Foreword

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Insight in impacts of atmospheric emissions of pollutants on air, soil and water quality, and thereby on terrestrial and aquatic ecosystems, is crucial for adequate policy support. The Convention on Long-range Transboundary Air Pollution (LRTAP Convention) aims to gain such insights based on a combination of experimental study, monitoring, and modeling.

With an increasing importance of emerging challenges, such as the change of climate and biodiversity, it has become necessary to extend the system boundaries of relationships between multiple pollutants and impacts. This is vital for the future support of European air pollution abatement policies under climate change. This is reflected in the long-term strategy of the LRTAP-Convention, adopted in December 2010, which aims at delivering a sustainable long-term balance between the effects of air pollution, climate change, and biodiversity. Following up on this long-term strategy, the effect based logic of the Working Group on Effects, its ICPs in general and the ICP-IM in particular, is further strengthening its capabilities to monitor and model multiple impacts caused by interactions between multiple-pollutants and multiple-issues.

Where modeling is essential to predict and scale up impacts of air quality and climate change on a regional to global scale, it is crucial that such models are adequately backed up by process based information, based on experimental studies, and/or empirical relationships based on integrated monitoring. The latter data can also be used for validation of large scale impact models.

The International Cooperative Programme on Integrated Monitoring (ICP-IM) under the Convention focuses specifically on the monitoring of physical, chemical as well as biological processes in time and space to increase the knowledge on causes of ecosystem changes. The focus has been on determining and forecasting the state of soils and surface water with respect to interacting impacts of air

pollutants, especially nitrogen, sulphur, and metals. With its nineteen participating Parties to the LRTAP-Convention, which run about 50 sites, the ICP-IM is also well prepared for the new added focus on climate change and biodiversity. Data are gathered in all ecosystem compartments that lead to a better understanding of physical, chemical, and biological processes that cause effects to soils, catchments or vegetation in response to changes in air quality and climate.

This special issue of AMBIO illustrates—for the Swedish ICP IM sites—how the required modeling and monitoring capabilities could be used. Results of modeled and monitored temporal and regional variations of air pollution depositions as well as related chemical and biological processes are described. Changing meteorological conditions over the north-south gradient of Swedish ICP-IM sites show how confounding effects of air pollution under climate change could be addressed. The papers included focus on the impacts of air quality (specifically declining S deposition) and climatic factors on (i) external inputs, internal cycling by litterfall and decomposition and leaching of nutrients and metals and related critical loads, (ii) recovery from acidification and dynamics of dissolved organic carbon, and (iii) biodiversity in terms of impacts on epiphytic lichens and algae and on plant species diversity of the ground vegetation. The results, which are based on a combination of modeling and monitoring, show that ICP-IM can help strengthen the ground-truthing of the effect based support of European air pollution and climate strategies.

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