Evaluation of Gothenburg protocol and global change on acidificiation and eutrofication of soil and water

Jakub Hruška[1], Jiří Kopáček[2], Irena Skořepová[3]

[1]Czech Geological Survey

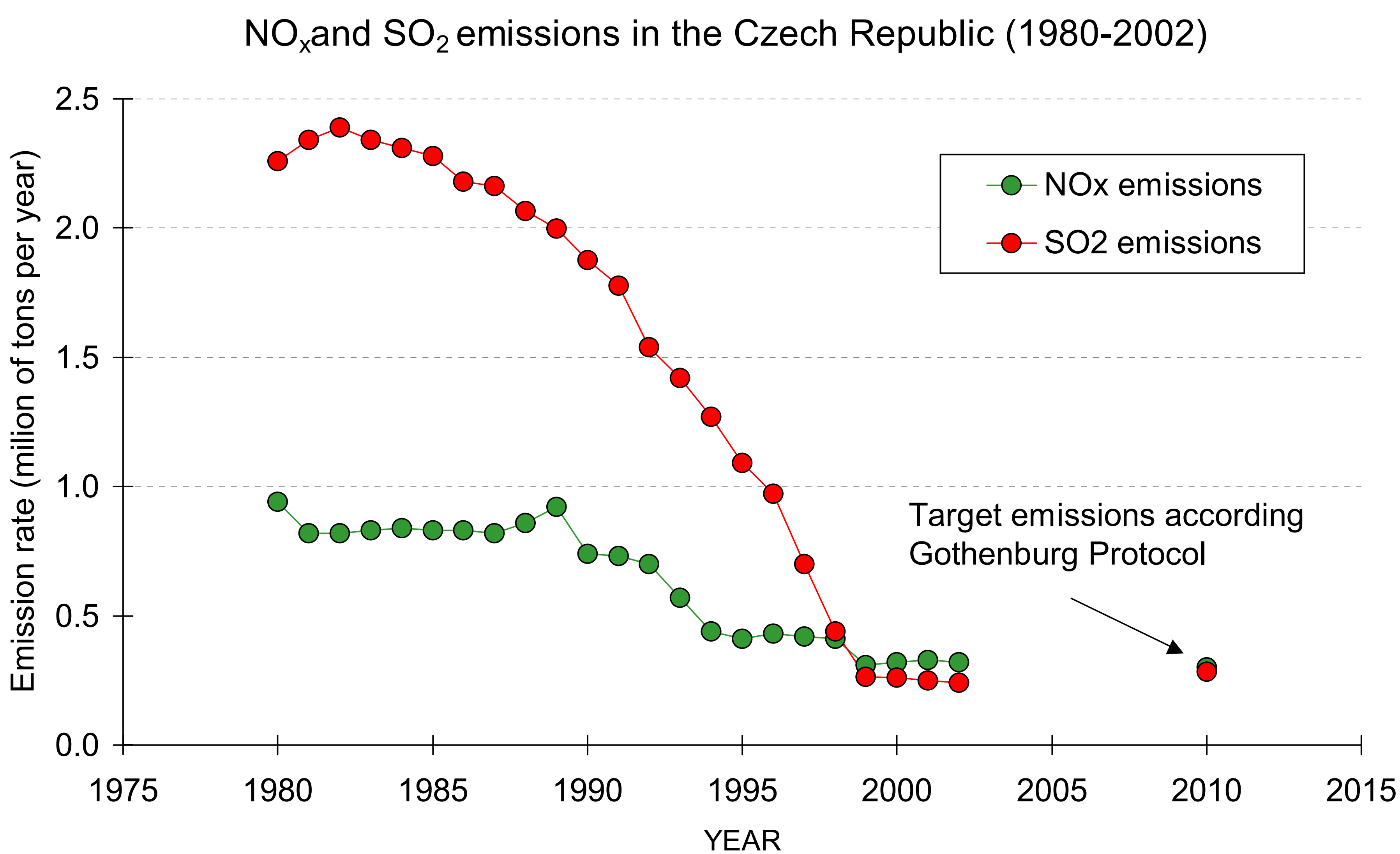
[2]Hydrobiological Institute, Academy of Sciences

[3]Czech Environmental Institute

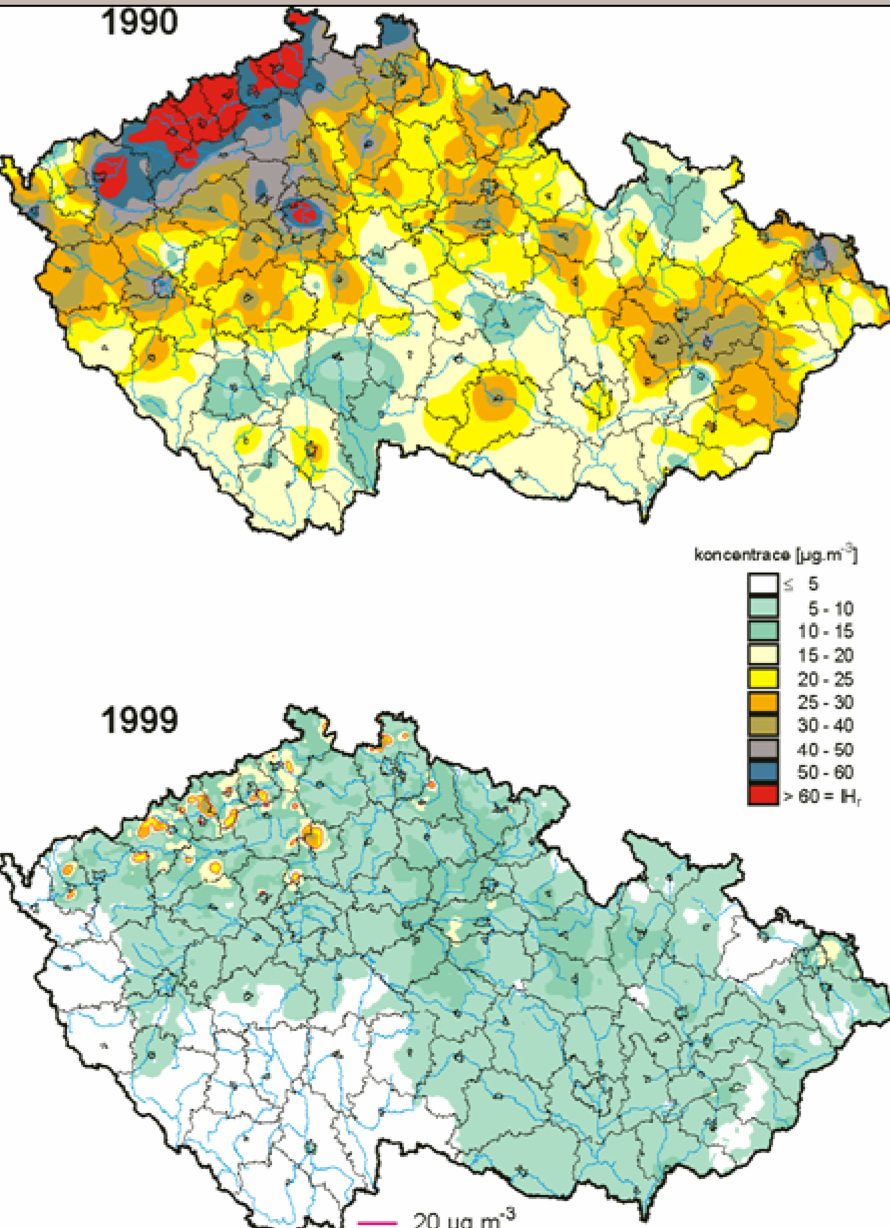
with contribution of Thorjorn Larssen, Norwegian Institute of Water Research

Gothenburg Protocol (UN ECE, 1998)

