



Bern-Liebefeld (Switzerland)

Karcag (Hungary)



Overview on European Lysimeter Stations and Soil Hydrology Measuring Sites:

Purpose

Equipment

Research Results

Future Developments

COST 629 Workshop, Larnaca (Cyprus)
December 8-9, 2005

Christine Lanthaler, Graz
(Austria)

30 Minutes for ...



Research results,
Future developments

Definitions; background
and method of survey

Internet platform
for lysimeter stations

Parts of the diploma
thesis; purpose of
research stations

Lysimeter types and
lysimeter errors

What are Lysimeters?

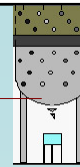
Definitions

- „lysimeter“ = combination of Greek words:
 - „luis“ = „solution“ and
 - „metron“ = „measure“



- „A lysimeter is a device that isolates a volume of soil or earth between the soil surface and a depth given and includes a percolating water sampling system at its bottom.“

Johnstown
Castle
(Ireland)



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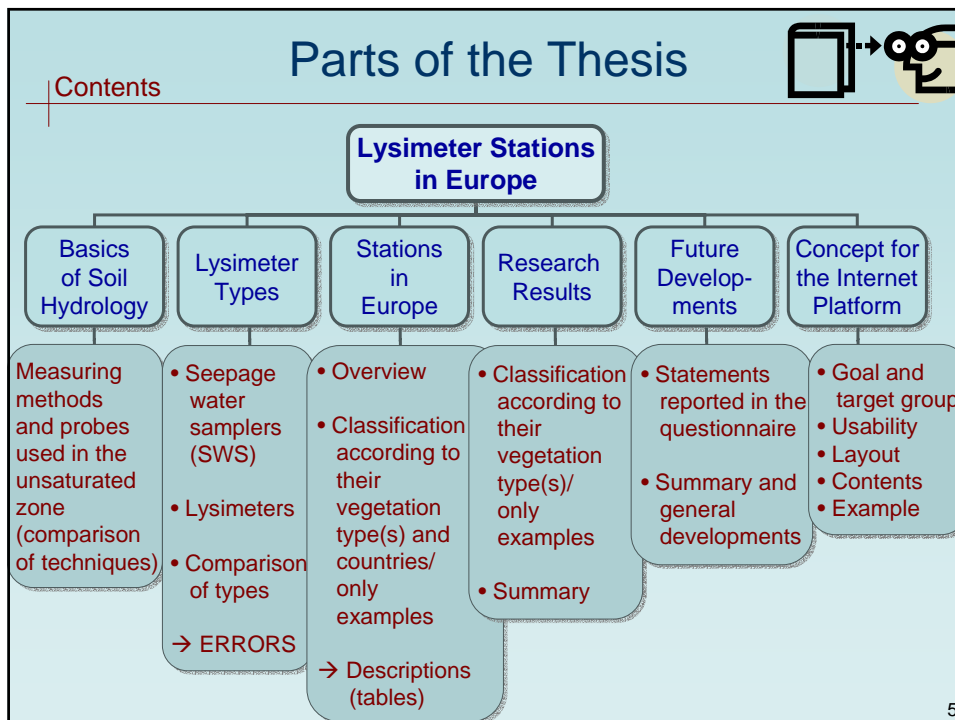
Diploma thesis

Background and Methods

- Searching for information (e. g. proceedings of lysimeter conference Gumpenstein/Austria)
- Developing a questionnaire (MS Excel)
- Collecting addresses (internet, etc.)
- Sending out the questionnaire, correspondence (e-Mail)
- Creating data base (MS Access), entering data (of questionnaires and other sources)



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Purpose of Research Stations

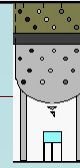
Use of lysimeters in different fields of research:

- (Soil) Hydrology, Soil Science, Hydrogeology, Water Economy
 - water balance/evapotranspiration, monitoring seepage water/groundwater quality and quantity ...
- Agronomy, Agricultural Economy, Forest Economy
 - nutrient and pesticide/herbicide leaching losses, water demand of agricultural areas ...
- Ecology, Environment Protection
 - seepage water prediction of polluted sites, source term determination ...

