- Rilsan® sample bags (provided centrally)
- Strip-locks for the sample bags (attention, the locks cannot be opened again once closed!) (provided centrally)
- Scalebar for "surface" photographs (provided centrally)
- Small cardboard cards for sample number (provided centrally)
- Zip-lock bag for sample number card (provided centrally)
- Field observation sheets (please print out yourself)

Additional sample equipment needed by each field team:

- GPS [for recording the sample site coordinates (geographical coordinates: degrees, minutes, and seconds)]
- Maps (topographical maps, preferred scale 1:50,000) for recording sample sites in case of later discussions of the GPS coordinates
- Digital camera for required field documentation (minimum 5 megapixels)
- Permanent drawing ink marker (ONLY black colour allowed – provided centrally)
- Plastic or heavy duty cardboard boxes for packing samples.

2.4 Sampling

ATTENTION: The samples will be analysed for Ag, Au, and Pd – Therefore, it is not allowed to wear any jewellery or rings when sampling! Please pay great attention to this "little", but very important, detail.

SMOKING is NOT PERMITTED during sampling.

Composite soil sample

Establish a 10 x 10 m square at the selected plot (Figure 2).

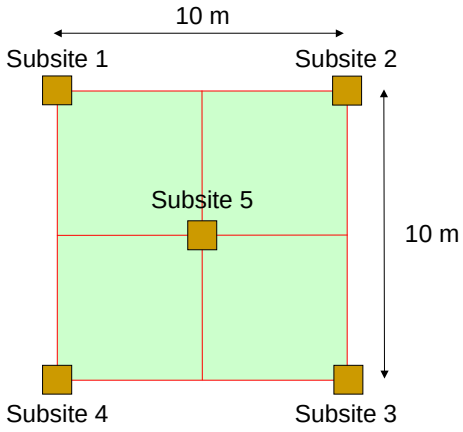


Figure 2. Composite soil sampling scheme. Soil samples are composited from 5 subsites from a 10 x 10 m square plot according to the above scheme.

Samples are then taken from each corner and the centre of the square and composited to provide 1 large field sample from the site, which is directly placed into the provided Rilsan® bag. NO other bag or material should come in contact with the soil samples. The soil samples MUST go directly into the Rilsan® bags in the field, and the bags securely closed with a zip-lock immediately after collection. The provided Rilsan® bags hold 2 - 2.5 kg of soil when half-full (up to the centre of the white label).

Sample numbers

The sample numbers will be alphanumerical:

- A three digit code identifying the country of origin (as given in Table 1),
- A three-digit sample number, and
- A code identifying the sample type [Ap for agricultural soil, ploughed (0-20 cm), and Gr for grazing land soil (0-10 cm)].
- In case of duplicate samples an additional "D" at the end of the number.

Following sample preparation, all soil samples will be randomised for quality control reasons, and receive new laboratory numbers. Samples of agricultural and the grazing land soil, taken within the same grid cell, shall be given the same field number – the sample type code (Ap or Gr) is used to differentiate the two sample types.

(a) Agricultural soil sampling

(1) "Clean" the spade by sticking it several times into the soil at the new sample site.
(2) Establish the 10 x 10 m grid for taking the five subsamples of the composite sample (Figure 2). Avoid local depressions. The plot should be as flat as possible.
(3) Write (a) the sample site number on the Rilsan® bag, e.g., GER001Ap, and (b) the same sample site number on one of the small cards provided. Place the card into one of the small ziplock bags provided.
(4) Dig a soil profile to establish soil type and horizons, and ploughing depth. The depth of the pit should reach into the second soil horizon.
(5) Cut a spade wide square *c*. 20 cm deep soil section at each corner and the centre of the sample grid (Figure 2). Take a composite soil sample from these 5 subsites (it is easiest to use the knife to cut a slice from each of the 5 samples), and place each subsample directly into the Rilsan® bag. Large rock fragments should be removed from the sample before placing it into the Rilsan® bag. The final sample volume

(6) Record all necessary information on the field observations sheet. The correct coordinates are of utmost importance, use geographical coordinates only, WGS84 system. Degrees, minutes and seconds should be recorded.
(7) Mark the sample site on the 1:50,000 topographical map, and check that the GPS coordinates are correct. *This is a very important routine check that must be performed, before leaving each site*.
(8) Take all necessary digital photographs to document site conditions. At each site take the photographs in the following order:
    (a) A close-up of the sample site number card (Figure 3a) ATTENTION FOR SECURE IDENTIFICATION THIS MUST ALWAYS BE THE FIRST PHOTO;
    (b) The soil profile with the EuroGeoSurveys project scale card (if necessary take two photographs a normal photograph and one with fill-in flash) (Figure 3b).
    (c) A landscape photograph or photographs showing local conditions (Figure 3c).
    (d) Take any other photographs you deem necessary (take rather a photo too much than to few photos- Fig. 3d – it is important to document any peculiarities, *i.e.*, distant major road, power lines, *etc*).

Fig. 3a Close-up of sample number of the first test sample site on arable land. This MUST always be the first shot in a series of field photos. Make sure that the number is readable!

Fig. 3b Soil profile at first test sampling site GER001Ap. Note that soil scientists would usually fix the scale in the upper left corner of the photograph with the "0" of the scale at the top of the first minerogenic soil horizon.

Fig. 3c General landscape, field training site GER001Ap. This photo provides a more realistic impression of the landscape situation than Fig. 3d, showing a special site feature. The correct procedure is to take both photos, a good photo of the general landscape (like this one) and a photo of the "special feature", the high voltage power line.

Fig. 3d Additional photo, field training site GER001Ap. This photo shows the "special feature" at this site, the high voltage power line crossing the field. However, note that this photo does not really provide a good impression of the "general landscape". To get a more realistic impression of the landscape situation at this site the combination with the Google Earth shot (Figure 6a) is needed (or additional field photos – Fig. 3c.

It is important to follow the order of the photos and always start with the close-up of the site number. In case you have made a mistake, erase all photographs and start from the beginning.