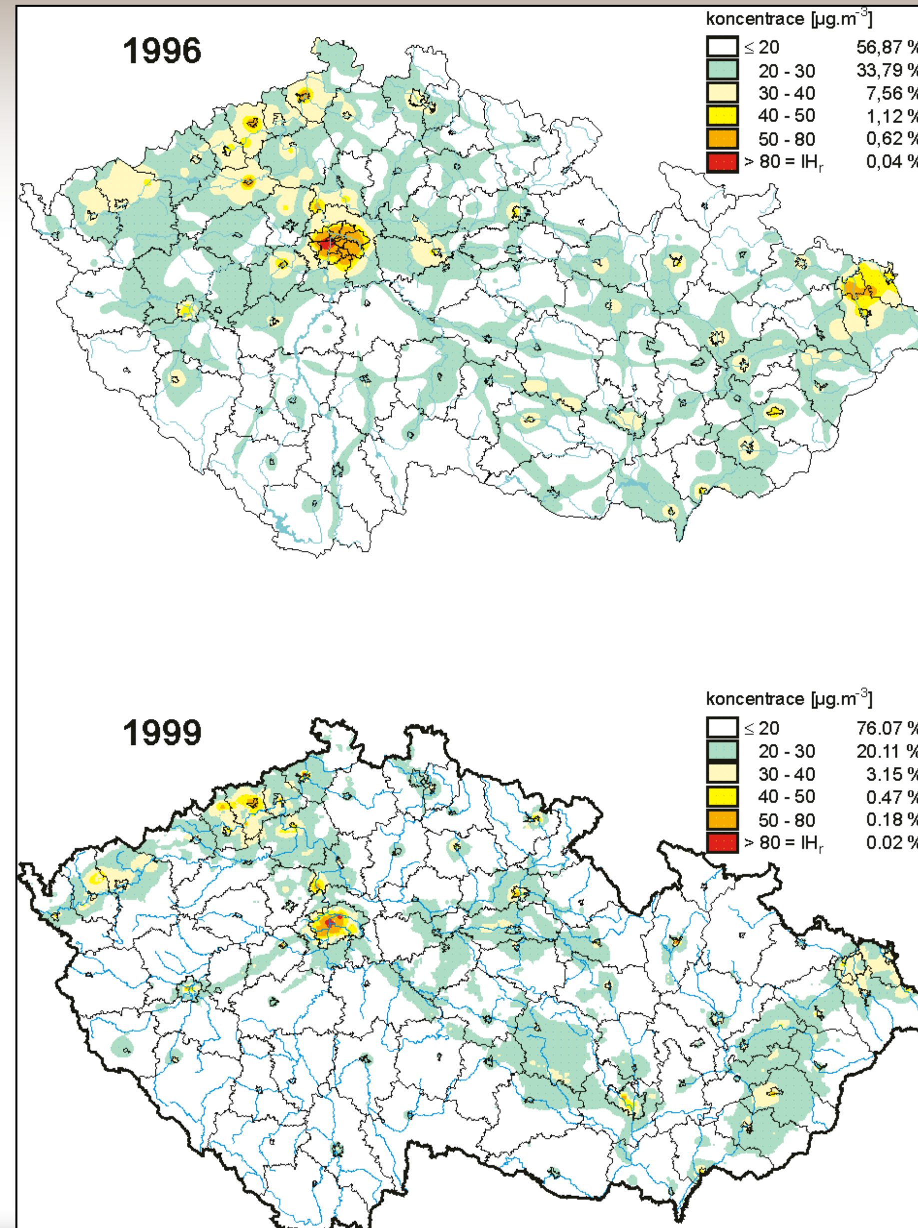
Protocol to Abate Acidification, Eutrophication and Ground Level Ozon



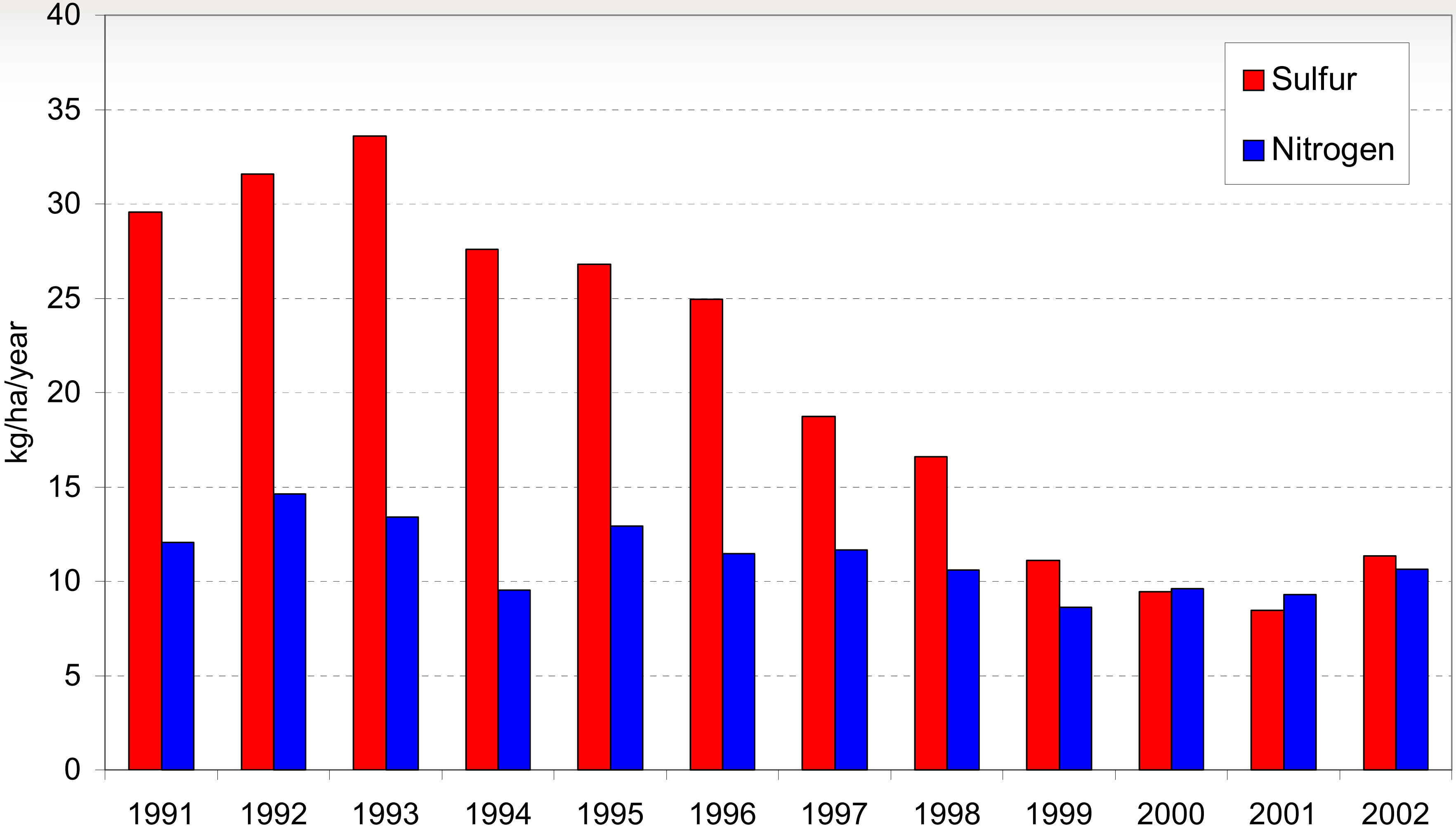
SO_2 concentration



NOx concentrations



Atmospheric deposition – western CZ



The effect on atmosphere is clearly positive – but how ecosystems responde?

1. **Soil and water regeneration** – small catchments and lakes monitoring and dynamic modeling according protocol predictions

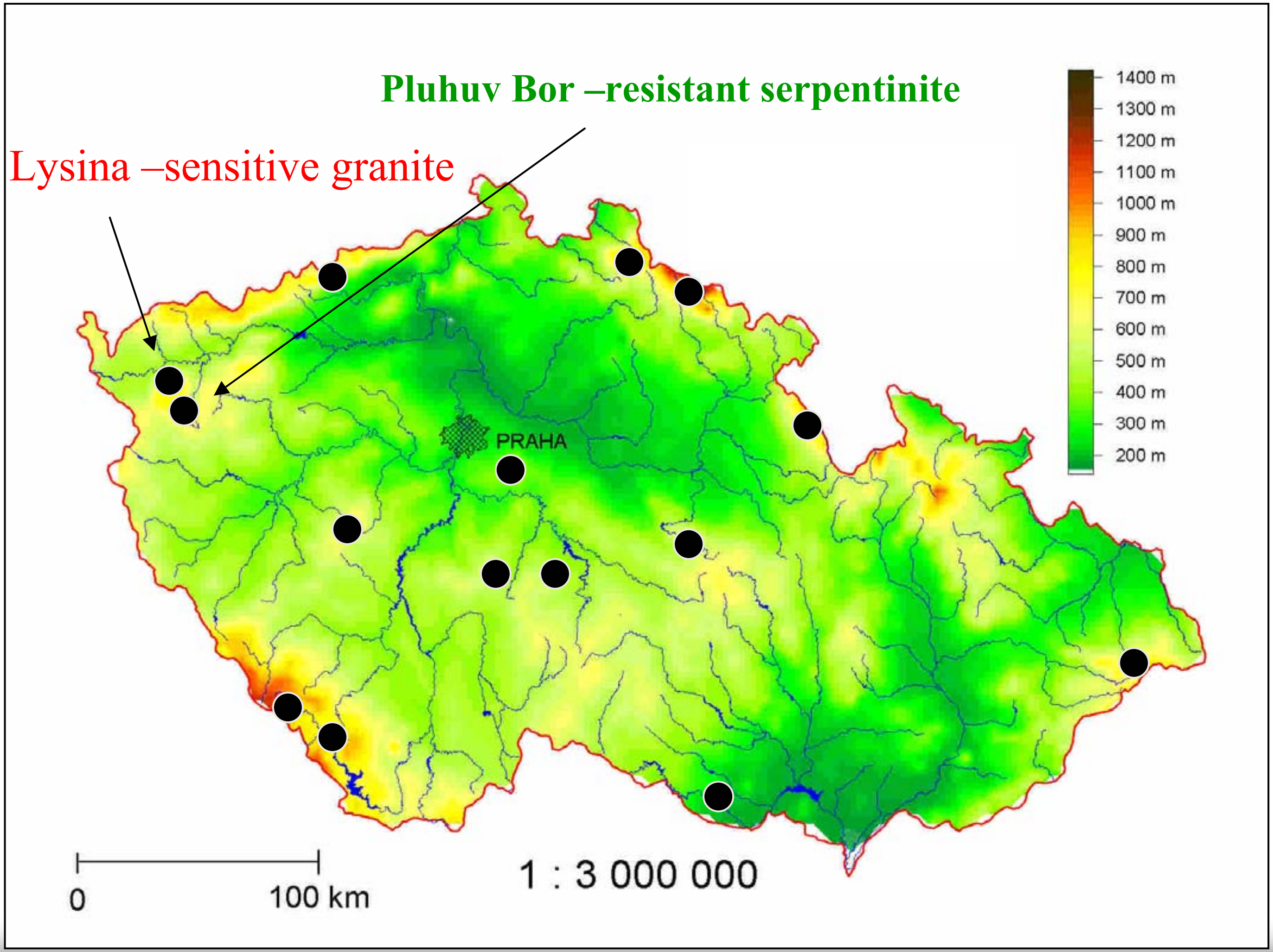
2. **Mapping of streamwater chemistry** (prior the Protocol and after that)

