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Soil monitoring networks in Europe: a representativeness study

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This study is part of the Envasso project (Environmental assessment of Soil for Monitoring, http://www.envasso.com/content/envasso_home.html), which aims to design and test a single, integrated, operational and EU-wide set of measurable criteria and indicators as a basis for a harmonised comprehensive European soil and land information system. The aims of this study were to provide a description of the monitoring networks and their databases, to document coverage (geographical and time) and variables and to check the representativeness of the actual network based on soil map, land cover and some pressure data. This constitutes the most exhaustive review of European soil monitoring networks to date.

Official frameworks for comprehensive soil monitoring exist in most countries. However, uniformity in methodology and coverage, albeit existing in some countries, is far from common even among national systems. This review highlights the differences between existing networks. The present coverage is very heterogeneous between countries. National and regional networks are much denser in northern and eastern parts of Europe than in southern countries. The median density of sites in 50 x 50 km cells applied all over Europe is 1 site per 300 km². Such a density is close to the density of the ICP Forest grid. Converted into a systematic grid, the median density of sites would be equivalent to a 17 x 17 km grid covering Europe. If we take into account the existing sites, achieving that all 50 x 50 km cells have at least this median density would require to settle 4,074 new sites, mainly located in southern countries (Italy, Spain, Greece), and part of Poland, Germany, Norway, Finland and France. This figure might be slightly overestimated, considering the fact that some metadata are missing for Italy and Spain, and that some sites are currently being implemented (France).

Among the indicators identified for the soil threats, the density of the coverage is very heterogeneous. Soil organic carbon and pH are the most often measured parameters, whereas some other parameters have very scarse coverage, even if we restrict this evaluation to risk areas concerned by the threat they cover. In particular, indicators related to soil biodiversity and to soil erosion are very rare. Some trace elements are measured in almost all the countries (i.e. Pb), whereas others are often not (i.e. Hg). Indicators for soil compaction such as bulk density are not measured in about half of the countries. A quite large number of peri-urban areas are not monitored for contaminants, especially in southern countries. A quite large number of peri-urban areas are not monitored for contaminants, especially in southern countries. Areas identified as having the highest heavy metal deposition rates appear not to be sampled with enough density, especially concerning Hg. Areas with high livestock pressures are unequally covered by related indicators measurements.

Most of the soils and the land uses of Europe have at least one monitoring site; however the density of sites and of the parameters measured is far from homogeneous. The density of sites in soil mapping units of Europe is highly variable.

In view of this situation, it is clear that harmonisation and co-ordination are necessary. When soil monitoring networks are dense enough, this harmonisation could be done by adding measurements of the lacking indicators in existing sites. In numerous cases, it would also require to add new sites. Indeed, considerable efforts are still needed to reach a common acceptable level in soil monitoring in Europe.

Key-words: Europe; soil monitoring; representativeness.