(b) Grazing land soil sampling

(1) "Clean" the spade by sticking it several times into the soil at the new sample site.
(2) Establish the sub-sites for taking the five subsamples of the composite sample (Figure 2). Avoid local depressions and very steep gradients.
(3) Write (a) the sample site number on the Rilsan® bag, e.g., GER001Gr, and (b) the same sample site number on one of the small cards provided. Place the card into one of the small ziplock bags provided.
(4) Dig a soil profile to establish soil type and horizons. The pit should reach and show the second soil horizon.
(5) Cut a spade wide square *c*. 20 cm deep soil section at each subsite (Figure 2). Use the stainless steel saw knife to remove the green grass at top of the sample, but do not remove the grass roots. Then use the knife to cut off the living vegetation and a slice the uppermost 10 cm of the soil. Take a composite soil sample from these 5 subsites, and place each subsample directly into the Rilsan® bag. Large rock fragments should be removed from the sample before placing it into the Rilsan® bag. The final sample volume should be approximately a half full bag (up to the centre of the white label). If 5 subsamples are not enough to obtain the required 2 – 2.5 kg of material, take more subsamples from spots near the selected subsites.

Do not place more material into the Rilsan® bag, because it is important that it can be securely locked! Place the closed ziplock bag with the card for the sample number inside the bag and on top of the sample. Close the Rilsan® bag securely with one of the provided strip-locks.

(6) Record all necessary information on the field observations sheet.

(7) Mark the sample site on the 1:50,000 topographical map, and check that the GPS coordinates are correct. *This is a very important routine check that must be performed, before leaving each site*.

(8) Take all necessary digital photographs to document site conditions. At each site take the photographs in the following order:
   (a) A close-up of the sample site number card (Figure 4a) ATTENTION: THIS MUST ALWAYS BE THE FIRST PHOTOGRAPH;
   (b) Soil section with the EuroGeoSurveys project scale card (if necessary take two photographs a normal photograph and one with fill-in flash) (Figure 4b).
   (c) A close-up of the soil surface showing the type of vegetation, including the EuroGeoSurveys project scale bar on the left-hand-side of the photograph (Figure 4c);
   (d) Landscape photograph or photographs showing local conditions – it is important to document any peculiarities, *i.e.*, distant major roads, power lines, *etc* (Fig. 4d).
   (e) Take any other photographs you deem necessary to best document the field situation (Fig. 4e).

Fig. 4a Close-up of sample number of the first test sample site on permanent grass land. This MUST always be the first shot in a series of field photos at any new site. Make sure that the site number is readable!

Fig. 4b Soil profile at first permanent grass land sampling site GER001Gr.

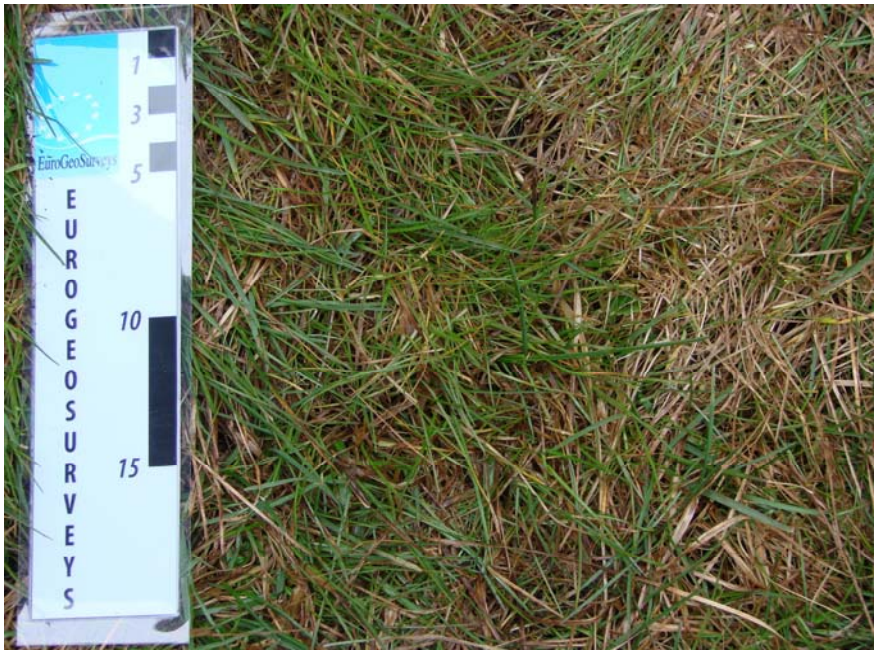


Fig. 4c Close-up of vegetation at the first permanent grass land sample test sample site in Germany, GER001Gr. Select a typical patch of vegetation and use the scalebar as the left hand border of the photo.

Fig. 4d General landscape at the permanent grassland test sample site in Germany, GER001Gr.

Fig. 4e) An additional landscape photo shows the motorway in the far distance.

It is again stressed that it is important to follow above order of taking photos, the first shot MUST be the site number to allow clear identification of all following photographs. In case you have forgotten to take this photo first, erase all photographs and start from the beginning.

(c) Duplicate soil sampling

At every 20th sample site, or, in small countries with more than 10, but less than 20 sample sites, at one of the sample sites, a duplicate agricultural and grazing land soil sample should be collected, following again above procedures (same plot of land, but different sub-sites). The duplicates shall be clearly marked as a duplicate of the routine sample (identified by the same site number, and coded with a suffix D, *i.e.*, for agricultural soil GER020ApD, and for grazing land soil GER020GrD) on the card that is placed into the sample bag, recorded on the field observation sheets. Use exactly the same coordinates for these samples as for the original samples.

The duplicates shall be clearly marked as a duplicate of the routine sample on the bag (D) and please note on the Field Observation sheets that a duplicate was taken at this site.

2.4.1 Field documentation

The photographs, field observations sheets (for two completed examples from the field training course see Figures 5a,b) and the topographical maps are part of the necessary field documentation. In case you are able to provide an overview shot of the sample site, e.g., from Google Earth (see Figures 6a,b of the German test sites) please do so.

Field photographs

As described above, at each site a set of digital photographs is taken (do please check photograph quality at site! If the photograph is not of sufficient quality, erase it and take another). Please do ALWAYS follow the same sequence, starting with a close-up of the site number

- A close-up of the card with the sample site number
- A photograph of the soil profile dug up for checking site conditions with the EuroGeoSurveys project scale bar on the left-hand-side.
- A close-up of the soil surface (agricultural site) or of the grass cover (grazing land site) including the EuroGeoSurveys project scale bar on the left-hand-side.
- At least one photograph of the sample plot and the general landscape at the sample site.

For an example see the provided figures from the field sampling course (Figures 3a-d and 4a-d).