3. **Critical loads for acidity and eutrofication** (prior the Protocol and after that) – response of forest health

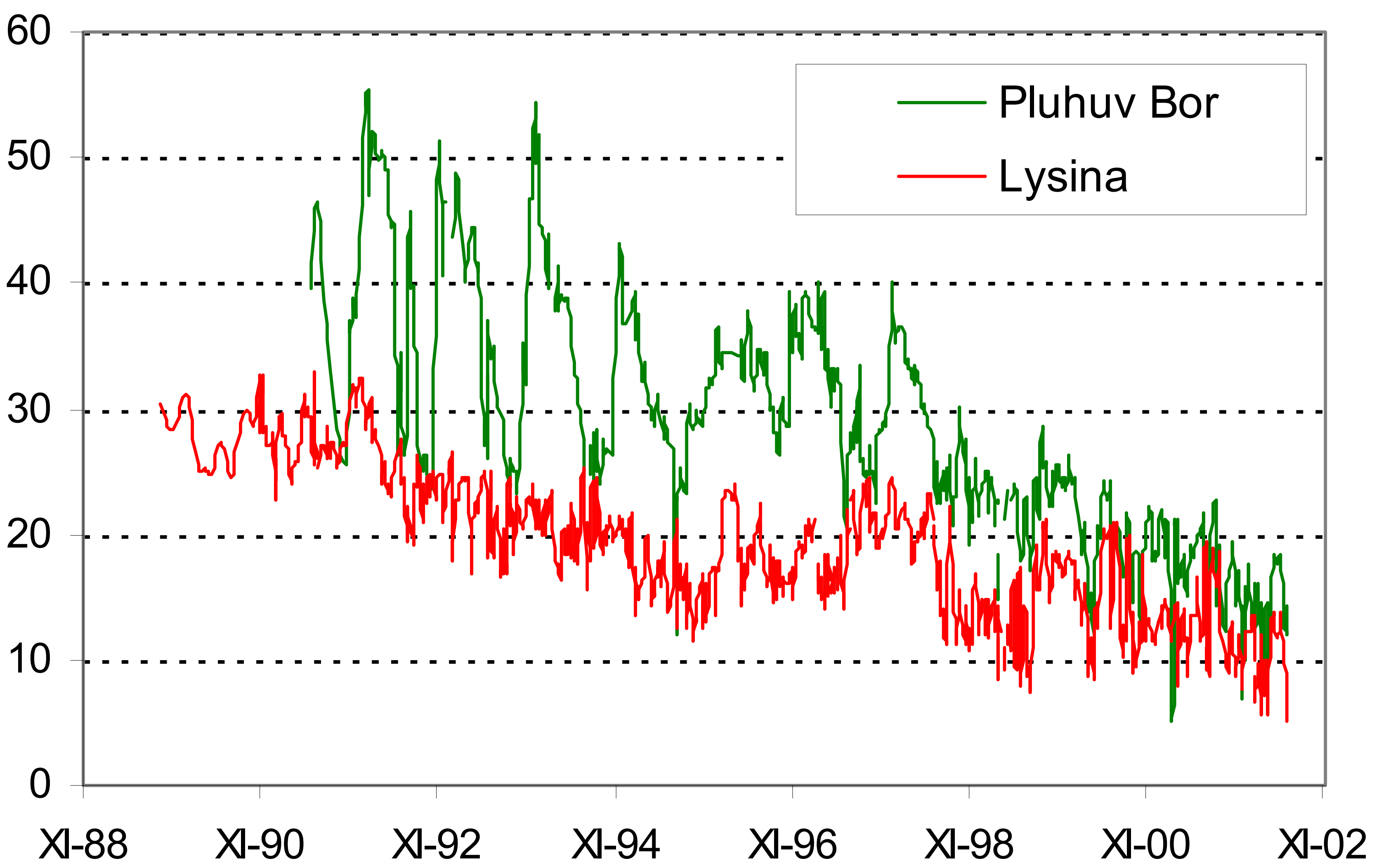
4. **How global change affect regeneration?**

Small catchments network **GEOMON** (deposition, soils, streams, forest healt)

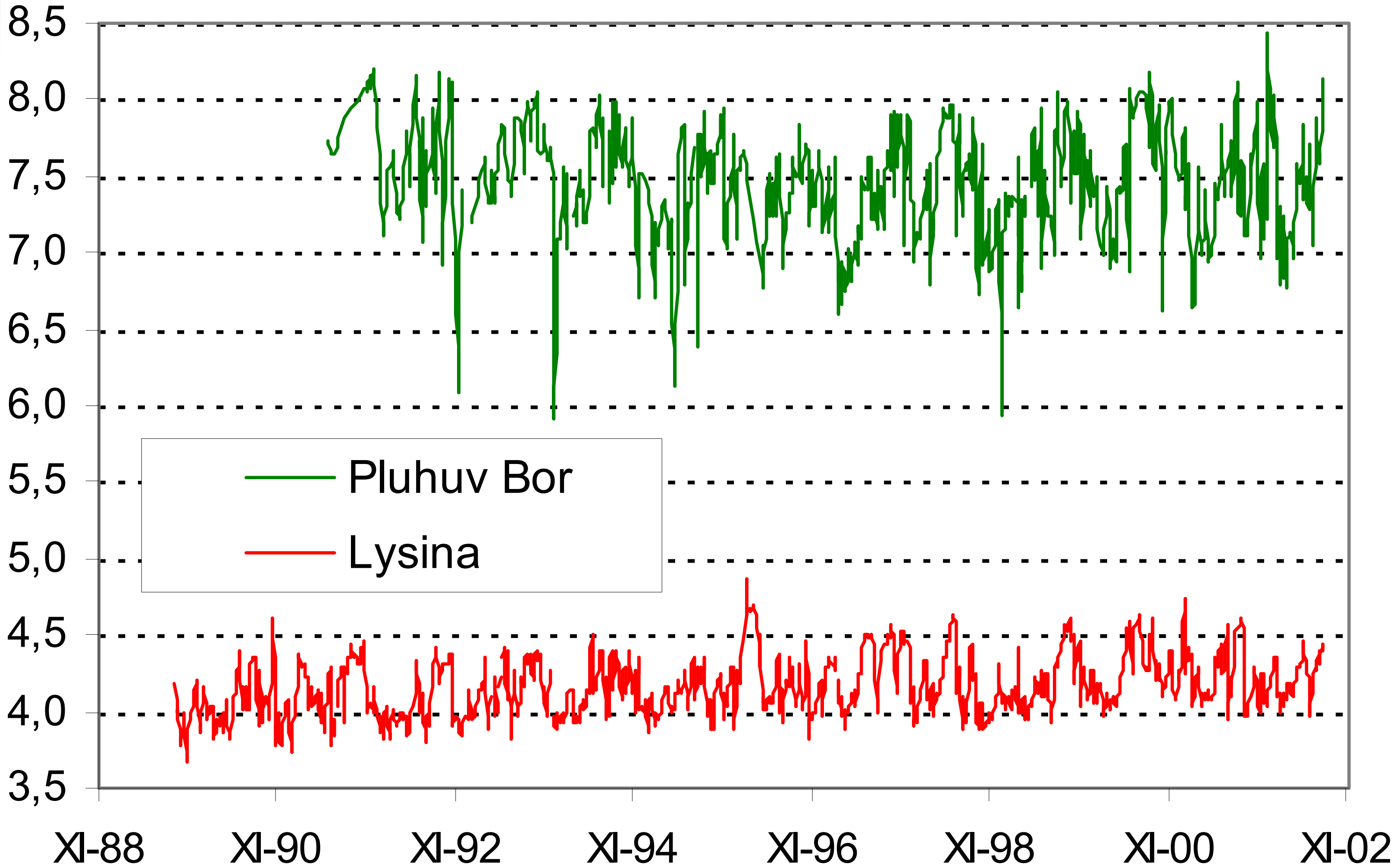
- at minimum 11 years of data (27 years the longest record)
- excellent tool for monitoring and modeling of long-term responses



Streamwater SO_4 (mg/L) 1990-2002 – decline due to protocols aplication



Streamwater pH 1990-2002



Soil and water future (and history)????

