

Experiences with soil contamination maps in an European region

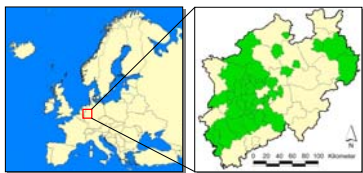
- what implications does that have for the European soil strategy?

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Keywords: soil contamination map, wide spread soil contamination, background-contamination, immission, heavy metal, PAH, German Soil Protection Law

1 INTRODUCTION AND BACKGROUND

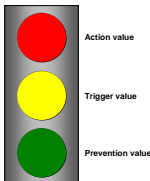
- In Northrhine-Westphalia (NRW) a program is currently carried out to collect data of soil contamination with persistent contaminants and to produce soil contamination maps covering at present already an area of about 15.000 km² (~40% of NRW).
- The NRW-approach for mapping top soil contamination is based on the use of a multiplicity of data merged in a Geographic Information System (GIS) [1].
- To achieve soil contamination maps for the non settled areas in acceptable quality in an 1 : 50.000 scale an average of about 0.2 to 1 sample per km² is needed. However, the sampling points are not regularly distributed but distributed according to the (expected) variability and spatial distribution of the factors influencing the concentration of contaminants in the top soil.



Districts / towns in NRW with soil contamination maps (status: Sep. 2005).

2 THE GERMAN LEGAL SOIL VALUE SYSTEM

The German Soil Protection Law [2] is the legal basis for the evaluation of soils in Germany. In this law different values are defined, in the German Soil Protection Ordinance [3] these values are figured.



Action value
Values, where in the standard case actions have to be taken. With respect to the transfer paths soil – agricultural crop the values have been derived on the basis of german standards for agricultural crops. The respective European Directives (e. g. Directive 2002/32/EC of the European Parliament and of the Council on undesirable substances in animal feed) generally are comparable, but with exception of some parameters.

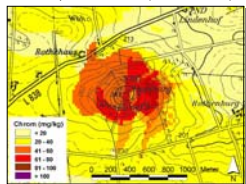
Trigger value
These are given for different transfer paths. When exceeded, risks cannot be excluded.

Prevention value
Values, when exceeded are indicating the anxiety, that detrimental changes of soil quality might develop. The values are derived from the "average" natural background in top soil, but also taking into account health risks. Concentrations above the prevention value are referred to as "contamination".

3 MAIN RESULTS OF THE SOIL CONTAMINATION MAPPING PROGRAM IN NRW

3.1 Lithogenic / pedogenic contaminant accumulation

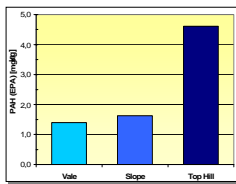
- Natural factors influence the distribution of metals in soils. From geochemistry it is known that anomalies in the bed rocks can be detected by surveys of the soil.
- The studies show that even when metal concentrations are or have been below the level interesting for mining local or regional contaminations may occur in the top soil (e. g. Pb/Zn-anomalies in the Rhenish shield). Another example are soils which developed on basic volcanics (Cr- and Ni-anomalies).



Geogenic caused Cr-contents in the upper soil developed on a basic volcanic cone in Eastern NRW.

3.2 Immission after airborne contaminant transport

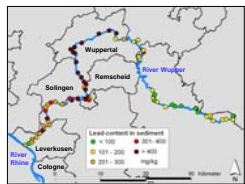
- Both effects of short and long distance airborne contaminant transport can be observed in certain regions.
- Effects of long distance airborne contaminant transport can be observed especially in exposed (mainly forested) mountainous areas even more than 100 km away from the industrial centres of NRW [4-5].



Immission controlled PAH-contents (mg/kg) in the A-forest soils in a protected area of the Rhenish shield depending on exposure.

3.3 Inundation in contaminated river catchments

- In soils of a number of river flood plains in NRW a strong accumulation of contaminants can be observed, being caused by deposition of contaminated river sediment. A major source for contamination in river catchments are (mostly former) processing and ore mining activities, especially in some places in the southern parts of NRW, dating back to – at least – early medieval times.



Lead-content in current sediments of River Wupper (data from [6]).

4 IMPLICATION FOR THE EUROPEAN SOIL STRATEGY

4.1 Methods for acquiring data on the spatial distribution of contaminants in soils

- The first step in an approach to acquire data on the spatial distribution of contaminants in soils should be an analysis of the area under concern. In a second step this analysis should lead to contamination hypotheses, which can be verified or falsified by a sampling scheme adapted to the specific hypothesis.
- Using available (digital) topographic information, especially land use data, and soil mapping data allows to develop an optimized sampling scheme.
- Thus maximum information can be extracted from each sample. This offers the possibility of "extrapolation" to nearby areas with similar factors, and, after some processing, the possibility of interpolation using geostatistics.



4.2 Towards European management strategies for wide spread contaminated land

- Certainly NRW is not representative for the whole of Europe. However, the authors expect that on European level typical "clusters" of wide spread contaminated land problems could be identified. This contamination may have adverse effects on both agriculture and the multifunctionality of river systems, e. g. ecotoxicological effects cannot be excluded.
- With this background the authors believe it is worthwhile to work on a common European strategy to manage and overcome wide spread contaminated land problems (e. g. [7]).

5 LITERATURE

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