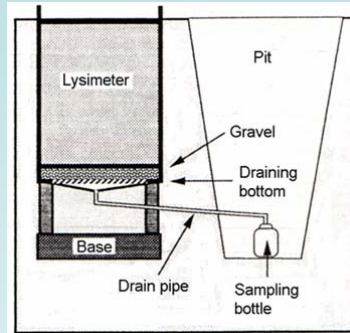
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Gravitation lysimeter

Lysimeter Types



- percolating water is collected gravimetrically = gravitation lysimeter



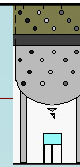
Principle sketch of a gravitation lysimeter

MULLER 1996

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Weighable lysimeter (monolithic)

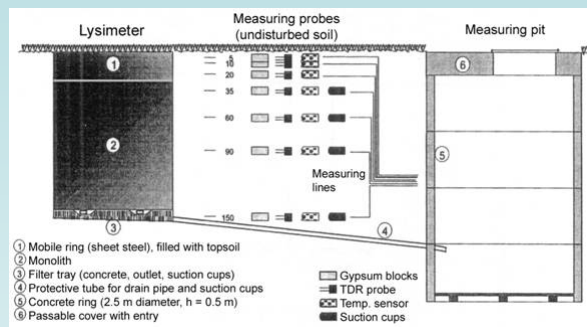
Lysimeter Types



- lysimeters are either weighable or non-weighable



Weighing equipment (3 load cells) in Wagna
picture: C. Lanthaler, August 2004

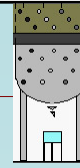


Equipment of a measuring site including a non-weighable monolithic field lysimeter and soil hydrology measuring probes

according to HARTL et al. 2001, p. 216, modified

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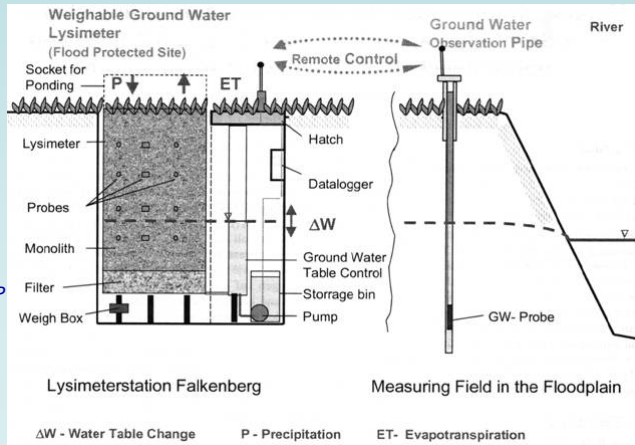
Lysimeter Types



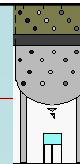
- an artificial groundwater level can be simulated = groundwater lysimeter

Principle of a groundwater lysimeter with variable groundwater level

KESSLER, MEISSNER and RUPP in BAL 2001, p. 135



SWS Types

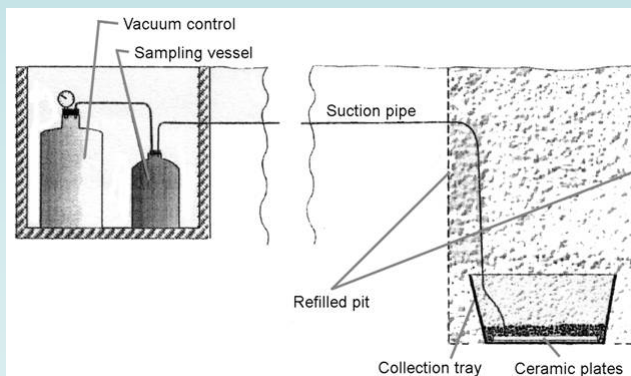


SWS do NOT reach the earth's surface!