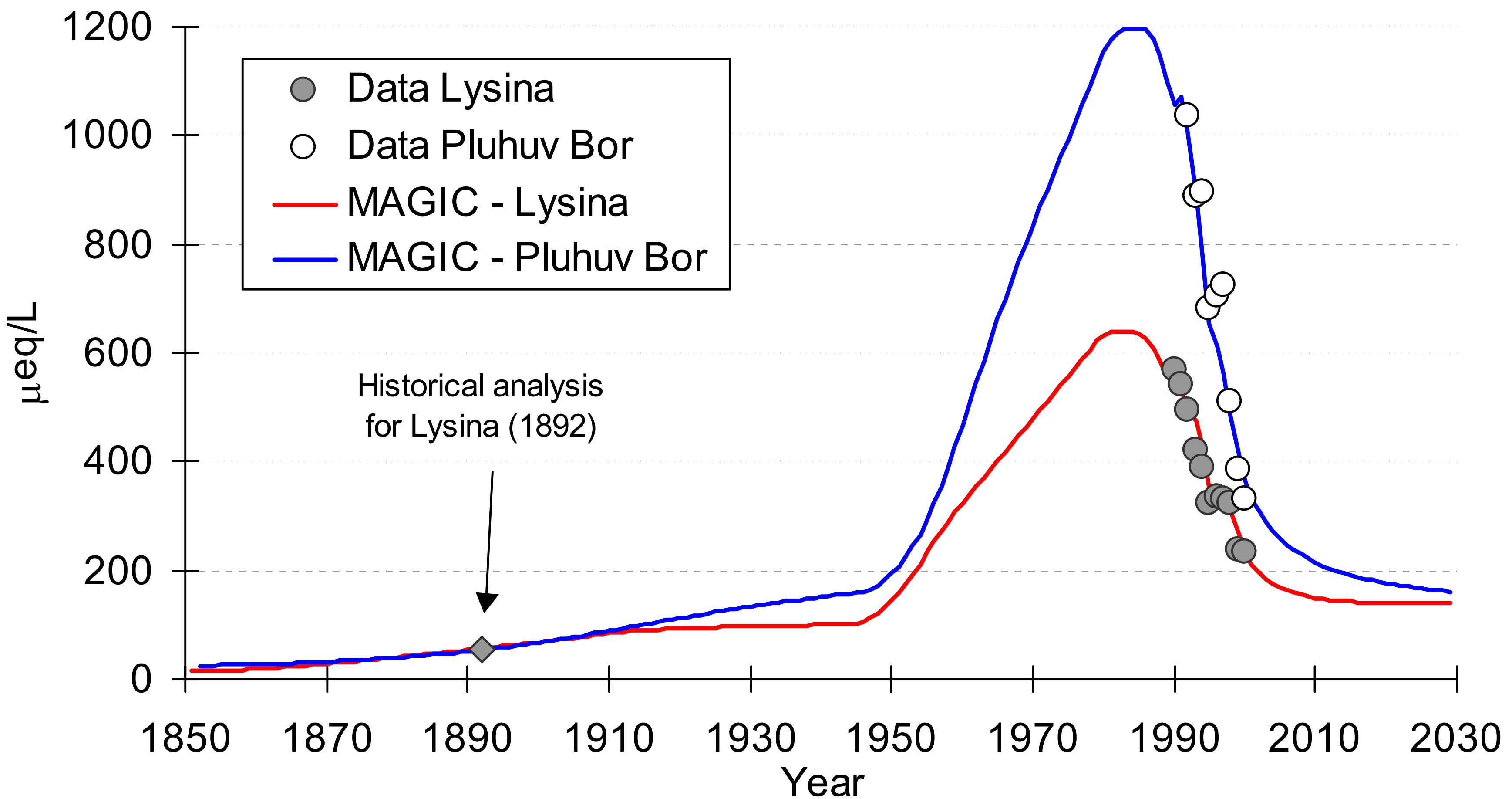
Biogeochemical modeling by MAGIC model (NIVA)

MAGIC (**M**odel of **A**cidification of **G**roundwater **i**n **C**atchments):

- **Inputs:** atmospheric deposition (**PROTOCOLS**), actual soil chemistry and water chemistry

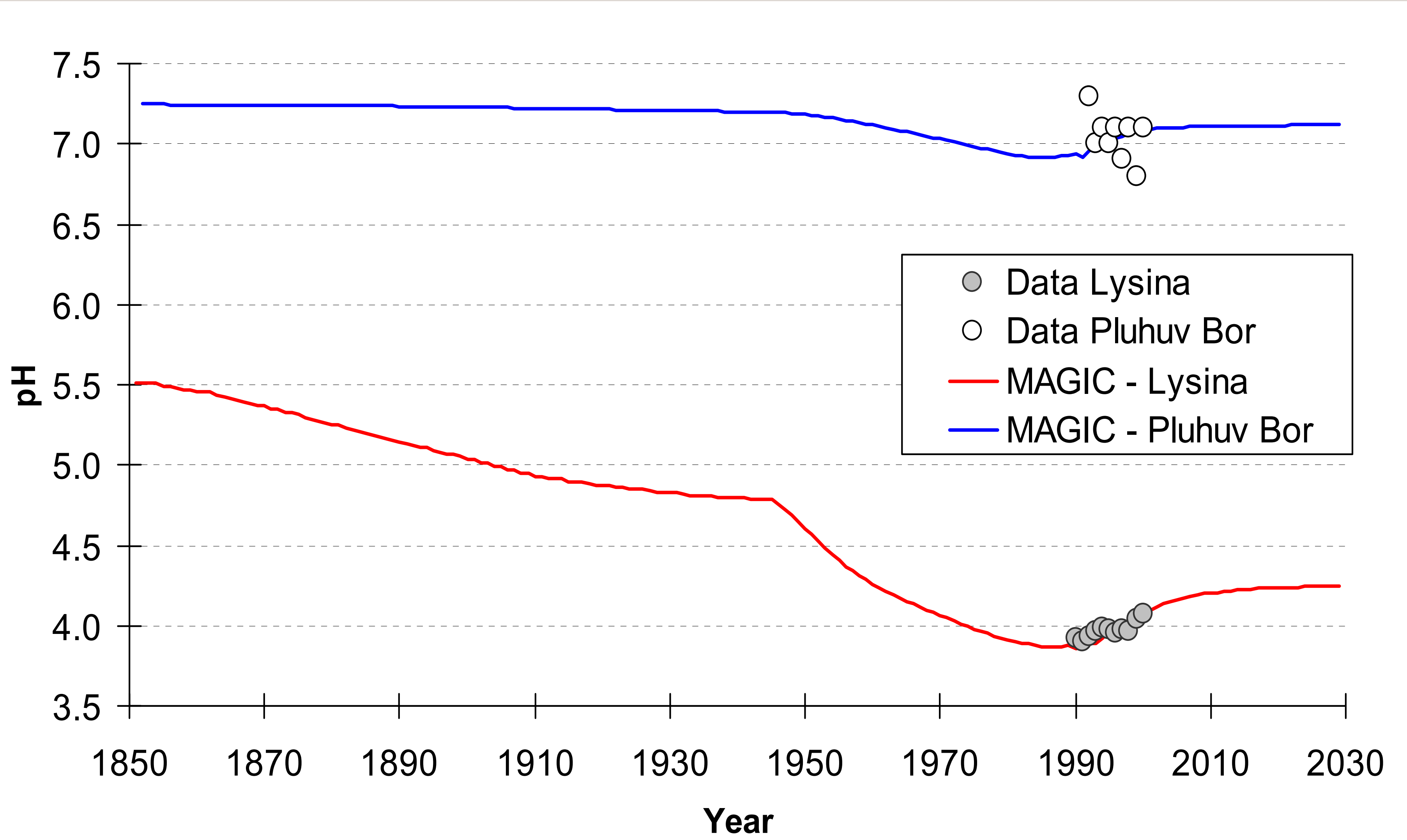
- **Results:** Long-term trends of soil and water chemistry for the past and the future