While travelling do please remember that a number of really good landscape photographs will be needed from the whole survey area. So do take rather too many photographs than too few, and try to make some really good shots of agricultural fields and grazing land in a landscape connection in your country. Always check the quality of the photographs, before leaving the site. This is a significant routine check that must be made for all photographs taken. If the photographs are not of good quality erase them, and retake them. Also, it is very important to always follow the same order of photograph taking. If the wrong order has been taken, then erase them and retake them.

EuroGeoSurveys GEMAS – GEOCHEMICAL MAPPING OF AGRICULTURAL AND GRAZING LAND SOIL IN EUROPE

Field Observation Sheet **AGRICULTURAL SOIL (Ap-HORIZON)**

Country:___GERMANY_____ Date:_____06.03.2008

SAMPLE NO:_____GER001Ap_____

COORDINATES (Use Geographical coordinates (WGS84) ONLY) in Deg./Min./Sec

NORTH: ._52° 13' 59.2"_____ EAST: __13° 23' 20.8"_____

ALTITUDE:_____42_____ metres above mean sea level

Size of field selected for sampling:____c.300_____x____c.400__m
Distance to minor road:_200 m Distance to major road: _several km
Last crop: ___Wheat; ___Barley; ___Oat; ___Rye; ___Rice; ___Maize;
___Grass; ___Rapeseed; ___Sunflower; ___Sugarbeet; ___Potato, _X_Unknown
___Other, specify:_____

Soil Sample depth (0-20 cm) and 5 subsites. If different, specify: _____
Soil moisture on day of sampling: __Dry; _X_Medium; __Wet;
Ploughing depth: _30_cm

Rockiness of agricultural field: rocks >200 mm: __Many; _Some; __Few; _X_None
Rock fragments 60-200 mm: _ _Many; _X_Some; __Few; __ None;___No rocks >60 mm

Main rock type in surroundings of sample location: __Metamorphic; __Igneous; (__Plutonic;
__Volcanic); __Sediments, consolidated; _X_Sediments, unconsolidated
__Greenschist; __Gneiss; __Phyllite; __Marble; __Micaschist; __Blackschist
__Granite; __Granodiorite; __Syenite; __Gabbro
__Rhyolite; ___Andesite; __Tuff; __Basalt
__Limestone; __Dolomite; __Sandstone; __Shale; __Marl
Other(s), specify:_thick quaternary deposits (soil on till, many granitic rock fragments)

Landform: _+/-X_Level; __Sloping; __Steep

Remarks (any unusual observations):
Large power line crosses field; field slopes slightly; sample location close to small forest; many granitic rock fragments in field; minor road at one side of the field, ca. 250 m from sample location_____
_____
_____
_____
_____
_____
Sampler(s):___ALL_____

Signature:_____CR, TV_____

EuroGeoSurveys GEMAS – GEOCHEMICAL MAPPING OF AGRICULTURAL AND GRAZING LAND SOIL IN EUROPE

Field Observation Sheet **GRAZING LAND SOIL**

Country:___GERMANY_____ Date:_____06.03.2008

SAMPLE NO:_____GER001Gr_____

COORDINATES Use Geographical coordinates (WGS84) ONLY in degrees, minutes, seconds

NORTH: ___52° 17' 41.7"_____ EAST: ___13° 22' 4.8"_____

ALTITUDE:_____38_____ metres above mean sea level

Size of grassland selected for sampling: >300___x__500_ m
Distance to minor road:_250 m; Distance to major road: 500 m; Fenced in __yes; _X_no

Primarily used for: _X_Cattle grazing; __Sheep grazing; __Horse grazing; __Unused
Soil Sample depth (0-10 cm) and 5 subsites. If different, specify: _____
Soil moisture on day of sampling: __Dry; _X_Medium; __Wet
Grass root depth: _5_cm
Depth of organic horizon: _15_cm

Main rock type in surroundings of sample location: __Metamorphic; __Igneous; (__Plutonic; __Volcanic); __Sediments, consolidated; _X_Sediments, unconsolidated
__Greenschist; __Gneiss; __Phyllite; __Marble;__Micaschist; __Blackschist
__Granite; __Granodiorite; __Syenite; __Gabbro
__Rhyolite; __Andesite; __Tuffs; __Basalt
__Limestone; __Dolomite; __Sandstone; __Shale; __Marl
Other(s), specify:_thick quarternary deposits, soil developed on ancient lake bottom

Landform: _X_Level; __Sloping; __Steep

Remarks (any unusual observations):
This site is in a depression (former lake bottom); major road (Autobahn) ca. 500 m from sample site_____
_____
_____
_____
_____
_____
Sampler(s):_____ALL_____

Signature:___CR, TV_____

Figure 5a,b. Example of field documentation from the two German test sites sampled during the GEMAS field training course near Berlin, Germany (a) arable land, (b) permanent grass cover.

(a)

