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KEY ELEMENTS OF ENVIRONMENTAL MONITORING IN AUSTRIA

Abstract: This paper presents key innovative technological techniques for ecological monitoring in Austria. An overview of the air quality, biodiversity, forest, soil, water, land cover and land use has been presented. Finally, it has been described typical data flow for data in this area.

1. INTRODUCTION

The natural environment encompasses several compartments, the land surface and soil, the atmosphere, water bodies from creeks to the oceans and also ground water, and, importantly, biological habitats in several compartments. Moreover, to assess the state of the natural environment and changes thereof, human activity must be considered including settlements, agriculture, traffic infrastructure, industrial infrastructure etc. and their effects on the various parts of the natural environment, including destruction or fragmentation of habitats, sealing or altering of soils, emissions into the atmosphere, pollution of water bodies and the like. Accordingly, to holistically capture the state of the natural environmental, a wealth of professional monitoring processes are needed of a high degree of sophistication.

This paper relates to a presentation given at the workshop „Importance of GEO initiatives and Montenegrin capacities in this area" held in Podgorica 17. October 2011. Covering environmental monitoring in its entirety is beyond the scope of the presentation given and also of this paper. Moreover, the workshop was organised in the frame of the FP 7-project BalkanGEONet (www. balkangeo.net) which aims at contributing to capacity building in the region. Therefore, a selection of key elements of innovative environmental monitoring activities were chosen to be presented in some depth as examples for existing capacity.

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2. AIR QUALITY

The Austrian Environment Agency (Umweltbundesamt) runs an air quality background network consisting of 8 stations situated in different Austrian border regions (Fig. 1). This background network is intended to capture large scale distribution of air pollutants and to provide an overall framework for the air quality networks of the Austrian Länder (Provinces). Compounds measured are nitrogen oxides, particulate matter, ground ozone, methane, sulfur dioxide.

Austrian air quality monitoring is embedded in several international programmes including but not limited to EMEP (European Monitoring and Evaluation Programme), which relates to the Convention on Long-range Transboundary Air Pollution (CLRTAP) for international co-operation on transboundary air pollution; the UNECE Economic Commission for Europe, the Global Atmosphere Watch (GAW)-Programme of the World Meteorological Organisation (WMO), and the International Cooperative Programme (ICP) on Integrated Monitoring of Air Pollution Effects on Ecosystems.

Squares are the individual measurement stations.

Each of the Austrian Länder runs its own air quality monitoring network. An example is the Lower Austrian NUMBIS (Niederösterreichisches Umweltbeobachtungs – und Informationszentrum). Data of the 24 individual stations are frequently updated and presented on a web site (Fig. 2). In this way, the state of the air quality is presented to the citizens in a transparent and easily comprehensible way.