Sulfate

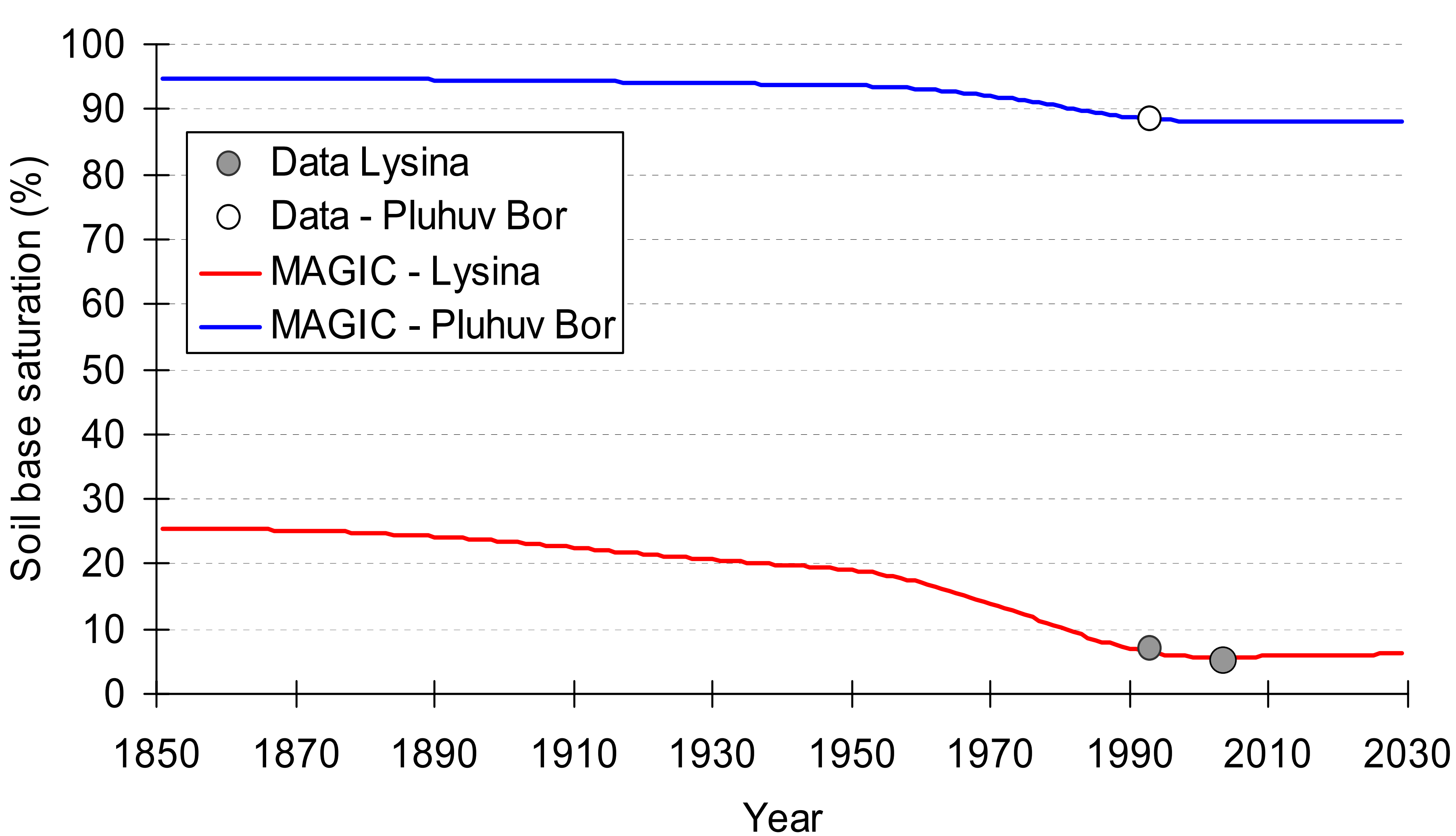


Data Lysina
Data Pluhuv Bor
MAGIC - Lysina
MAGIC - Pluhuv Bor
Historical analysis
for Lysina (1892)
μeq/L
1200
1000
800
600
400
200
0
1850
1870
1890
1910
1930
1950
1970
1990
2010
2030
Year

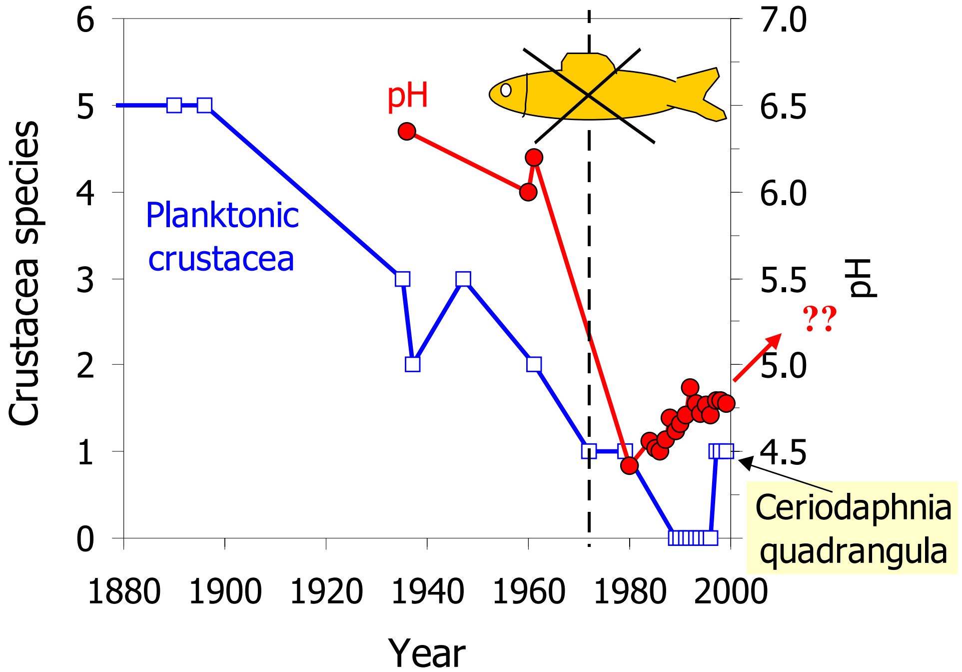
Streamwater pH



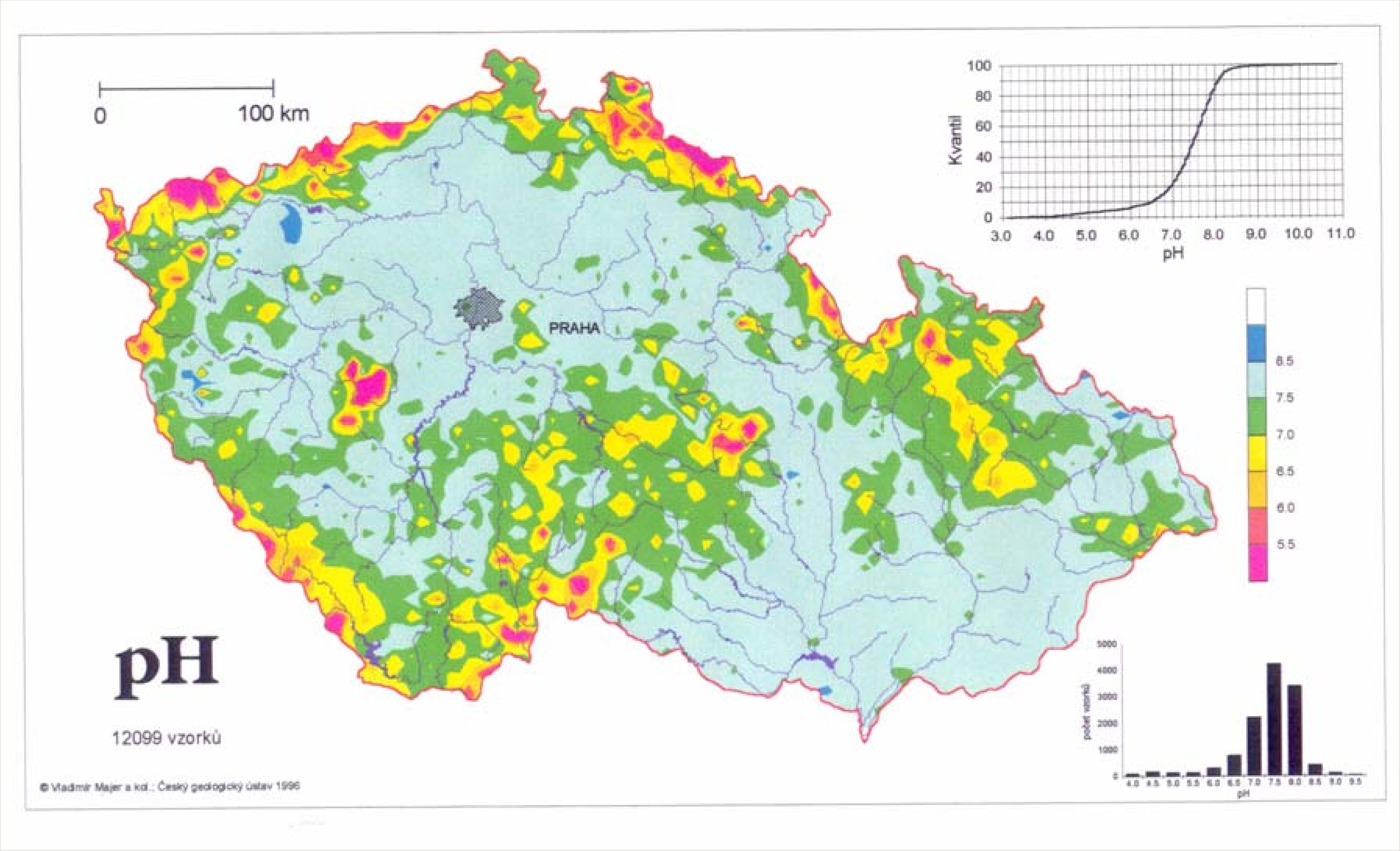
Soil base saturation – NO REGENERATION until 2030