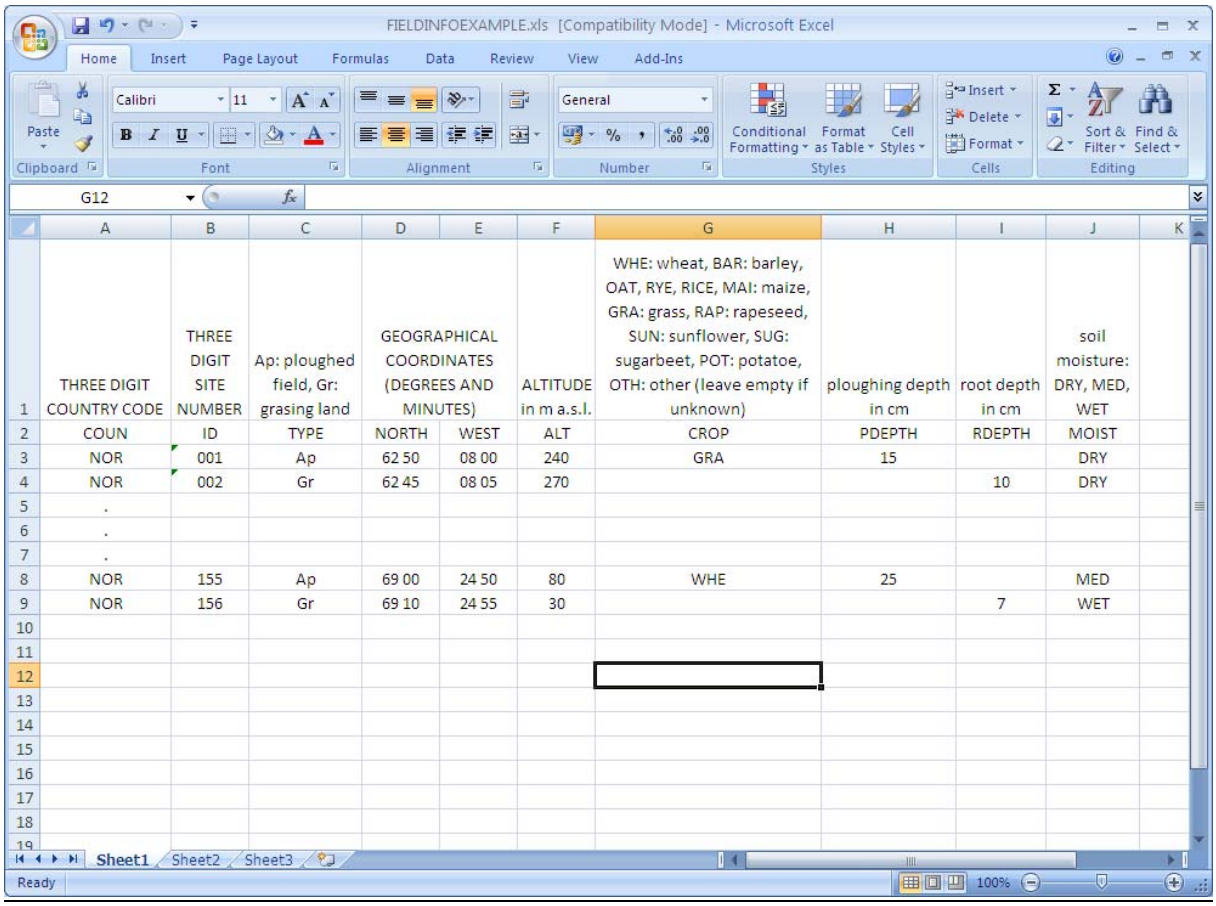
(b)

Figures 6a,b Google Earth view of the two German field training sample sites (a) arable land (GER001Ap) and (b) land under permanent grass cover (GER001Gr).

Field Observations Sheets

The field observations sheets are on purpose kept very simple. The 2 sheets [one for agricultural soil – Ap-horizon (0-20 cm) – and one for grazing land soil (TOP 10 cm)] are at the end of this document. The reason is that scientists from more than 30 countries are participating in this project, and that teams with a very different background will be in the field. The main aim must, thus, be to obtain comparable samples. Field Observations Sheets are mainly needed for recording the sample numbers and coordinates, the sampled soil depth, *etc.*, and especially any unusual observations at any one site as a reference during future data analysis. The Field Observations Sheet information of each country should be provided in digital form (Excel-files) to the project coordinator. An example Excel file will be provided. The format of this Excel file must NOT be changed. All countries are of course free to collect

additional field information, by adding columns at the end of the project worksheet. The field sheets provide the required minimum information per site.



	A	B	C	D	E	F	G	H	I	J	K
1	THREE DIGIT COUNTRY CODE	THREE DIGIT SITE NUMBER	Ap: ploughed field, Gr: grasing land	GEOGRAPHICAL COORDINATES (DEGREES AND MINUTES)		ALTITUDE in m a.s.l.	WHE: wheat, BAR: barley, OAT, RYE, RICE, MAI: maize, GRA: grass, RAP: rapeseed, SUN: sunflower, SUG: sugarbeet, POT: potatoe, OTH: other (leave empty if unknown)	ploughing depth in cm	root depth in cm	soil moisture: DRY, MED, WET	
2	COUN	ID	TYPE	NORTH	WEST	ALT	CROP	PDEPTH	RDEPTH	MOIST	
3	NOR	001	Ap	62 50	08 00	240	GRA	15		DRY	
4	NOR	002	Gr	62 45	08 05	270			10	DRY	
5	.										
6	.										
7	.										
8	NOR	155	Ap	69 00	24 50	80	WHE	25		MED	
9	NOR	156	Gr	69 10	24 55	30			7	WET	
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											

Figure 7. Screen snapshot of Excel file containing field information as required from each country.

3. SAMPLE PREPARATION AND ANALYSIS

3.1 Sample Preparation

All samples will be shipped soon after sampling to the project's central sample preparation facility (*to be determined)*. If money for organic analyses (e.g., PAH, PCB, DDT, Dioxins) is found before the middle of 2008, a small amount from each sample (*c*. 100 - 200 g) will remain untouched in the Rilsan® bags and resealed. These bags will then to be stored in refrigerated conditions.

In general, the main sample preparation for the GEMAS project will follow the underlying scheme:

Details
All samples will be shipped soon (within few weeks) after sampling in the course of 2008 (May to October 2008) to the project's central sample preparation facility from all participating countries. The sample preparation laboratory is responsible for holding the possibly necessary import and handling permits for soil samples from all of Europe. The samples are shipped packed in RILSAN plastic bags, each sample weighs between 2 and 5 kg. The sample number follows each samples on a cardboard card in a separate plastic bag inside each sample bag and is also marked on the outside of each bag.

In general, the main sample preparation for sample preparation will follow the underlying scheme:

DRY (at max. 40 degrees C)

DISAGREGATE (if necessary)

SIEVE to <2 mm, nylon screen

SPLIT: 4 bottles (PP or HDPE) 250 ml <2 mm for general storage, and
6 bottles (PP or HDPE) 100 ml <2 mm for analyses
per sample.
OVERSIZE and remaining material is discarded.

FROM ALL FIELD DUPLICATES (c. 1 in 20 samples and clearly marked "D"): prepare a second split of 6 bottles of 100 ml capacity (for analytical duplicates).

SAMPLE RE-NUMBERING:

WHEN ALL SAMPLES ARE PREPARED THEY NEED TO BE RANDOMISED:

- One batch of laboratory numbers (0001 – 2999) is reserved for agricultural soil.
- One batch of laboratory numbers (3001 – 5999) is reserved for grazing land soil.
- Reserve 2 sample numbers per batch of 20 samples for (a) the analytical duplicates prepared from the field duplicate in the same batch, and (b) the project reference sample.

- Another 21 sample numbers well spread over the whole batch need to be reserved for the insertion of (a) the Australian project reference sample, (b) the North-American project reference sample, and (c) an international certified reference material.

