

# Bark biomonitoring of air quality with immission fingerprinting



A new sampling device and method for  
quantifying **air pollutant loads** in order to monitor  
emitters and conduct areal monitoring



- **ÖKOLOGIE-BÜRO HOFMANN**
- **TIEM INTEGRIERTE UMWELTÜBERWACHUNG GBR**



Analyses, expertises and environmental studies

## The HOFMANN ECOLOGY BUREAU

... was established in Bremen in 1990. Its activities are focussed on the environmental impacts of pollutants on ecosystems, and monitoring of same, including the development of solutions for sustainable protection of nature and landscapes.

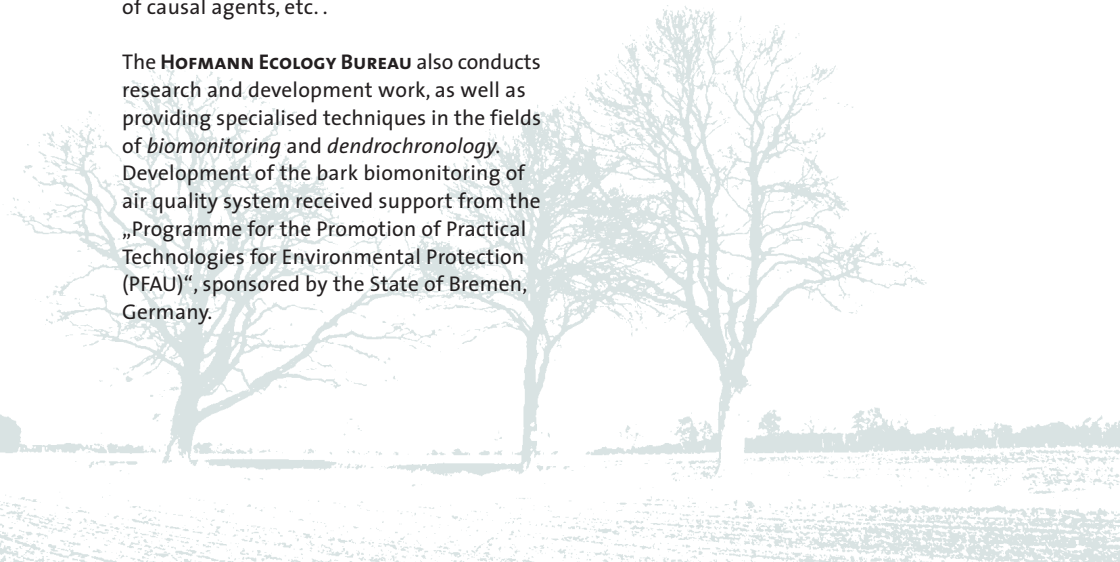
The **HOFMANN ECOLOGY BUREAU** undertakes analyses, conducts environmental studies and provides consulting and project management services for both public-sector and private-sector clients. Activities have extended beyond Germany to other countries in Europe and the rest of the world.

The **HOFMANN ECOLOGY BUREAU** has specialised expertise in monitoring emitters with the aim of clarifying the sources of immissions. This includes the differentiated determination of specific incremental loads by particular emitters relative to baseline pollution in a particular area and to other cross-cutting factors. Such data are important for many areas of environmental protection, including approval procedures, EIAs, audits, management decision-making, clarification of causal agents, etc. .

The **HOFMANN ECOLOGY BUREAU** also conducts research and development work, as well as providing specialised techniques in the fields of *biomonitoring* and *dendrochronology*. Development of the bark biomonitoring of air quality system received support from the „Programme for the Promotion of Practical Technologies for Environmental Protection (PFAU)“, sponsored by the State of Bremen, Germany.

## TIEM INTEGRATED ENVIRONMENTAL MONITORING GBR

Complex tasks in environmental protection can no longer be handled in an appropriate manner by single persons or companies. What is needed here is a transdisciplinary approach. **TIEM** was established, under the general management of the **HOFMANN ECOLOGY BUREAU** and the **SCHLECHTRIEMEN EXPERT SERVICES** in Nörten-Hardenberg, to bring together science and technology specialists, as well as acknowledged experts and accredited laboratories from a variety of disciplines and countries. Within **TIEM**, expertise is collated and focussed in order to implement projects in a concentrated form, organisationally and content-wise, so that optimal conditions are provided for sustained success.



