

1 Introduction and goals

An undesirable change in the physical, chemical, or biological characteristics of the natural environment, brought about by man's activities. Pollution may affect the soil, rivers, seas or the atmosphere. There are two main classes of pollutants: those that are biodegradable (e.g. sewage) and those, that are non-biodegradable (e.g. heavy metals, DDT and other chlorinated hydrocarbons used as pesticides), which accumulate in the environment and may be concentrated in food chains.

Soil is very specific component of the biosphere, because it is not only a geochemical sink for contaminants, but also it acts as a natural buffer controlling the transport of chemical elements and substances to the atmosphere, hydrosphere, and biota. Soils are sink for persistent and rather immobile inorganic and organic pollutants such as heavy metals and persistent organic pollutants. There are both anthropogenic and natural sources of heavy metals entering the environment, while most of the priority organic pollutants (POPs) sources are of anthropogenic origin. Thus soil – if not contaminated by the direct application of pollutants reflect the air pollution.

Regarding the heavy metals it is important to stress the dual action of some of them, being important micronutrients (Cu, Zn, Ni, Cr), but on the other side there is clear evidence of their toxic influence at higher level. With respect to some of them (Pb, Cd, Hg) only the toxic effect is recorded as they are not essential for living organisms. Heavy metal contamination has received much attention with regard to accumulation in soils, uptake by plants, and contamination of water. Environmental hazards derived from heavy metals, they are linked closely to their movement in soil profile because even slow transport through soil and subsoil materials may eventually increase the content of heavy metals in the groundwater.

In contrast to heavy metals naturally occurring as constituents of the Earth's crust, the majority of persistent organic compounds is not originally present in nature in relevant amounts (NAUMANN 1994). They are quite resistant to degradation. When the release of these compounds into the environment exceeds their degradation capacity, significant accumulation is observed. The existence of permanent pollution sources results in the accumulation in soil, plants, and water bodies. Possible fates of organic pollutants and their

breakdown metabolites entering soil environments include volatilization to air, biodegradation, transfer to organisms, binding to soil, and leaching into groundwater (CERNIDLIA 1992; JONES et al. 1996).

Bearing in mind the small territory of Bulgaria (111 000 km²), a relatively large number of industrial enterprises have been built up during the sixties. Their activities brought and bring about various ecological problems including soil pollution. The effects of pollution with heavy metals turned out rather stable. In some areas they did not only cause damages and losses for agriculture, but also initiated some serious health problems due to the content of heavy metals in the food, as well as the continuous air and water contamination. Figure 1.1 shows the distribution of land in Bulgaria, according Ministry of Environmental and Water (1999).

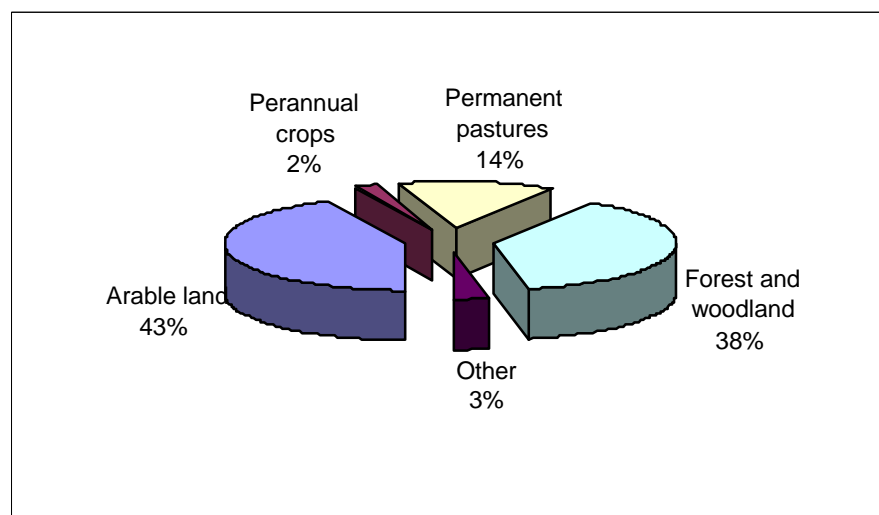


Fig. 1.1: Land use in Bulgaria (MINISTRY OF ENVIRONMENTAL AND WATER 1999)

The main resources of Bulgaria are agricultural and approximately one-third of Bulgaria is forested. While in arable lands the main pollution comes from metallurgical smelters and agriculture, for forest it is assumed that atmospheric deposition is the only source of heavy metals. However the input of heavy metals in forest ecosystems can be higher in comparison with the open field conditions due to the filtering effect of the rough structure of the plants cover.

During the last 15-20 years many investigations have been carried out in order to describe the soil pollution in Bulgaria. In soils located in the vicinity of point sources of pollutants like Cu-Zn-Pb smelters, the content of the trace elements is determined essentially by the deposition of air-transported particles (ATANASSOV and ANGELOVA 1995; DIMITROV 1998). The knowledge about atmospheric deposition and soil contamination levels of POPs in Bulgaria is much more limited than for heavy metals (MÜLLER et al. 1998; ATANASSOV et al. 1999). With agreement with European standards Ministry of Environment and Water of Bulgaria (1997) identified as “priority pollutants” three groups of organic pollutants: Polycyclic aromatic hydrocarbons (PAH), Polychlorinated biphenyls (PCB) and organochlorinated pesticides (HCB, HCH, DDE, DDD, DDT). Chemical structures of priority organic pollutant are present in Figure A1 and A2 (appendix).

Now it is important for Bulgaria to develop new criteria and standards for assessment the degree of pollution of soils by heavy metals and priority organic pollutants. To be solved the problem, new investigations are necessary to be carried out in attempt to reveal the background concentrations of the trace elements in the main soils of the country and to define the basic background values for the heavy metals in the soil. It is accepted that in the base of the values obtained, a new quality standards for soils can be determined. These quality criteria can serve as a base for development new legislation. In any case, the determination of background values for soils take an important place. Taking into account the recent needs, the purposes of this investigation can be defined as follows:

- To describe the total content of Cd, Cu, Ni, Pb, and Zn in whole soil and particle-size separates, extracted from master soil horizons of studied profiles.
- To verify which particle-size separates contain information about geogenic and/or background concentration of these metals.
- To determine the concentrations of priority organic pollutants (PAHs, PCBs, HCH, HCB, DDX-compounds) and to obtain the basic data for content of these components as well in arable as in forest soils.
- To calculate critical loads for metals at first priority (Cd and Pb) on a regional scale for arable and forest soils.