The analytical duplicate of the field duplicate can always be inserted in the 20th position (sample numbers 0020, 0040, 0060,...2500..., *etc*.).

For the project reference sample, a random sample number has to be reserved per batch of 20 samples. The sample bottles will only be marked with the random number.

Sample preparation starts when the first samples are received (May 2008) and all splits must be ready and packed for further transport in May 2009. Samples must be dried immediately after arrival in the laboratory. It is expected that the bulk of samples will arrive in the sample preparation facility in August/September/October 2008.

All laboratories performing analyses for the project will be required to analyse all samples in the exact sequence of the laboratory sample numbers.

Results from field duplicates, analytical duplicates and all samples can then be used for an unbalanced ANOVA, and the estimation of measurement uncertainty (Ramsey 1997, 1998). Analytical duplicates can be used to estimate analytical precision [*e.g*., Thompson and Howard plots (Howard and Thompson, 1976; Thompson and Howarth, 1976, 1978)], and the results of the project reference samples can be used to estimate accuracy. The laboratories will be required to re-analyse batches of 20 samples each in case the results for the duplicate or the project reference sample are outside of agreed levels. The reference materials from Australia and the United States of America are used to establish inter-comparability between the projects in the three continents. The results of the CRC are used to document the "trueness" of the obtained results.

4. QUALITY CONTROL PROCEDURES

The quality control procedures will by and large follow the procedures as outlined by Reimann and Wurzer (1986). From each field duplicated site an additional analytical duplicate shall be prepared from the routine and field duplicate (Figure 8). The duplicates are analysed rather close to one another within the sample batch. A project reference sample will be produced and inserted into the samples at a rate of 1 in 20. Two or three international reference materials will be purchased specifically for the project, and also be analysed a number of times (*c*. 15-20 times) each.

A contract with the laboratories will be established, describing the quality control procedures, and what will happen should the required quality is not met. Quality Control will commence immediately after results are received from the laboratories.

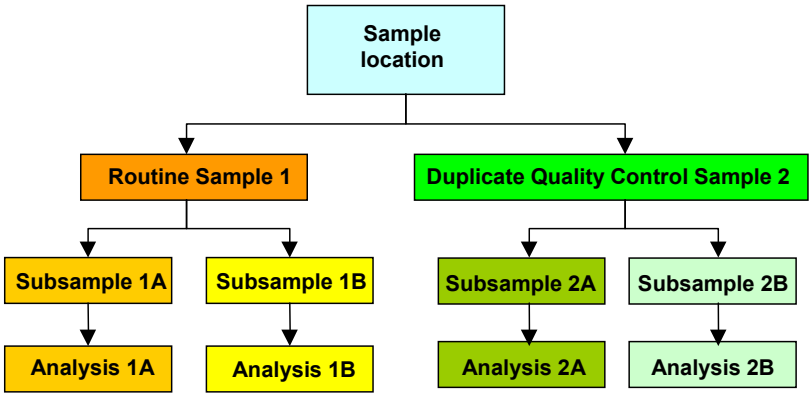


Figure 8. Balanced hierarchical geochemical sampling and analytical scheme for the estimation of geochemical, sampling and analytical variance and random components of measurement uncertainty.

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6. ATTACHMENTS

FIELD DOCUMENTATION SHEETS

- AGRICULTURAL SOIL and
- GRAZING LAND SOIL.

List of participating countries and organisations and names and e-mail addresses of the responsible country coordinator.

List of project sponsor organisations from industry at time of writing.

Different language editions of "GEMAS IN SHORT"

EuroGeoSurveys GEMAS – GEOCHEMICAL MAPPING OF AGRICULTURAL AND GRAZING LAND SOIL IN EUROPE

Field Observation Sheet **AGRICULTURAL SOIL (Ap-HORIZON)**

Country:_____ Date:_____

SAMPLE NO:_____

COORDINATES (Use Geographical coordinates WGS84 ONLY in degrees, minutes, seconds)

NORTH: _____º_____'_____" EAST_____º_____'_____"

ALTITUDE:_____ metres above mean sea level

Size of field selected for sampling:_____x_____m
Distance to minor road:____m Distance to major road: ____m
Last crop: ___Wheat; ___Barley; ___Oat; ___Rye; ___Rice; ___Maize; ___Grass; ___Rapeseed; ___Sunflower; ___Sugarbeet; ___Potato, ___Unknown ___Other, specify:_____

Soil Sample depth (0-20 cm) and 5 subsites. If different, specify: _____
Soil moisture on day of sampling: __Dry; __Medium; __Wet;
Ploughing depth: _____cm

Rockiness of agricultural field: rocks >200 mm: __Many; __Some; __Few; __None
Rock fragments 60-200 mm: __Many; __Some; __Few; __ None;___No rocks >60 mm

Main rock type in surroundings of sample location: __Metamorphic; __Igneous; (__Plutonic; __Volcanic); __Sediments, consolidated; __Sediments, unconsolidated
__Greenschist; __Gneiss; __Phyllite; __Marble; __Micaschist; __Blackschist
__Granite; __Granodiorite; __Syenite; __Gabbro
__Rhyolite; ___Andesite; __Tuff; __Basalt
__Limestone; __Dolomite; __Sandstone; __Shale; __Marl
Other(s), specify:_____

Landform: __Level; __Sloping; __Steep

Remarks (any unusual observations):
_____
_____
_____
_____
_____

Sampler(s):_____

Signature:_____

EuroGeoSurveys GEMAS – GEOCHEMICAL MAPPING OF AGRICULTURAL AND GRAZING LAND SOIL IN EUROPE

Field Observation Sheet **GRAZING LAND SOIL**

Country:_____ Date:_____

SAMPLE NO:_____

COORDINATES [Use Geographical coordinates WGS84 ONLY in degrees, minutes seconds]

NORTH: _____º_____'_____"
EAST_____º_____'_____"

ALTITUDE:_____ metres above mean sea level

Size of grassland selected for sampling: ___x____ m
Distance to minor road:____m; Distance to major road: ____m; Fenced in __yes; __no

Primarily used for: __Cattle grazing; __Sheep grazing; __Horse grazing; __Unused
Soil Sample depth (0-10 cm) and 5 subsites. If different, specify: _____
Soil moisture on day of sampling: __Dry; __Medium; __Wet
Grass root depth: ____cm
Depth of organic horizon: ___cm

