



# 20 years of continuous soil monitoring in Baden-Württemberg

## 20 JAHRE BODENDAUERBEOBACHTUNG IN BADEN-WÜRTTEMBERG

Continuous soil monitoring is the long-term monitoring programme of Baden-Württemberg, anchored in the state's Soil Conservation and Contaminated Site Law. Its objective is to identify and monitor the condition of the soil in the state and its change. This is the responsibility of the LUBW, Baden-Württemberg's State Environmental Agency (full name: Baden-Württemberg State Institute of the Environment, Measurements and the Nature Conservation ("Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg")). This report describes the development of this programme over 20 years, from the classical soil investigations of the first decade through to the multi-media environmental balances.

With the setting up of the soil monitoring network from 1986, the then State Institute for Environmental Protection ("Landesanstalt für Umweltschutz" - LfU) completed the list of its sectoral monitoring networks. To this end, the LfU installed 154 monitoring sites in areas of Baden-Württemberg not specifically contaminated and deduced corresponding background values for typical uses and soil forms. It was found that the inorganic contaminant levels extractable through aqua regia are decisively determined by the parent rock of the soil formation. The availability or mobility of the inorganic contaminants in soil was examined from 1992 through ammonium nitrate extraction. Apart from the total content, the avail-

ability is determined by the pH value and the level of organic carbon. Also in 1992, a survey of organic contaminants in soils of the background area was carried out, which substantiated their ubiquitous distribution. Use-typical distribution patterns were determined on the basis of calculated contaminant stocks. For example, farmland soils frequently contain the largest stocks of organic contaminants. By the mid-1990s, the chemical soil condition for the background area of Baden-Württemberg was therefore adequately described. This information is supplemented by regional surveys in more highly contaminated areas, which are published in regional soil condition reports.

Classical soil investigations were combined with material/substance flow balances for improved detection of soil changes. In the monitoring network, the modified concept resulted in the erection of 33 monitoring sites in the background area and five current intensive monitoring sites. The results show that in general, classical soil investigations are only able to detect changes in the very long term. However, in the short-term, soil changes can be detected via the balance approach, in which the substance stocks and substance flows are analysed in a synopsis. To date, the intensive monitoring site at Bruchsal/Forst on the A5 motorway, affected by traffic, has been balanced. Despite increasing mileages, the traffic emissions have fallen for almost all parameters. The deposits

of platinum, rhodium and palladium from catalytic converters and of antimony from brake linings have increased. All traffic-related contaminants continue to accumulate near the carriageway. The effect of traffic decreases with increasing distance from the carriageway, although this differs for each individual substance. In the forest edge area, for example, a steady state between input and output of cadmium is seen, while in the case of lead, slow accumulation takes place with translocation of previously formed stocks from the organic cover into the topsoil. In the case of polycyclic aromatic hydrocarbons, the current accumulation rate in the organic cover is up to 2 % per year.

The results to date substantiate the importance of continuous soil monitoring as an important information basis for precautionary soil conservation. The programme has proven to be suitable for fulfilling its purpose, anchored in legislation. The intention is to develop the concept and the balancing methods further in order to make the programme even more efficient. It is planned to integrate other soil conservation issues such as erosion and soil-related climate consequences in the programme.