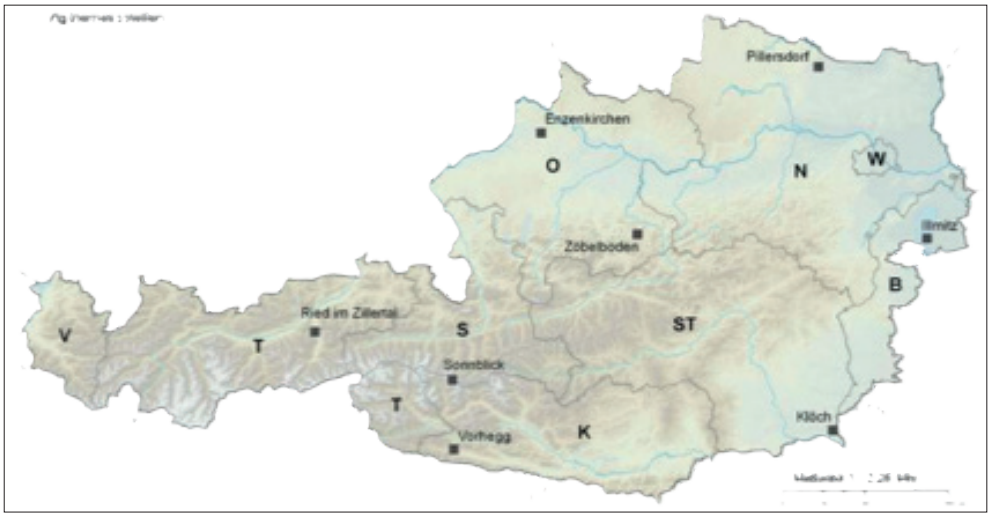

Fig. 1: The Austrian air quality background network

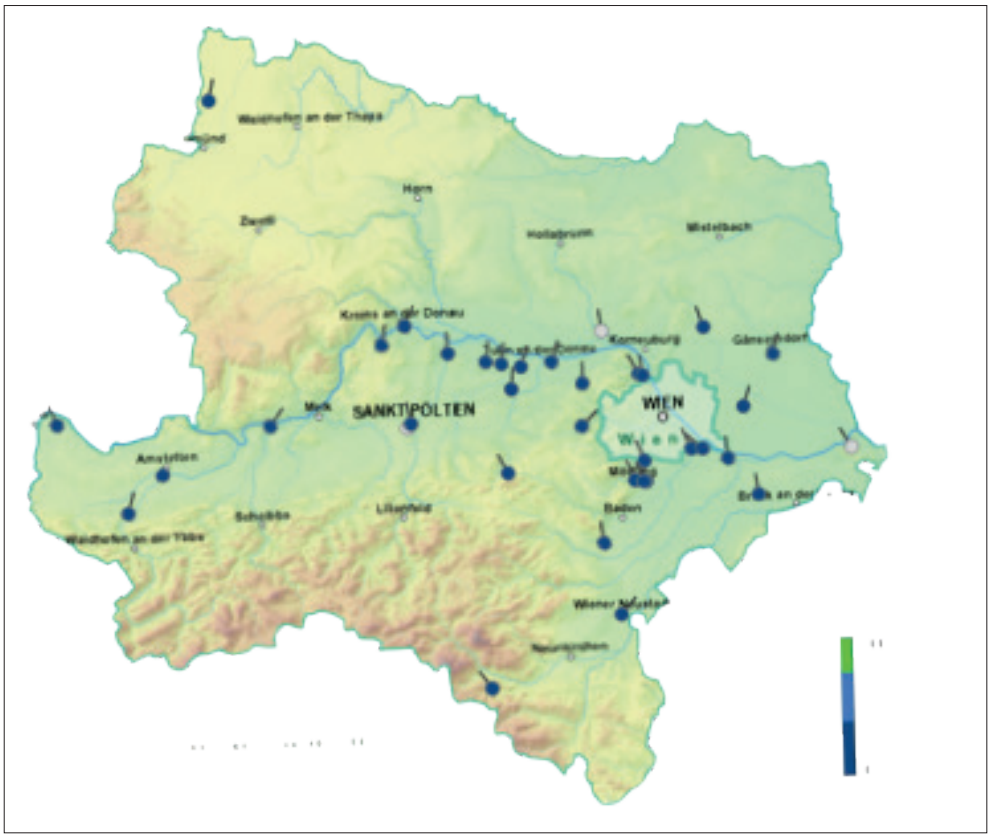

Fig. 2: Lower Austrian air quality network NUMBIS, showing nitrogen oxide

3. BIODIVERSITY

Biodiversity is a rather complex issue, much more than air quality. This is true for the topic itself (considering the many different types of habitats and organisms), as well as the political setting and the range of initiatives. The majority of monitoring activities is not sustainably funded. Unfortunately, within the population and also among decision makers, there is insufficient awareness for this important topic.

The Fauna-Flora Habitat-Directive has led to the setting up of a network of Special Areas of Conservation, which together with the existing Special Protection Areas (resulting from the Directive on the Conservation of Wild Birds) form a network of protected sites across the European Union called Natura 2000. These areas cover about 18% of the land surface of the European Union. The member states are required to safeguard these areas.

The Ramsar Convention aims at identifying and protecting especially valuable wetlands. It does not formally require any actions. Currently, 20 sites in Austria are registered under Ramsar and safeguarded. Such activities are conducted by the Län-

Fig. 3: Measurement devices as part of LTER in the Calcarious Alps

der, because in Austria, nature protection is under their auspices. They also conduct e. g. mapping of habitats.

The International Convention for Biodiversity (CBD) which Austria is a member of, asks for compulsory biodiversity monitoring. Currently, to develop a mode to comply with this duty, in Austria the project MOBI (MOnitoring Biodiversität) has worked out 16 Indicators focussing both on the actual state of biodiversity and human impact thereon. The project is conducted by a consortium consisting of the Environment Agency Austria, the Federal Forest Office and several consultancies. The Environment Agency Austria since 1992. conducts the Long Term Ecological Research (LTER) in the Calcareous Alps. This initiative includes simultaneous measurements of physical, chemical and biological properties of an ecosystem over time and across different compartments at the same location (Fig. 3). Among other targets, it aims at observing the effects of air pollution and climate change on eco systems and includes sophisticated chemical balancing. Inputs and outflows are measured as part of the international network UN-ECE (Economic Commission for Europe) Project Integrated Monitoring. The Austrian LTER is linked to international research activities.