Main rock type in surroundings of sample location: __Metamorphic; __Igneous; (__Plutonic; __Volcanic); __Sediments, consolidated; __Sediments, unconsolidated
__Greenschist; __Gneiss; __Phyllite; __Marble;__Micaschist; __Blackschist
__Granite; __Granodiorite; __Syenite; __Gabbro
__Rhyolite; __Andesite; __Tuffs; __Basalt
__Limestone; __Dolomite; __Sandstone; __Shale; __Marl
Other(s), specify:_____

Landform: __Level; __Sloping; __Steep

Remarks (any unusual observations):
_____
_____
_____
_____
_____
_____
_____

Sampler(s):_____

Signature:_____

LIST OF PARTICIPANTING ORGANISATIONS AND THE PROJECT COORDINATOR(S) IN EACH COUNTRY (at time of writing)

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-European Copper Institute (ECI)
-European Nickel Institute (ENIA)
-European Precious Metals Federation (EPMF)
-International Antimony Oxide Industry Association (IAOIA)
-International Manganese Institute (IMnI)
-International Molybdenum Association (IMoA)
-International Tin Research Institute (ITRI)
-International Zinc Association (IZA)
-Lead Development Association-International (LDAI)
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GEMAS IN SHORT in a selection of different project languages (Russian, Serbian, Croatian, Spanish, Portuguese, Greek)

Пробоотбор по ПРОГРАММе «GEMAS»

(краткое содержание)

Имеющийся фактический материал о содержании химических элементов в почвах Европы весьма неоднороден вследствие чего он не может служить основой для определения геохимического фона в европейских странах (из-за различия в методах отбора проб, процедурах пробоподготовки, методиках аналитических исследований и т.д.). Поэтому, для согласования данных местного и европейского масштаба необходима единая справочно-информационная сеть. Геохимический атлас Европы, созданный европейскими геологическими службами (массив данных FOREGS, Салминен *и др*., 2005; Де Вос *и др.,* 2006) продемонстрировал, что геохимическое картирование с низкой плотностью опробования позволяет получить необходимую информацию о геохимическом фоне в природных почвах, речных водах, речных и пойменных отложениях. Геохимические данные для сельскохозяйственных почв северо-востока Европы имеются только для нескольких (десяти) стран (Рейманн *и др.*, 2003), а данные для почв целинных земель отсутствуют.

Геохимическое изучение основных видов естественных и сельскохозяйственных почв Европы выполняется с целью создания геохимического атласа распределения химических элементов в пахотных и пастбищных землях данного континента, а также для определения геохимического фона в европейских странах. В этой работе заинтересованы как производители сельскохозяйственной продукции, так и представители промышленности – для реализации принятого в декабре 2006 года нового Европейского регламента по химическим продуктам (REACH - регистрация, оценка и легализация химикатов).

Выбор мест и методика опробования почв определяется международным проектом GEMAS и сводится к следующему:

Частота отбора проб будет такой же, как и в проекте по геохимической съемке почв в странах Балтии (BSS – Рейманн *и др.*, 2003): 1 проба на 2500 км^2. Для этого вся территория Европы разбивается на квадраты размером 50 км x 50 км по равновеликой проекции Ламберта. В пределах каждого квадрата отбираются две пробы. Одна – из пахотного слоя типичных сельскохозяйственных земель, вторая – из самой верхней части почвы пастбищных земель. Места отбора определяются с учетом максимальной отдаленности от промышленных и других техногенных источников потенциального загрязнения окружающей среды. Пробы отбираются методом „конверта” со стороной квадрата 10 x 10 м из верхнего слоя почвы: на пахотных землях опробуются верхние 0-20 см почвы, на пастбищных землях – верхние 0-10 см. При этом, в центральной части квадрата опробования почвы, проходится шурф до почвообразующих пород, зачищенная стенка которого документируется путем фотографирования. Ландшафт в месте опробования также фотографируется. Координаты мест опробования почв определяются с помощью навигационных приборов GPS и проверяются с помощью топооснов, имеющих масштаб 1:50 000 – 1:100 000. Пробы весом 2-2,5 кг отбираются в специальные пакеты, документируются и готовятся к отправке в единую лабораторию для пробоподготовки и аналитических исследований. Большой вес отбираемых проб почв обусловлен использованием части отобранного материала для создания литотеки почв Европы. В каждом двадцатом квадрате отбираются контрольные пробы (дубликаты).

Информация из ведомостей полевых наблюдений из каждой страны-участника пересылается координатору проекта в электронном виде в Excel формате (Excel-файлы).

ВНИМАНИЕ: пробы будут анализироваться на содержание Ag и Au – поэтому при отборе проб не разрешается носить какие-либо ювелирные украшения или кольца!

GEMAS UZORKOVANJE UKRATKO

Po svakoj lokacijiod 2500km^2, jedan uzorak poljoprivrednog tla (oranice) (Ap) i zatravnjene zemlje (zemlje pod stalnim travatim pokrivacem) (Gr).
Broj uzorka: trocifren kod zemlje, trocifren broj uzorka, dvocifren broj materijala npr. GER001Ap i GER001Gr za prvu celiju u Nemackoj.
Upotrebiti isti broj uzorka za svaki par oranice i stalno zatravnjenog tla.
Uzeti DUPLIKAT svakog tipa uzorka za svaku 20tu lokaciju uzorkovanja i jasno obeleziti duplikat sa istim brojem uzorka i dodatno "D" na kraju.

PAZNJA: NE NOSITI BILO KOJU VRSTU NAKITA ZA VREME UZORKOVANJA; BEZ ZLATNOG PRSTENJA!

PUSENJE NIJE DOZVOLJENO ZA VREME UZORKOVANJA.

Svaki uzorak je sastavljen od 5 poduzoraka (minimum) – kompozitni uzorak.

Uzorkovani materijali:

- Ap horizont poljoprivrednog tla (oranica), 0-20cm;
- TOP 10cm stalno zatravnjene zemlje, samo zivu vegetaciju ukloniti.

Uzorkovanje:

- upotrebiti iskljucivo RILSAN kese;
- upotrebiti samo crni vodo otporni marker za pisanje na kesi;
- takodje, napisati broj uzorka na datoj maloj kartici koja se stavlja u odgovarajucu zip kesicu i to onda na vrh uzorka u RILSAN kesu;
- Cvrsto zatvoriti kesu sa datom trakom (PAZNJA, ove kese ne mogu biti otvarane ponovo a da se ne uniste).

