The
Environmental Specimen Bank
Program in Germany

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Umwelt Bundes Amt für Mensch und Umwelt

Definition

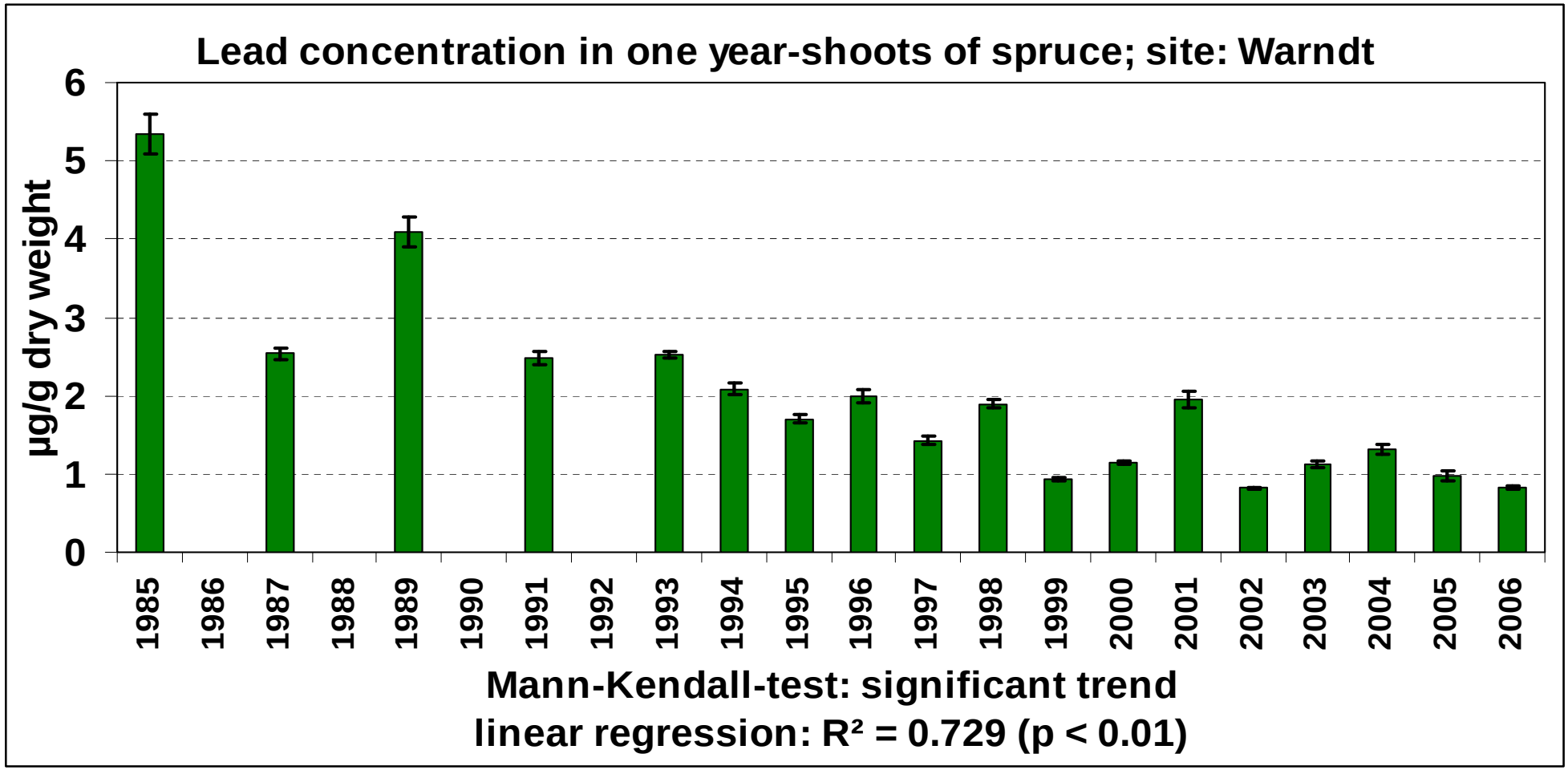
An environmental specimen bank is an archive of representative environmental samples which are collected in regular intervals in a standardized manner.