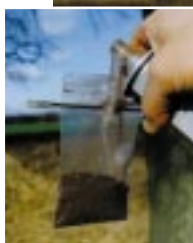
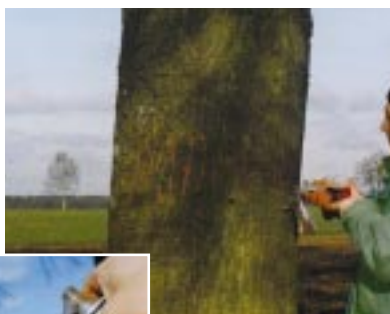
# Bark Biomonitoring of air quality

## A new method for standardised air pollution measurements

In order to reach reliable conclusions with the technical methods currently available (collectors and continuous measurements), it is necessary, due to the usually high variability of air pollution, to perform long-term multi-annual surveys. Approval procedures for industrial facilities, for example, militate against this option. Tree bark has been exposed to air pollutants for many years and accumulates contamination in the outermost layers of bark. The outer tree bark is also dead material with no interfering growth cycles or metabolic processes, as may be the case with other plant bioaccumulators. This innovative **bark sampler** is the first device to permit standardised removal of a predefined thickness

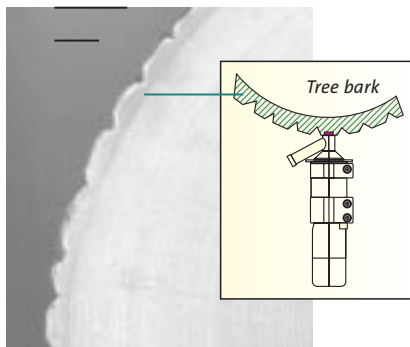
*Quantification of air pollutant depositions under standard immission conditions (open exposure to winds) and site conditions diverging in terms of ecological and immission factors (stands, Level II - areas)*

of tree bark while maintaining pro-analytical conditions, so that a single sample enables the mean deposition of immission loads to be determined for numerous accumulative and persistent pollutants on a comparative basis.



## Benefits

- Standardisable biomonitoring method
- Faster determination of local air pollution with a **single** sample
- Simultaneous determination of numerous accumulative contaminants
- Confirmation of immission sources by means of immission fingerprinting is therefore possible
- Suitable for large numbers of samples and hence also for areal surveys



## Areas of Application

- Immissions monitoring
- Monitoring emitters
- Areal monitoring
- Measuring of depositions on open land and stands
- Screening immissions for numerous contaminants
- Identification of critical loads
- Measuring typical baseline contamination levels of specific areas
- Determining the specific incremental load from pollutant sources using immission fingerprinting
- EIAs, eco-audits, approval procedures, clarification of damage
- Determination of immissions from industry, transport, agriculture, etc.

Characterisation of air pollution for numerous accumulative contaminants with a single sampling

### Agriculture



### Industry



### Transport



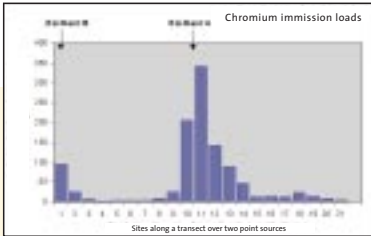
### Energy production



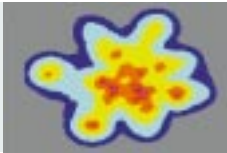
Immissions monitoring

Screening air pollution  
their causal agents

# Characterisation of air pollution for numerous accumulable contaminants with a single sampling

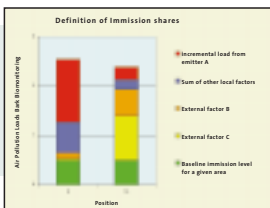
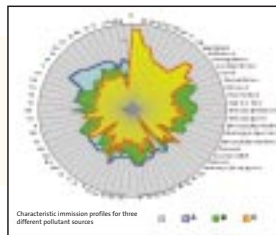


Analysing pollution gradients of immissions, here along a transect over two point sources



Areal identification of pollution hot spots and reference areas

Generation of local immission profiles for identifying critical pollutant loads, also for substances that are not subject to regular monitoring



Definition of the specific proportion of immissions from pollution sources relative to baseline contamination and from other sources by means of immission fingerprinting

# Fields of activity and services provided

## HOFMANN ECOLOGY BUREAU

- **Ecotoxicology**
- **Immissions monitoring**
- **Emitter-related monitoring of the environment**
- **Nature conservation and landscape protection**
  
- **Biomonitoring**
- **Dendochronology**

## TIEM INTEGRATED ENVIRONMENTAL MONITORING GBR

- **Monitoring emitters:** from characterisation of the emission source through distribution models and immissions measurements, to identification of ecological impacts; differentiation between baseline and supplementary impacts of pollution
- **Immissions monitoring:** chemical, physical and technical methods, biomonitoring and bioindication, identification of sources
- **Specification of damage** in respect of ecosystems, especially forests and woodland
- **Integrated environmental monitoring** at various levels and scales
- **Environmental analysis** for many pollutants, elements, isotopes and compounds
- **Integrated assessments, risk analysis, proposals** for effective solutions

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