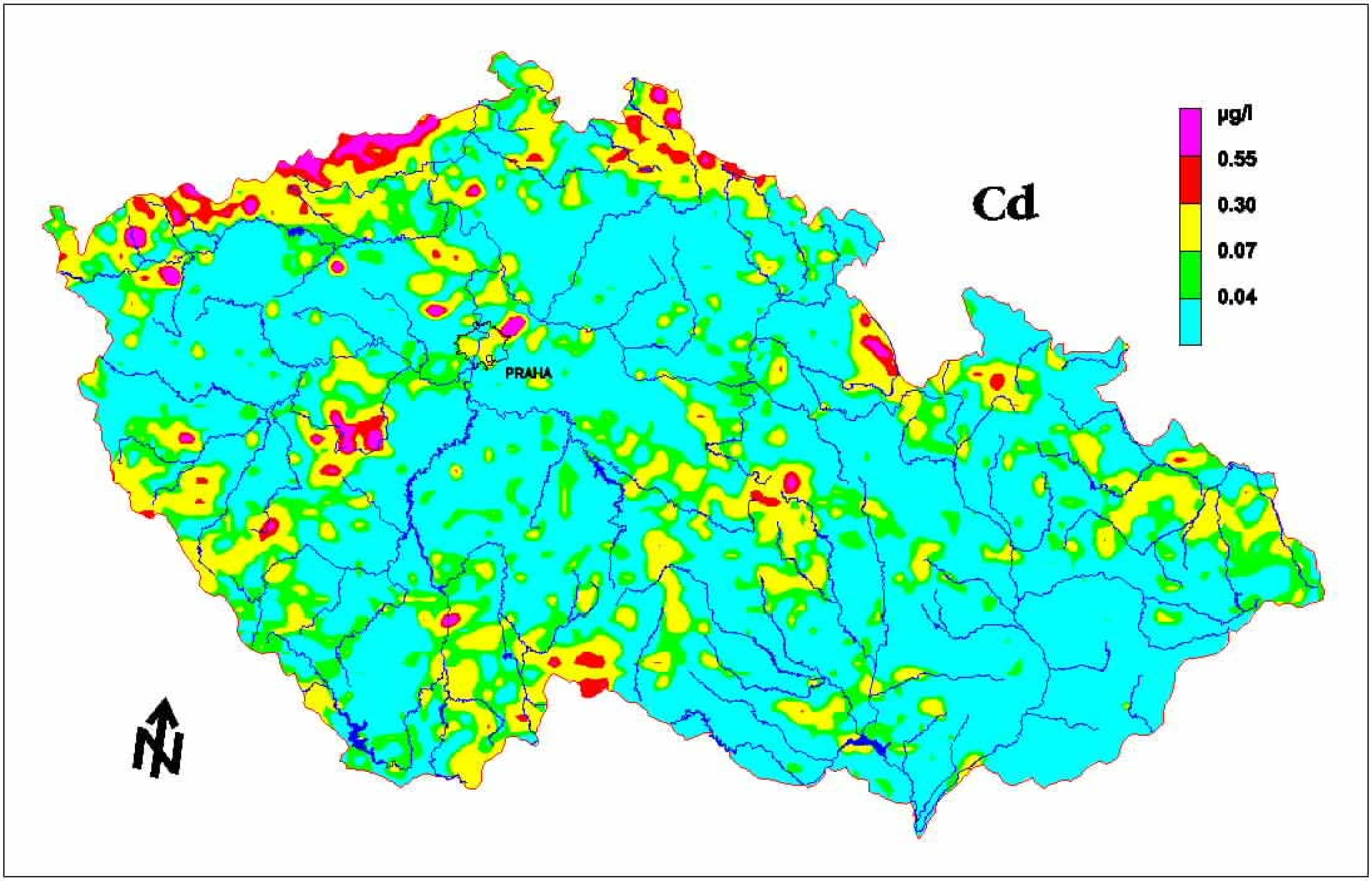
Bohemian Forest lakes – delayed biolological recovery



Stream water pH at 1980s/1990s (prior GP)



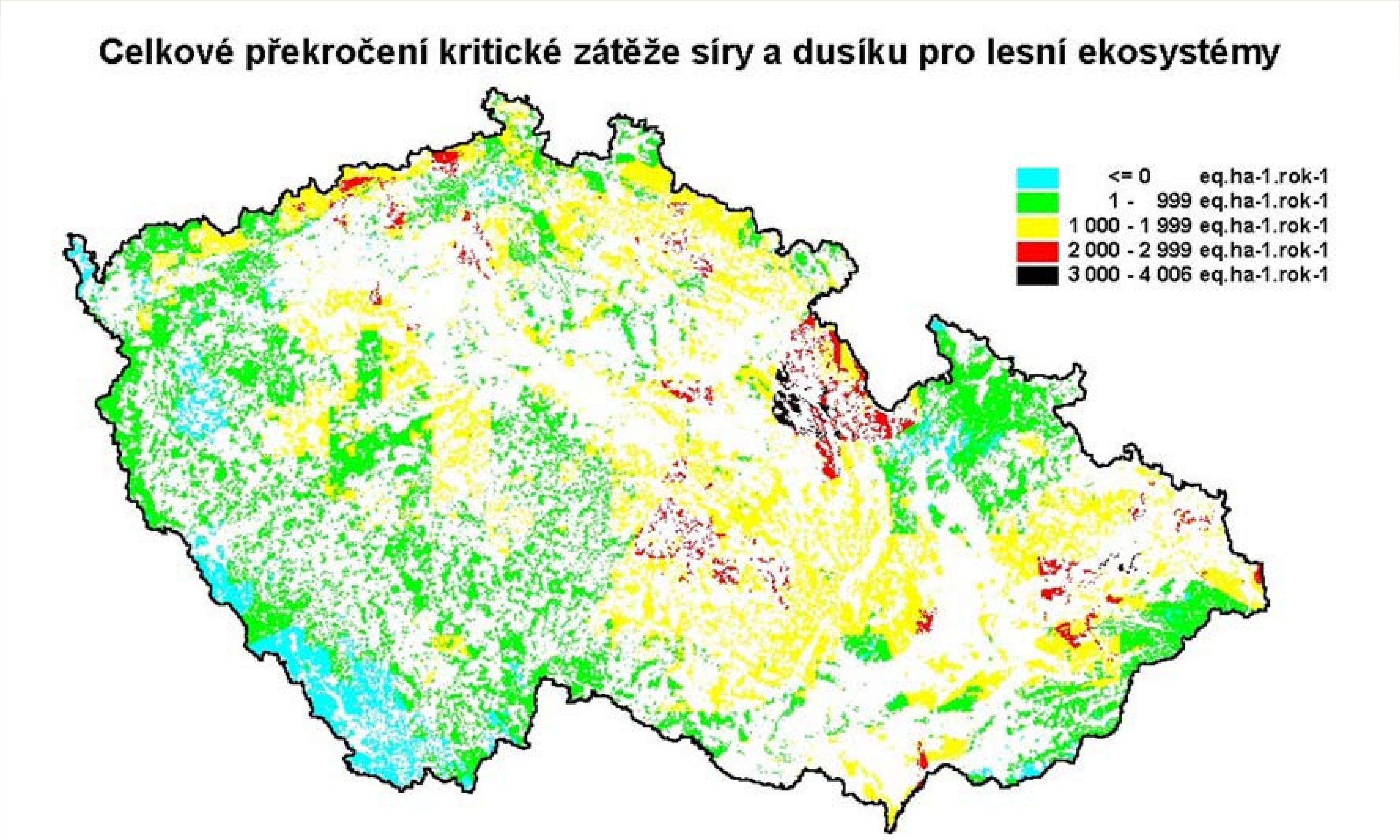
Cadmium at 1980s/1990s (prior GP)