- SWS with applied vacuum (backfilled)

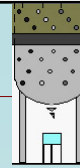
Seepage water sampler (SWS) according to E. STENITZER

EDER in BÖHM et al. 2002, p. 121, modified



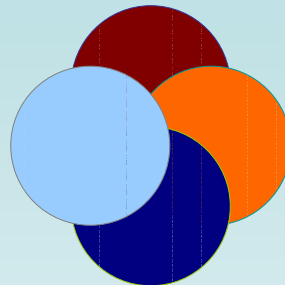
Lysimeter Types

Classification



Weighability
(non-weighable/weighable)

Groundwater
connection



Soil filling technique
(monolithic/backfilled)

Seepage water collection
(gravimetric or not)

Combined types (examples):

- Non-weighable backfilled gravitation lysimeter or
- Weighable monolithic groundwater lysimeter ...
- Large lysimeters/
test areas

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Lysimeter Errors

Measuring



*Natural hydraulic condition is disturbed, when
a lysimeter or SWS is installed*

- ✓ Island/oasis effects
vegetative, hydrological and micro-climatical conditions
have to be as highly as possible representative of the field
- ✓ Bypass fluxes
cannot be determined in containers; lateral water
transport is suppressed in a closed vessel
- ✓ Boundary effects at the borders
plants are prevented from spreading; surface water
may run in an uncontrolled way → keep **gaps** (between
cylinders) **as small as possible**; use **larger vessels!**

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Lysimeter Errors



Measuring

- ✓ Phenomena/boundary effects at the lysimeter bottom
natural soil profile (capillaries) is interrupted;
seepage water only occurs when hydraulic pressure
exceeds air pressure (when pores are saturated) →
use **several outlets to reduce dammed water!**
- ✓ Disturbed profile
when soil is artificially backfilled into lysimeters/SWS,
soil is mineralized due to aeration - higher nitrate
concentration! → investigate for **longer periods**, do **not
mix soil layers!**
- ✓ Protect lysimeters against **animals!**

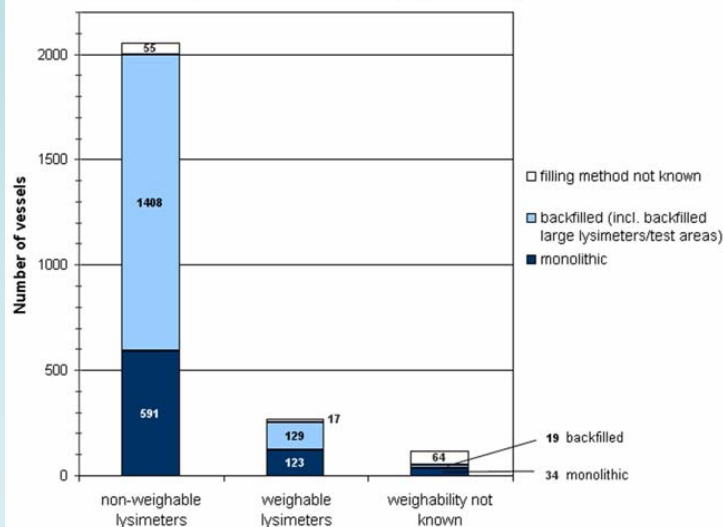
Lysimeter Types



Facts & Figures

- 2930 vessels
- 2440 lysimeters
490 SWS
- 178 sites (ca.)
in 18 countries
- operated by 117
institutions

Lysimeters in Europe according to their weighability combined with their soil filling method (survey 2004, only approximate figures)



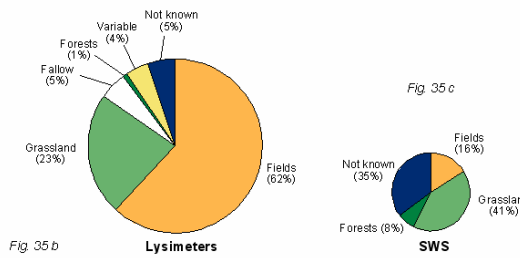
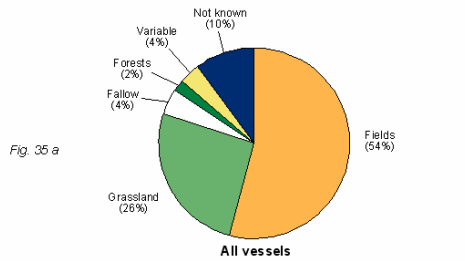
According to the survey 2004