4. FORESTS

47% of Austria is covered by forests, thus, they are a very important part of the landscapes. The Austrian Forest Inventory is one of the most sophisticated Forest Inventories in the world. It started as a pure forestry instrument, aimed at the economic utilisation of wood resources. Since then, its scope was widened to also cover ecology, including biodiversity in forests or essential elements for biodiversity preservation such as dead wood.

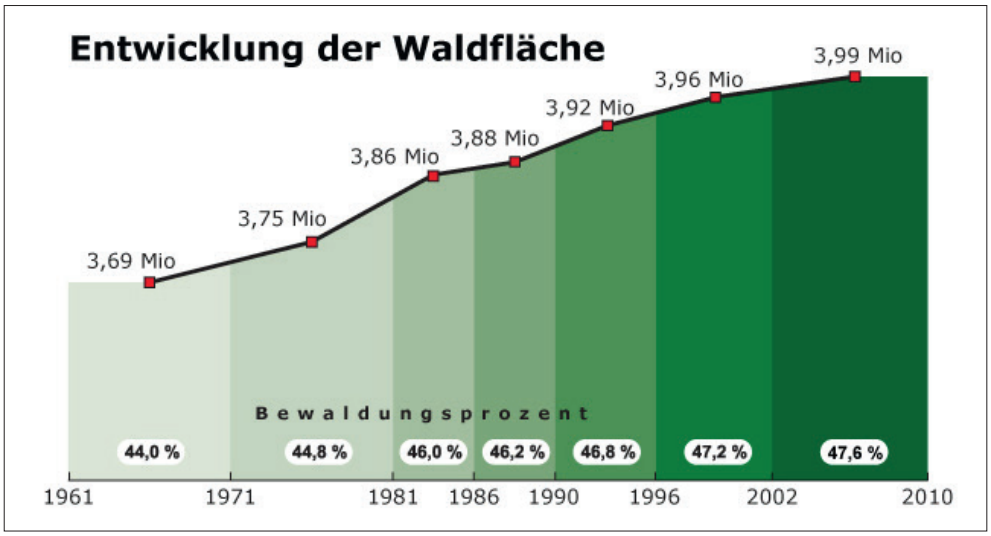

Fig. 4: Development of the total forested area in Austria

This forest inventory is conducted by the Federal Forest Office (BFW). It involves 11000 measurement points at each of which 32 parameters measured covering both forestry and biodiversity. The inventory is an area frame statistical survey conducted every three years. It has also shown that the total forest area in Austria is slowly increasing (Fig. 4).

The Genetic Inventory of Austrian Forests is a programme aimed at determining the large- and small-scale diversity and distribution of tree species and the influence on both by forestry measures and other human impact.

5. SOIL

Soil quality and contamination is again a very complex topic considering the many different kinds of soils, the many kinds of different human impact on them, and various purposes for determining soil quality. All this has brought about a wealth of different data sets. BORIS (Soil Information System) is run and maintained by the Environment Agency Austria. These include chemical, physical, and microbiological values. In spite of the different nature of the individual data sets in the system, BORIS involves a harmonisation effort which makes these originally heterogeneous data sets available for country wide analyses by various user groups. Currently, BORIS contains over 1.5 Million data sets from over 10.000 sampling sites.

The following data sets are integrated in BORIS: The state of soil inventory of all the Länder, the federal inventory of the state of soils in forests, the federal radio-caesium inventory, and data of over 30 further local investigations related to specific problems such as industrial sites or large settlements. Using a soil scientific key code, the data sets were compared regarding methodological differences and harmo-