Samples are stored in such a way that changes even over long periods of time are prevented

www.umweltprobenbank.de

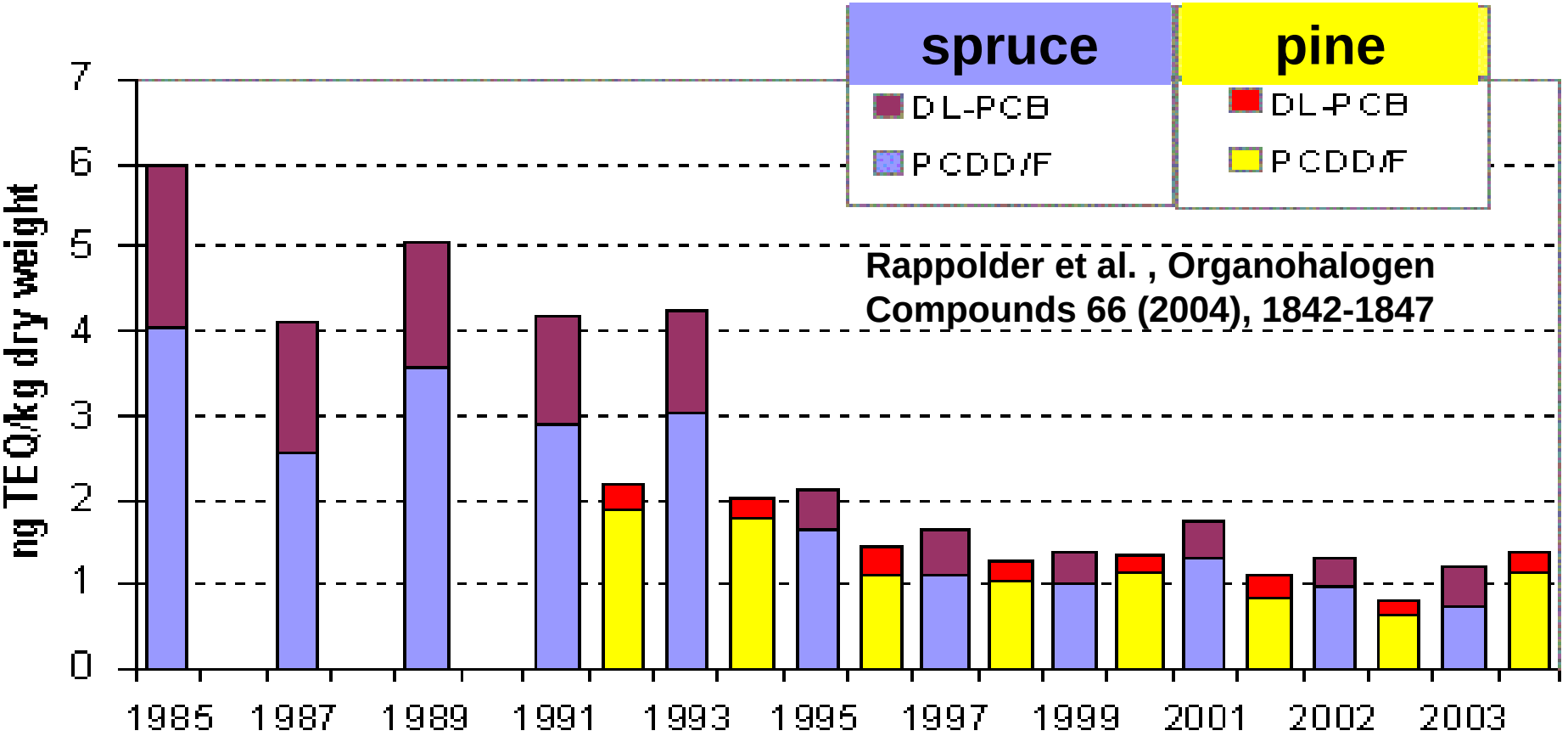
Main purposes of the German ESB (1)

- Routine monitoring of the environment for trends in local, regional or global pollution processes: **early identification of pollution trends and their ecotoxicological relevance**.



Main purposes of the German ESB (2)

- The determination of concentrations of substances which had not been recognized as hazardous when archived or which could not be analyzed at the time of sampling with the desirable precision: **retrospective monitoring**.



plant specimens and sampling areas

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Spruce (*Picea abies*)

The spruce is **widespread in Central Europe** due to its popularity with forestry managers

Its suitability as a specimen type for the Environmental Specimen Bank is founded on its **economic and ecological significance**, our **considerable understanding of its ecology, population genetics, and patterns of accumulation** in relation to many hazardous substances

Sampling target is the one-year-old shoot which, when sampled in spring, presents a comprehensive **picture of winter pollution** in the environment

In areas where spruce is not predominant, **pine (*Pinus sylvestris*)** is used as a substitute