Terenska dokumentacija:

- ispuniti terenske zapisnike/obrasce;
- 3-4 fotografije svaka lokacija, UVEK zapoceti sa fotografijom broja lokcije. Dodatno, najmanje jedna fotografija profila tla (sa razmernikom), jedna fotografija vegetacije (sa razmernikom-stalno zatravnjena zemlja), i jedna fotografija okolnog pejsaza;
- Koordinate: WGS 84, geografske koordinate u stepenima, minutama, sekundama (proveriti da je vas GPS ukljucen na "WGS84").

Obeleziti sve lokacije uzorkovanja na geografskoj karti.

UKRATKO O GEMAS UZORKOVANJU

Po 1 lokacija za poljoprivredno tlo (oranica) (Ap) i pašnjak (zemljište pod trajnim travnatim pokrivačem) (Gr) na 2.500 km^2.
Brojevi uzoraka: tri znamenke za oznaku zemlje, tri broja za broj uzorka, 2 znamenke za medij uzorkovanja kao npr. GER001Ap i GER001Gr za prvu ćeliju koja je uzokovana u Njemačkoj.
Upotrebljavaj iste brojeve uzoraka za svaki par - oranica i zemljište pod trajnim travnatim pokrivačem.
Uzmi DUPLIKAT od svakog tipa tla na svakoj 20-toj lokaciji i označi jasno uzorak s istim brojem uzorka, ali s dodatnom oznakom "D" na kraju.

PAŽNJA: TIJEKOM UZORKOVANJA NE NOSI NIKAKAV NAKIT; BEZ ZLATNOG PRSTENA!

ZA VRIJEME UZOKOVANJA PUŠENJE NIJE DOZVOLJENO.

Svaki uzorak je kompozit od 5 poduzoraka (minimalno).

Mediji uzokovanja
- Ap horizont poljoprivrednih tala (oranica), 0-20 cm.
- TOP 10 cm na pašnjacima, odstraniti samo živu vegetaciju.

Uzorkovanje:
- upotrebljavati samo RILSAN vrećice
- upotrebljavaj samo crni vodootporni flomaster za pisanje na vrećice
- napiši broj uzorka također i na dostavljenu malu etiketu, stavi je u malu vrećicu sa zatvaračem i stavi ih onda na vrh uzorka u RILSAN vrećici.
- zatvori čvrsto vrećicu s dostavljenom trakom (PAŽNJA, ta vrećica se kasnije više ne može otvoriti, a da se ne ošteti).

Terenska dokumentacija:
- ispuni terenske obrasce
- za svaku lokaciju načini 3-4 fotografije, UVIJEK počni s brojem lokacije. Dodatno načini najmanje jednu fotografiju profila tla (s mjerilom), jednu fotografiju vegetacije (s mjerilom – za permanentni travnati pokrivač) i jednu preglednu fotografiju krajolika.
- Koordinate: WGS 84, geografske koordinate u stupnjevima, minute, sekunde (provjeri da li je tvoj GPS namješten na "WGS84")

Označi sve lokacije i na geografskoj karti.

RESUMEN DE LA METODOLOGÍA DE MUESTREO PARA EL PROYECTO GEMAS

Un punto de muestreo para cada uno de siguientes tipos de muestra, **suelo agrícola** (tierra cultivable) (Ap) y tierra de pastizal (tierra bajo cubierta herbácea permanente) (Gr) por cada 2500 km^2.
Identificadores de muestra: tres dígitos para el código de país, tres dígitos para el nº de muestra, 2 dígitos para el tipo de material.
Ejemplo: GER001Ap y GER001Gr para la primera celdilla muestreada en Alemania.
Utilizar el mismo número de muestra para cada par de suelos, agrícolas o cultivables, y con cubierta herbácea permanente.
Tomar un DUPLICADO de cada tipo de muestra cada 20 puntos de muestreo y marcar claramente la muestra duplicada con el mismo identificador de muestra y una "D" adicional al final.

ATENCIÓN: NO LLEVAR NINGÚN TIPO DE OBJETOS DE JOYERÍA DURANTE LA OPERACIÓN DE LA TOMA DE MUESTRA; NO LLEVAR ANILLOS DE ORO.

NO ESTÁ PERMITIDO FUMAR DURANTE LA OPERACIÓN DE RECOGIDA DE MUESTRAS.

Cada muestra está compuesta por 5 submuestras o incrementos (mínimo).

Materiales o medios de muestreo:

- Horizonte Ap de suelo agrícola (tierra cultivable), 0-20 cm.
- 10 cm superiores, o de techo, de la tierra de pasto. Sólo se quita la capa superficial con vegetación viva.

Muestreo:

- Utilizar únicamente bolsas RILSAN
- Utilizar únicamente rotuladores negros resistentes al agua para escribir en la bolsa.
- Escribir también el número de muestra sobre la pequeña etiqueta suministrada, meter ésta en una bolsa de cierre hermético y ponerla sobre la parte superior de la muestra en la bolsa RILSAN..
- Cerrar las bolsas cuidadosamente con los cierres suministrados (ATENCIÓN, estas bolsas no pueden ser abiertas de nuevo sin destruirlas).

Documentación de campo:

- Rellenar las fichas de campo
- Hacer 3-4 fotos en cada punto de muestreo. Comenzar SIEMPRE por una fotografía del identificador o número del emplazamiento o punto de muestreo. Al menos, una foto adicional del perfil del suelo (con escala), una foto de vegetación (con escala) en el caso de terreno con cubierta herbácea permanente) y una foto del paisaje general del entorno del punto.
- Coordenadas: WGS 84, coordenadas geográficas en grados, minutos, segundos (comprobar que el GPS está ajustado a "WGS 84")..

Marcar asimismo todos los emplazamientos de muestras sobre los mapas geográficos.

RESUMO DA AMOSTRAGEM GEMAS

1 local cada, solo agrícola (solos arável) (Ap) e solo de improdutivo (solo permanentemente não cultivado) (Gr) por cada 2500 km^2
Número de amostras: três digitos de código de país, três dígitos de número de amostra, 2 digitos do material a amostrar
por exemplo, GER001Ap e GER001Gr para a primeira célula amostrada da Alemanha.
Utilize o mesmo número de célula para cada par de solos, arável e não produtivo (permanentemente não cultivado).
Tome um DUPLICADO de cada tipo de amostra a cada 20 sítios colhidos e marque claramente o duplicado com o mesmo número de amostra com e um "D" adicional no fim.