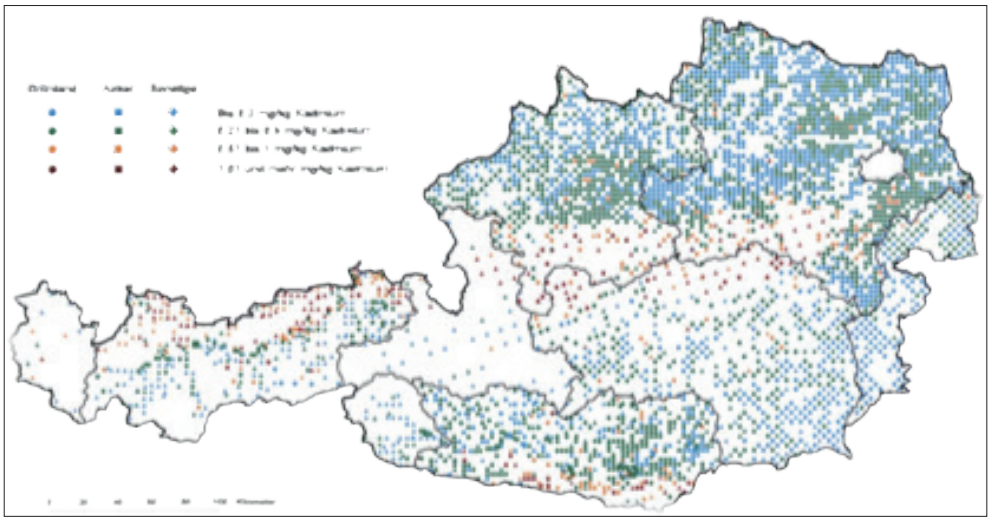

Fig. 5: BORIS showing cadmium in upper soil

nised. Moreover, BORIS visualises several important soil parameters to make the state of soils transparent and accessible (Fig. 5).

6. WATER

The Water Framework Directive requires 33 contaminants to be measured and documented. Out of these, eight substances relate to the contamination of water resulting from the discharge of specifically dangerous substances into the waters of the union. All water bodies with a catchment area above 10 km^2 should be considered, this is in Austria a stream network of 31.000 km and 7.244 surface water bodies.

Regarding water ecology, only 15% of these are in a very good state. Issues in Austria are typically artificial structures orthogonal to flow, such as water dams for power generation. In terms of water chemistry, the situation has improved in the last decades. Currently, 70% of the Austrian rivers are in good state. Other than rivers and creeks, 100% of the lakes are in good to very good state in all regards.

The European Groundwater Directive regulates monitoring of subsurface water bodies. Emphasis is placed on aquifers, groundwater bodies from which drinking water is drawn. In Austria, groundwater is monitored at 2030 measurement sites. The largest issue is overly high nitrate concentrations, which is found at 249 (ca. 12%) sites (Fig. 6). These chemicals are released by agriculture and, accordingly, the same sites often show overly high concentrations of insecticides. 22% of the sites show too high trace values such as phosphates, antibiotics etc. The amount of drinking water available is always good.