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Beech (*Fagus sylvatica*)

The common (or European) beech plays a **dominant role in most nearly natural and also anthropogenically influenced forest ecosystems**

Unlike the coniferous spruce, it prefers lower altitudes. The **leaves are the sampling target**. Sampling takes place in late summer

Lombardy poplar (Populus nigra 'Italica')

was chosen as alternative for eco-systems **close to urban settlements**

Poplar meets the requirements of **specimen reproducibility and the geographical comparability** of findings, above all because of its **consistent genetic pattern**

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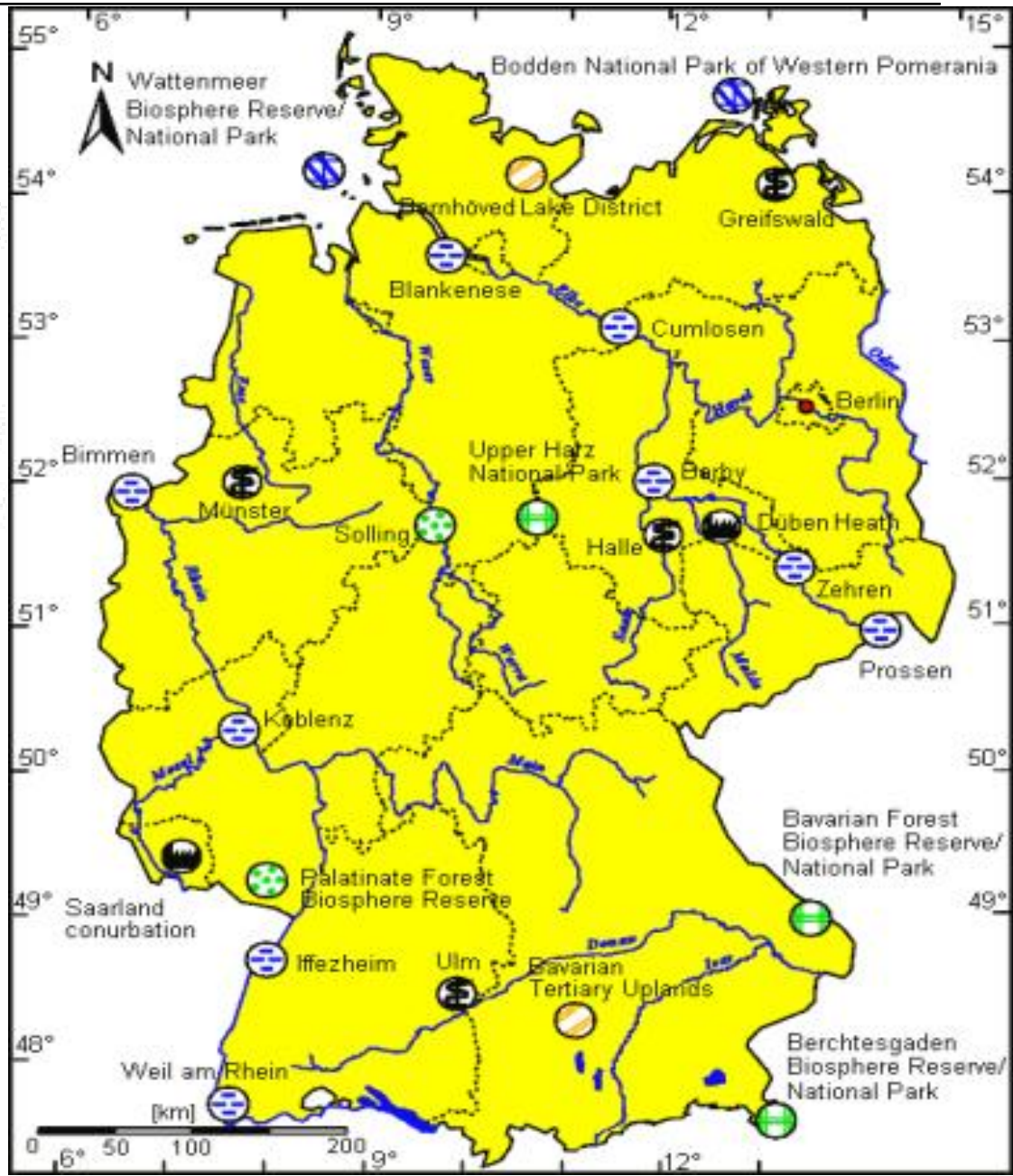
sampling areas:

- Agrarian ecosystems
- Nearly natural ecosystems
- Forestry ecosystems
- Ecosystems close to conurbations



Annual sampling of leaves/shoots depending on occurrence in the selected ecosystems

Sampling partly since 1985

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Standardization of all work steps: standard operating procedures

Umwelt Proben Bank
Des Bundes

Richtlinie zur Probenahme und Probenbearbeitung

Entwurf/Draft

Guideline for Sampling and Sample Treatment

Rot-Buche / Red Beech (*Fagus sylvatica*)

Mechthild Neitzke, Martina Bartel, Roland Klein, Kathrin Nentwich, Martin Paulus, Markus Quack, Gerhard Wagner

Universität Trier, FB VI – Biogeographie, Wissenschaftspark Trier-Petrisberg, D-54286 Trier

Umwelt Bundes Amt
Für Mensch und Umwelt

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4.1 Auswahl und Abgrenzung der

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4.1 Selection and Definition of the

Example: annual sampling of beech leaves

Selected trees are older then 40 years and predominant, dominant or co-dominant

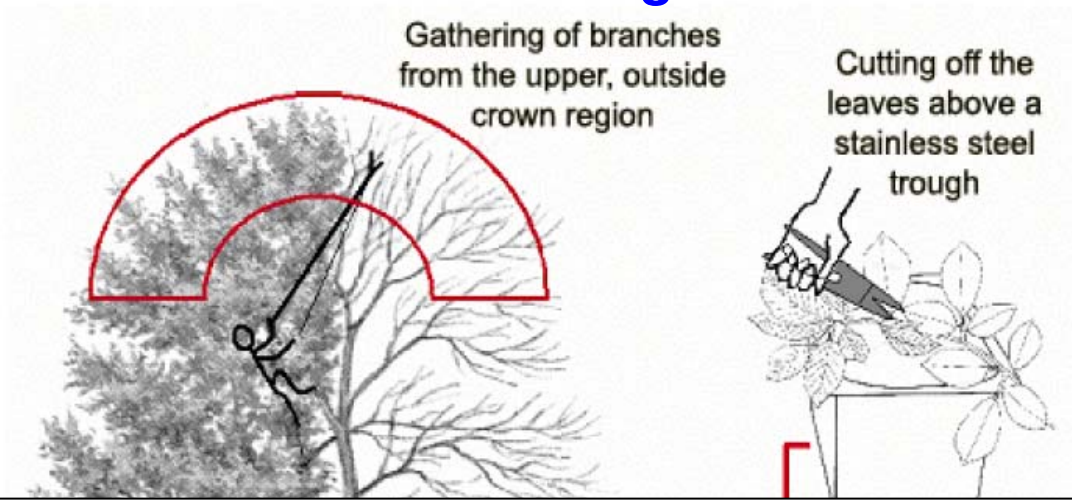
Trees must be free from intense biological damages (e.g. feeding on leaves) or mechanical damages

For statistical reasons, samples are taken from at least 15 trees per sampling site (at least 150 g fresh weight leaves per tree)

From each tree at least four branches out of the crown region are removed

Samples are directly cooled with liquid nitrogen

Samples are pooled, cryo-milled and homogenized, and finally stored as 10 g-sub-samples



Samplings are performed by members of the Institute for Biogeography, University of Trier

Biogeographie
Universität Trier

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- **Archive for Environmental Specimens** at Fraunhofer IME in Schmallenberg on behalf of the **Federal Environment Agency**
- Storage **temperature below -150°C**; **inert gas atmosphere** from evaporating nitrogen
- 50 cryogenic storage vessels, **automatic operation (filling with liquid nitrogen)**
- **Failure safe operation**, in case of longer power blackouts manual operation possible
- Since 1985 **approx. 225 plant specimens** with **> 50,000 sub-samples** were prepared
- Fast access to sub-samples by means of an **inventory data bank program**

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Storage costs

Investment for 1 cryostorage container with 1400 L volume, for up to about 50000 samples 20 k€

Racks for sample storage (depends on sample vial size, for 1 container) 15-25 k€

Liquid nitrogen costs per year for 1 container (depends on total nitrogen consumption) 1 k€

Costs for emergency 24/7 standby personnel per year 30-50 k€

Conclusion: large-scale storage is more cost-efficient!

Cryobanking at Fraunhofer IME:
http://www.ime.fraunhofer.de/EN/aoe/kernkompetenzen/cryobanking.jsp

more information at www.umweltprobenbank.de