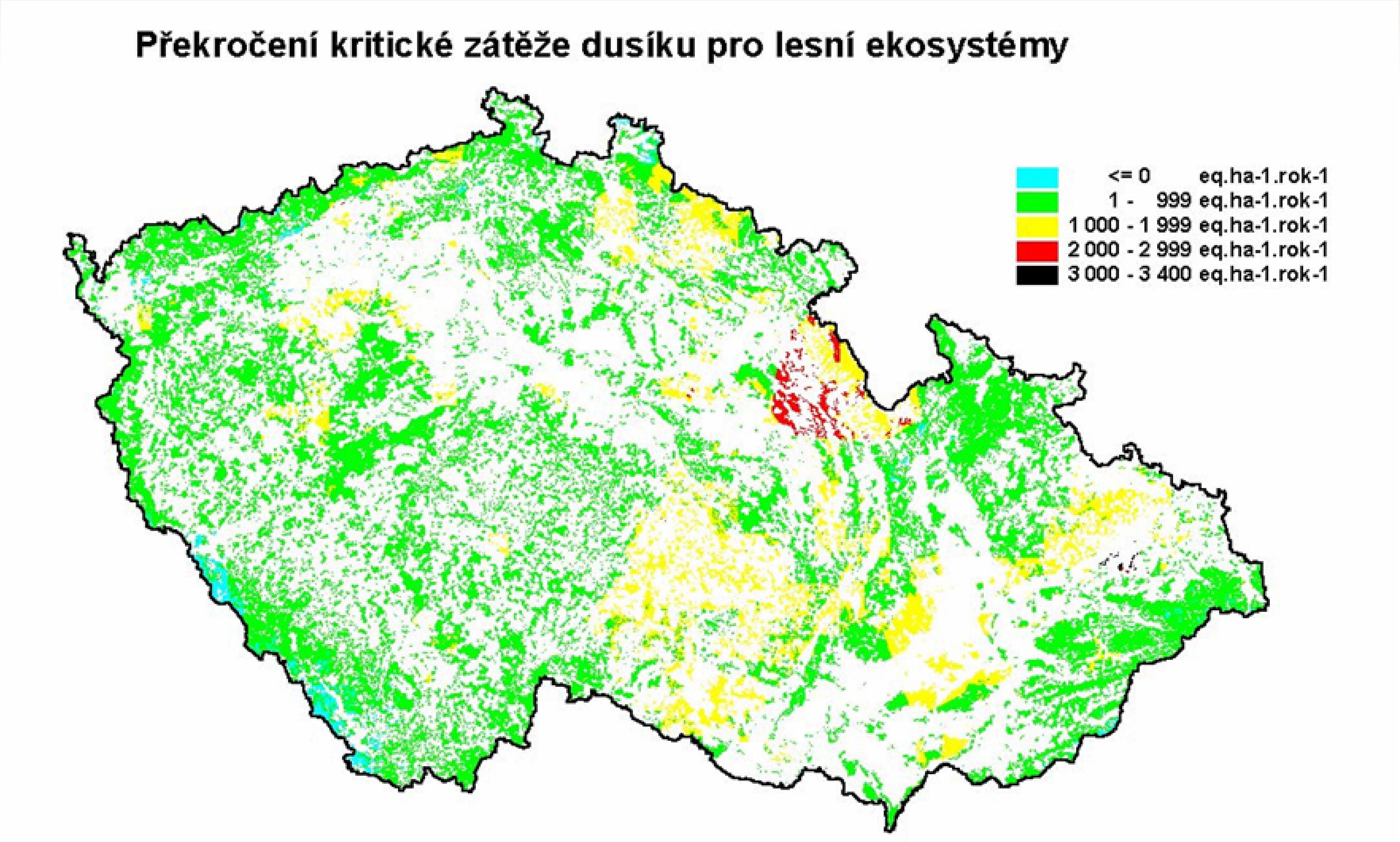
2. CRITICAL LOAD for sulfur and nitrogen

CL is a level of atmospheric deposition which does not have long-term harmfull effect on the most sensitive part of ecosystem (forest soil)

Exceedance of critical load for acidity (Skořepová, 1999)



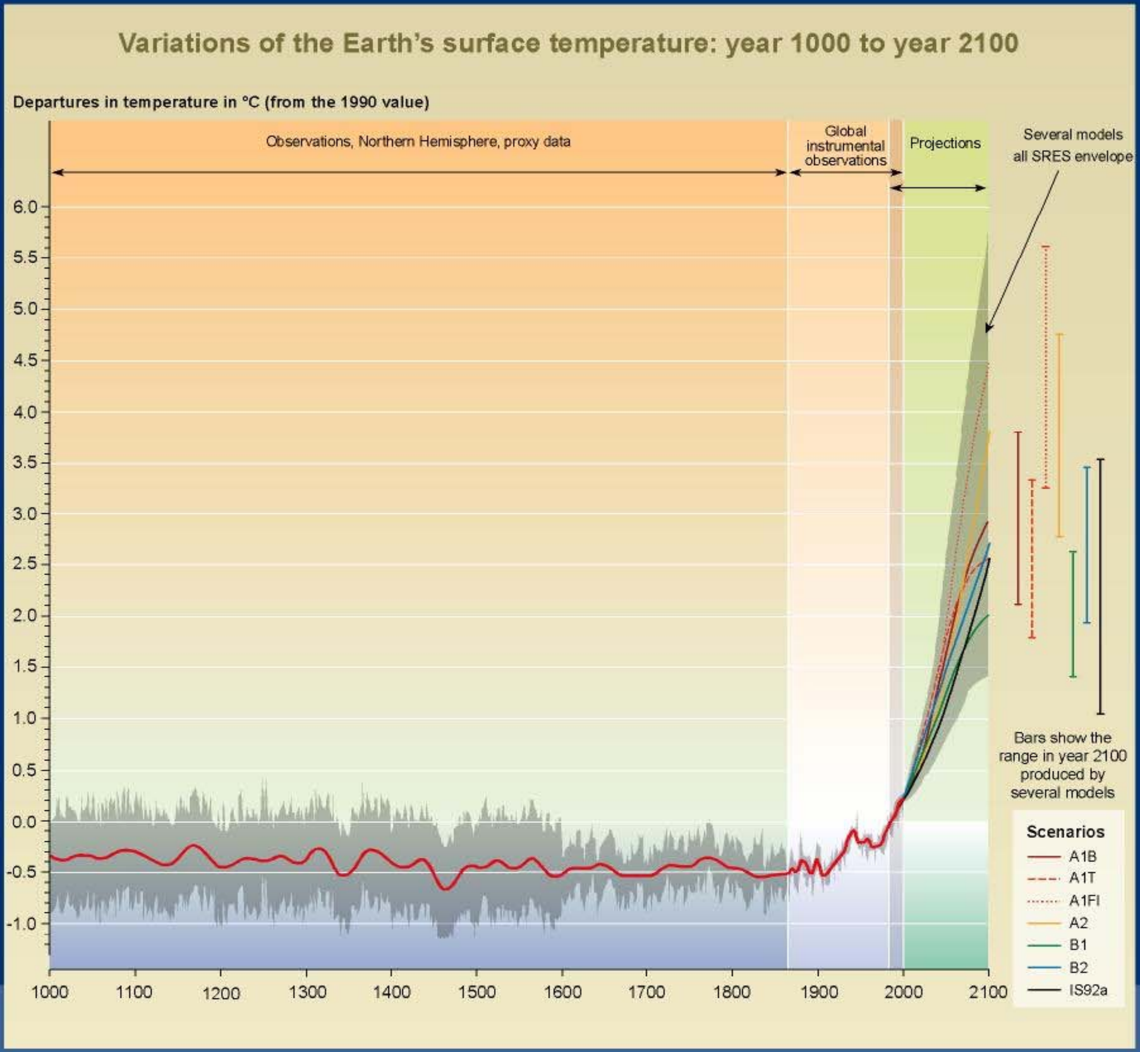
Exceedance of eutrophying nitrogen critical load (Skořepová, 1999)