ATENÇÃO: NÃO USAR JÓIAS DURANTE A AMOSTRAGEM, NÃO USAR ALIANÇAS!

NÃO É PERMITIDO FUMAR DURANTE A AMOSTRAGEM

Cada amostra é uma compósita de 5 sub-amostras (mínimo).

Material a amostrar:

- solo agrícola horizonte Ap (solo arável), 0-20 cm.
- Os 10 cm mais superficiais no solo não produtivo permanentemente não cultivado, apenas remover vegetação viva.

Amostragem:

- Usar apenas os sacos RILSAN
- Usar apenas os marcadores pretos resistentes à água para escrever nos sacos
- Escreva o número da amostra também no cartão pequeno que é fornecido e coloque dentro do saquinho colocando de seguida por cima da amostra dentro do saco RILSAN.
- Feche os sacos firmemente com os atilhos fornecidos (ATENÇÃO, estes sacos não podem ser abertos de novo sem destruir os atilhos).

Documentos de campo:

- Preencha as fichas de campo
- 3-4 fotografias cada local, comece SEMPRE com a fotografia do número da amostra. Adicionalmente pelo menos uma fotografia do perfil de solo (com escala), uma fotografia da vegetação (com escala – solo improdutivo), e uma fotografia da paisagem geral.
- Coordenadas: WGS 84, coordenadas geográficas em graus, minutos, segundos (certifique-se que o GPS está convertido para "WGS84").

Marque também todos os locais de amostra em mapas topográficos.

ΣΥΝΟΠΤΙΚΕΣ ΟΔΗΓΙΕΣ ΔΕΙΓΜΑΤΟΛΗΨΙΑΣ ΓΕΩΡΓΙΚΟΥ ΕΔΑΦΟΥΣ ΚΑΙ ΕΔΑΦΟΥΣ ΒΟΣΚΟΤΟΠΟΥ (GEMAS)

Σε κάθε τεμάχιο γης έκτασης 2500 km^2 λαμβάνεται ένα σύνθετο δείγμα γεωργικού (αρόσιμου) εδάφους (Ap) και ένα σύνθετο δείγμα εδάφους από βοσκότοπους (χωράφι με μόνιμη κάλυψη χλωροτάπητος) (Gr).

Αρίθμηση δειγμάτων: ο τριψήφιος κωδικός της χώρας ακολουθείται από τον τριψήφιο αριθμό του δείγματος και ολοκληρώνεται με το χαρακτηριστικό επίθεμα του τύπου του δείγματος, *π.χ.*, GER001Ap and GER001Gr για το πρώτο κελί που δειγματίσθηκε στην Γερμανία.

Χρησιμοποιήστε τον ίδιο αριθμό για κάθε ζεύγος δειγμάτων γεωργικού εδάφους και εδάφους βοσκότοπου, τα οποία προέρχονται από το ίδιο κελί.

Από κάθε 20^{η} κατά σειρά θέση δειγματοληψίας δειγματίζεται ΔΙΠΛΟ δείγμα από κάθε τύπο δείγματος και το κάθε δείγμα χαρακτηρίζεται προσεκτικά με τον αριθμό του κανονικού δείγματος με προσθήκη του "D" στο τέλος του αριθμού.

ΠΡΟΣΟΧΗ: ΜΗ ΦΟΡΑΤΕ ΚΟΣΜΗΜΑΤΑ ΚΑΤΑ ΤΗ ΔΕΙΓΜΑΤΟΛΗΨΙΑ.
ΜΗ ΦΟΡΑΤΕ ΧΡΥΣΑ ΔΑΚΤΥΛΙΔΙΑ!
ΤΟ ΚΑΠΝΙΣΜΑ ΑΠΑΓΟΡΕΥΕΤΑΙ ΑΥΣΤΗΡΑ ΚΑΤΑ ΤΗ ΔΕΙΓΜΑΤΟΛΗΨΙΑ.

Το κάθε δείγμα είναι σύνθετο από 5 υποδείγματα (τουλάχιστον).

Υλικά δειγμοληψίας:

- Ap ορίζοντας γεωργικού εδάφους (αρόσιμο χωράφι), 0-20 cm.
- ΕΠΙΦΑΝΕΙΑΚΑ 10 cm του εδάφους βοσκοτόπου, αφαιρείται μόνο η «ζωντανή» βλάστηση.

Δειγματοληψία:

- Χρησιμοποιείστε μόνο τις ειδικές σακούλες RILSAN.
- Χρησιμοποιείστε μόνο μαύρο ανεξίτηλο μαρκαδόρο για γράψιμο στη σακούλα.
- Γράψτε, επίσης, τον αριθμό του δείγματος στην μικρή ετικέτα που διατίθεται, μετά τοποθετείστε την στην αυτόκλειστη σακουλίτσα και στη συνέχεια βάλτε την στο άνω μέρος του δείγματος εδάφους μέσα στη σακούλα RILSAN.
- Κλείστε τη σακούλα σταθερά με τα ειδικά ελάσματα που παρέχονται (ΠΡΟΣΟΧΗ, αυτές οι σακούλες, μετά το κλείσιμο, είναι αδύνατο να ανοιχθούν, χωρίς να καταστραφούν. Γι' αυτό απαιτείται η όλη διαδικασία να γίνεται προσεκτικά.).

Υπαίθρια τεκμηρίωση:

- Συμπληρώστε σε κάθε θέση δειγματοληψίας το σχετικό φύλο υπαίθριων παρατηρήσεων.
- Σε κάθε θέση δειγματοληψίας τραβήξτε 3-4 φωτογραφίες. ΠΑΝΤΟΤΕ να αρχίζετε με τη φωτογράφιση του αριθμού της θέσης δειγματοληψίας. Επιπρόσθετες φωτογραφίες: τουλάχιστο μία της τομής εδάφους (με την κλίμακα), μία φωτογραφία της φυτοκάλυψης (με την κλίμακα – μόνιμα χωράφια με χλωροτάπητα) και μία γενική φωτογραφία της τοπογραφίας.
- Συντεταγμένες: WGS 84, γεωγραφικές συντεταγμένες σε μοίρες, λεπτά, δευτερόλεπτα (επιβεβαιώστε ότι το GPS είναι ρυθμισμένο σε "WGS84").

Σημειώστε όλες τις θέσεις δειγματοληψίας σε τοπογραφικούς χάρτες κλίμακας 1:50000.