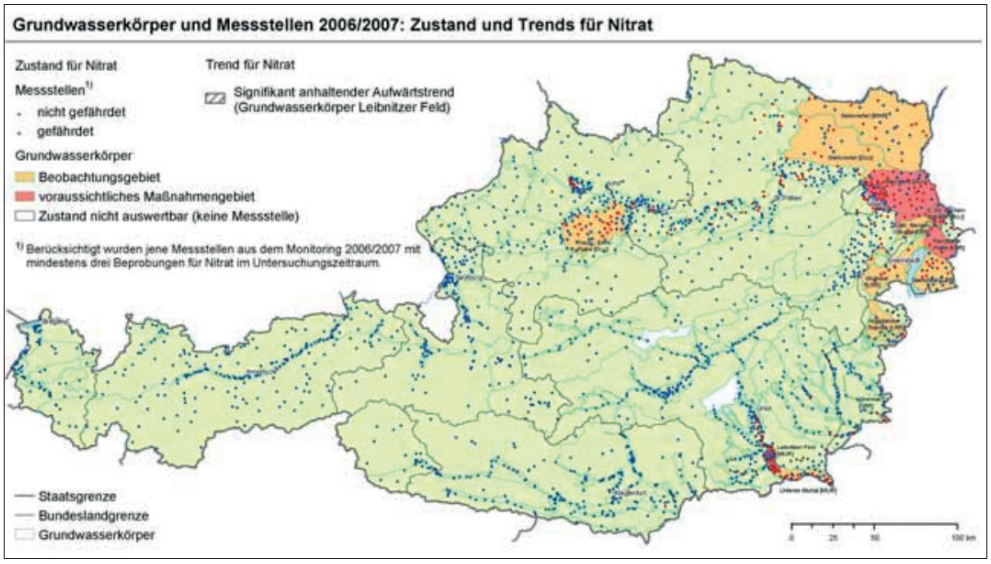

Fig. 6: Nitrate concentration in Austrian groundwater

7. LAND COVER AND LAND USE

The Land Information System Austria (LISA) is currently in a project state. It is intended to be established as an operational permanent service. Land Cover and Land Use (LULC) is derived from aerial imagery by semi-automatic interpretation (Fig. 7). The system uses an object based approach and provides maps with high resolution (25 m^2). The particular advantage of the system is the clear distinction between land cover (e. g. artificial surface) and land use (e. g. parking lot) and the fact that all objects can be described using attributes. Therefore, the maps fulfil the specific needs of the Länder. LISA can provide the basis for a range of policy matters and decision making related to the land surface, for spatial planning, traffic planning, biodiversity, agriculture, forestry etc.

8. PRIORITY DATA FLOWS

The environmental data are usually communicated in that the Länder (provinces) report their environmental data to the national environment agency. There, these data are linked with federal level data collections, such as the outcomes of the air quality background network. The collated data are then reported nationally to the environment ministry (currently integrated with the agriculture ministry) and internationally to the European Environment Agency, the European Commission Directorate General Environment, the Commission for Long-Range Transboundary Air Pollution, etc.

Austria has and always had a comparatively good standing within the ranking on fulfillment of reporting obligations within the EIONET (European Environment

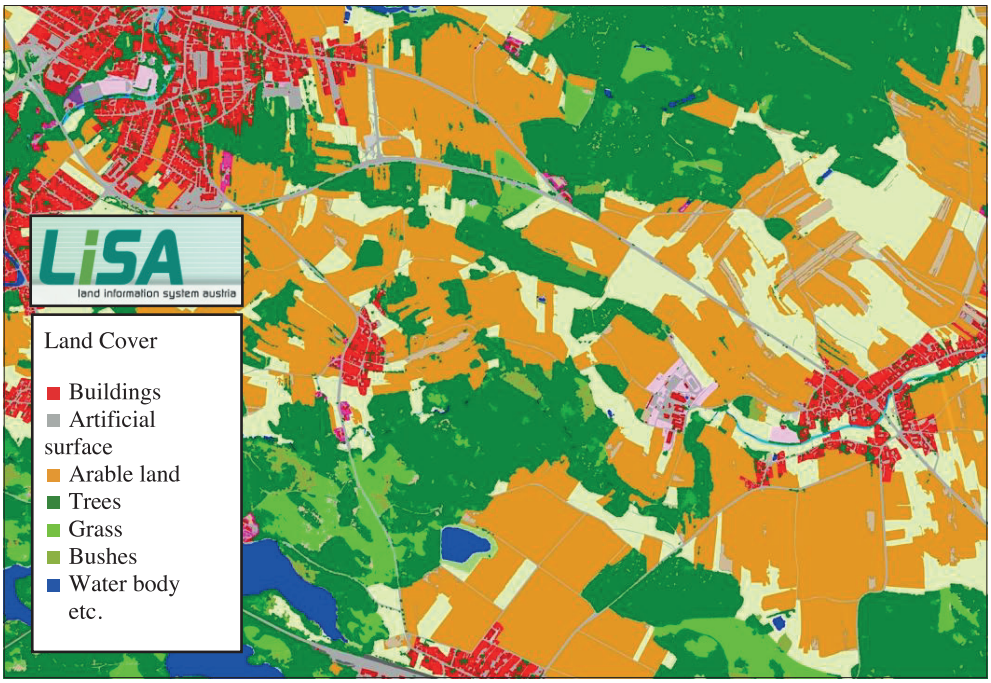

Fig. 7: Land Information System Austria (LISA), Land Cover

Information and Observation Network), see http://www.eionet.europa.eu/dataflows/pdf2011. However, the compliance with all reporting obligation went down from 100% in 2009. to 91% in 2011. Montenegro, after becoming independent, had to set up its own environmental monitoring mechanisms. Thus, it is quite impressive that its ranking has recently much improved from 17% compliance in 2008. to 65% in 2011.

9. CONCLUSION

The main directions in the environmental monitoring in Austria has been presented. Austria is rather advanced country in this field (always in top 3 in Europe in this area accoring to relevant analysis). Organization of monitoring is relatively complex due to the Länder responsibilities but this system is well integrated within the wider international framework.

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