Proposed work 2005-2009 (cooperation with NIVA):

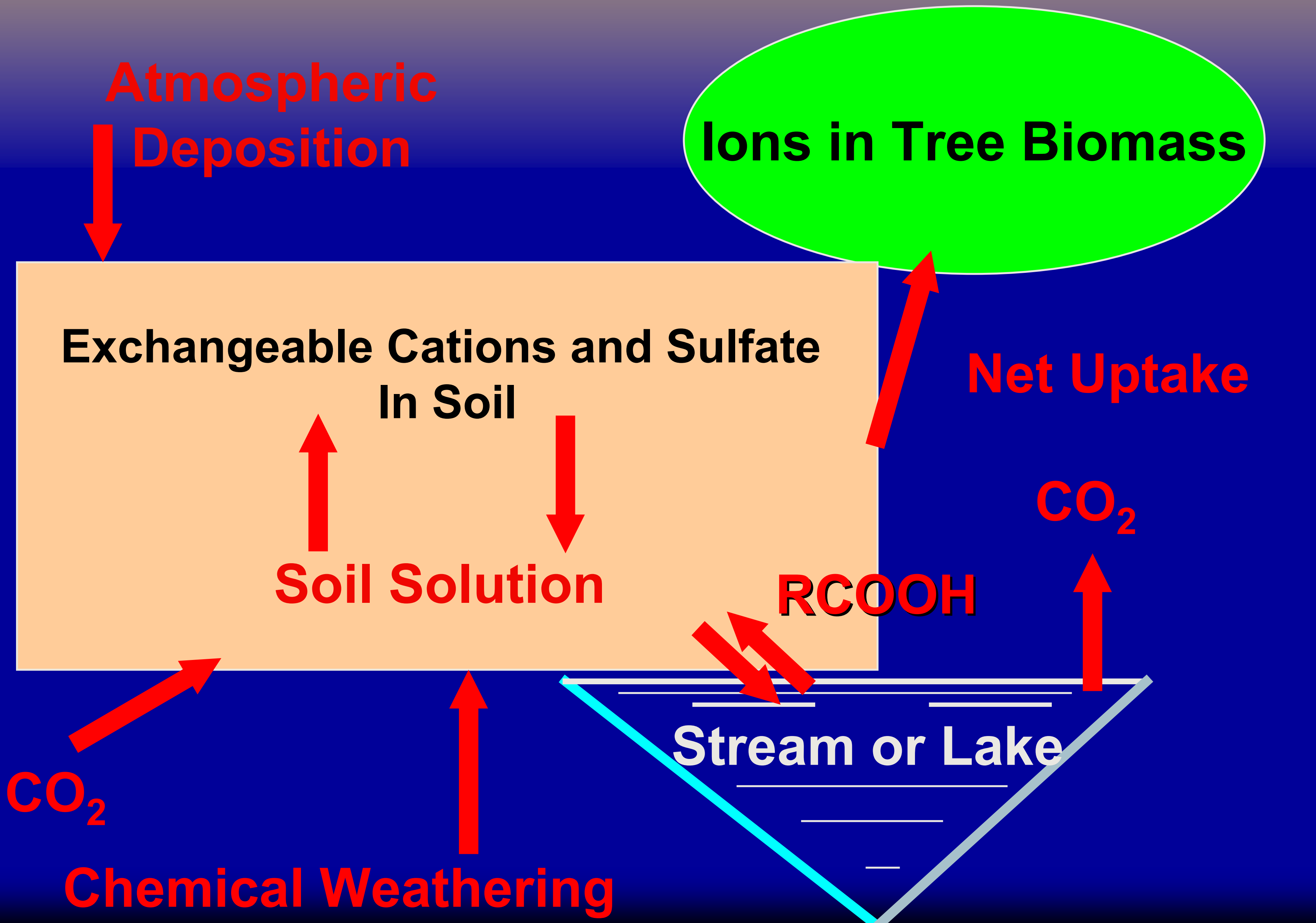
1. Evaluation and modeling of long-term observations (catchment and lakes) using GP scenario
2. Re-mapping of streamwaters in sensitive areas
3. Specific spatial modeling of further necessary reduction of S and N deposition (prioritising between measures and sources)
4. Recommendation for the next protocol (cost eficiency reduction)
5. **New topic – global warming effect on acidification and eutrophication**

Effect of climat change??

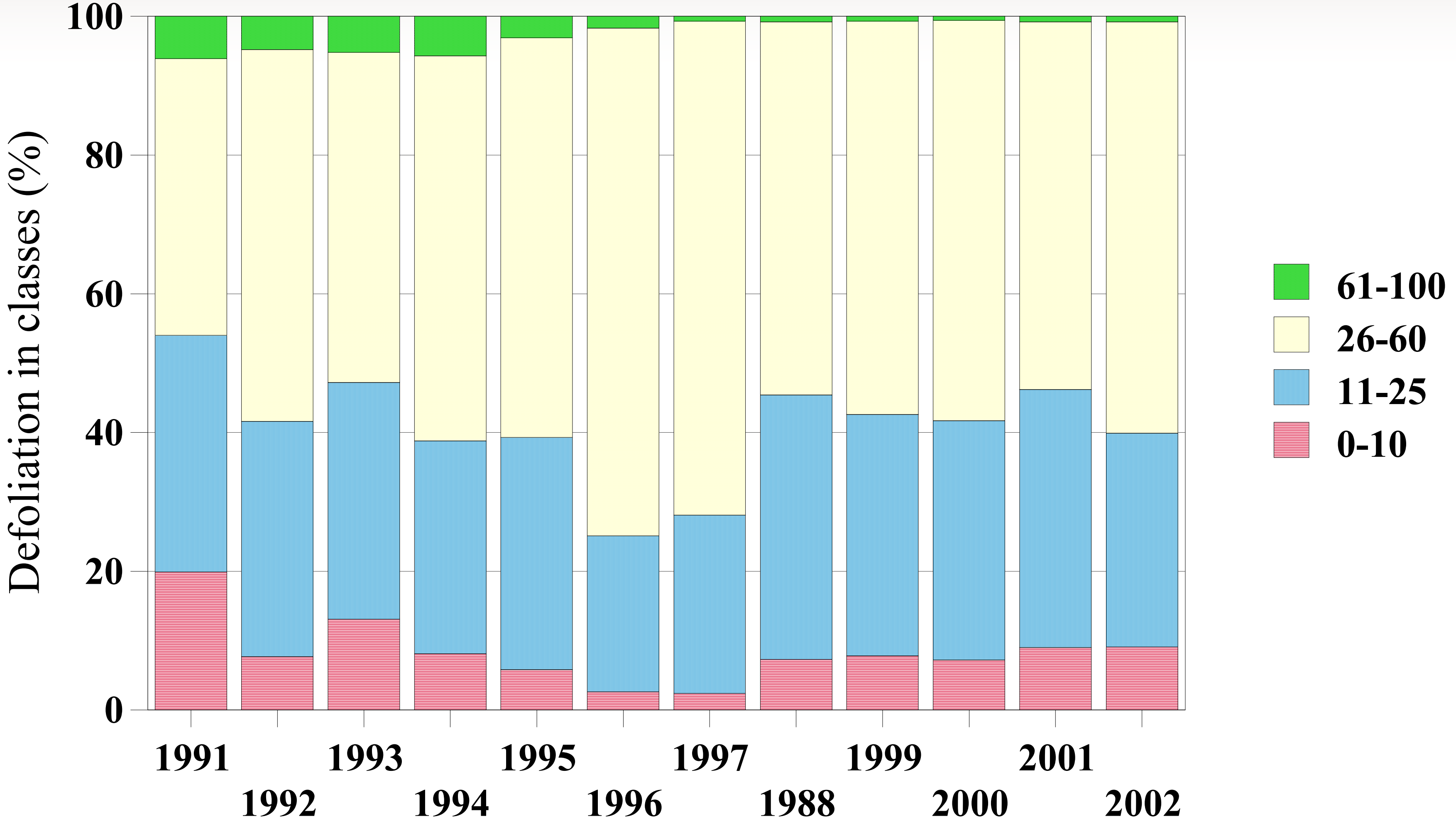


SYR - FIGURE 9-1b

Schematic View of the MAGIC Model



Forest defoliation did not change significantly



Model tools for prioritising emission measures

- Within the framework of the LRTAP Convention has emission reduction measures been prioritised both according to costs and environmental benefits
- For prioritising between measures on single installation (industries, powerplants, etc…) a modified approach from the same concept (emission to deposition modelling and critical loads) can be developed.
- Development of such methodology can guide to cost efficient measures with the optimal environmental improvement.
- Conceptually, the approach can be used for emissions to air, water and soils.
- Available survey data and tools from LRTAP Convention work make a good foundation for the development