Facts & Figures

Lysimeter Sites



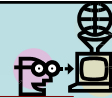
Lysimeters and seepage water samplers/SWS installed in Europe according to their main vegetation type (survey 2004)



According to the survey 2004

Lysimeter sites in Europe

Internet Platform




<http://www.lysimeter.at> → Research stations in Europe

The screenshot shows the website for the Lysimeter Research Group. At the top, there is a navigation bar with '... auf Deutsch' and '... in English'. Below this is a header with the group's logo and name: 'Arbeitsgruppe Lysimeter Research Group'. A central image shows a lysimeter setup in a field. To the right, there is a sidebar with navigation links: 'Über uns', 'News & Veranstaltungen', 'Publikationen', 'Forschungsstationen in Europa', 'Fotos', and 'Links'. The main content area features a map of Europe with colored regions indicating lysimeter stations. Text on the page includes a welcome message, instructions for users to update their station details, and contact information for the group's secretary, Barbara Jantshofer. There are also links to research reports and a list of stations.

Country/
Station

Internet Platform



European Lysimeter Platform

List of countries

Research reports

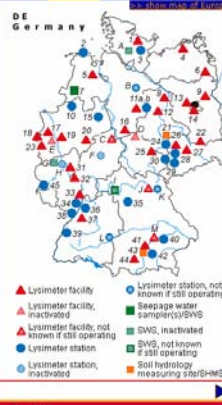
Links

Sitemap

Home

Germany (DE)

Operating lysimeter/soil hydrology measuring sites



- DE 1: Kist
- DE 2: Landisau
- DE 3: In the province of Sakhernia-Mulstein
- DE 4: Soth-Vokern
- DE 5: Uldenborg
- DE 6: Dacklow
- DE 7: Gumpersdorf
- DE 8: Falkenberg
- DE 9: Eberswalde
- DE 10: St. Amelands
- DE 11: Burgsdorf
- DE 12: Salsdorf
- DE 13: Rauhensand
- DE 14: Rade-Pahl
- DE 15: Gernsdorf
- DE 16: GutsMuths
- DE 17: Mönchshaus
- DE 18: Waldau
- DE 19: Eberswalde
- DE 20: Schmalde
- DE 21: GutsMuths
- DE 22: GutsMuths

▲ Lysimeter facility, inactivated
▲ Lysimeter facility, not known if still operating
▲ Lysimeter station, not known if still operating
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European Lysimeter Platform

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Germany (DE)

Operating lysimeter/soil hydrology measuring sites



Operated by: Institut Agrophysik, IAG EW, Forstliche Fakultät
 Leibniz Universität Hannover
 Leo-Braun-Strasse
 30559 Hannover
 Contact Dr. Thomas Pütz
 Phone: +49 51 204 24 24 24 24
 Fax: +49 51 204 24 24 24 24
www.iag.uni-hannover.de

Julich (DE 23)

Purpose of this facility

Investigation of the fate of anthropogenic substance input in the environment in the agricultural system in non-stationary of the water balance (transport, sorption, reduction, volatilization) according to BfL or OECD guidelines
NON-WEIGHABLE MONOLITHIC GRAVITATION LYSIMETER/2100-TENSION LYSIMETER

Lysimeter type

Operating since

Number of lysimeters

Rise classification

Plant area

Building material of container

Feature of lysimeter bottom

Seepage water determination

Nutrient/nutrient balances

Measuring interval(s) of substances

Soil texture(s)

Soil type

Soil thickness in m

Vegetation and utilization

Drinks installed

Data loggers: sensor, data base

Further investigations or equipment

Remarks

[see more details about this type](#)

European Lysimeter Platform

List of countries

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European Lysimeter Platform

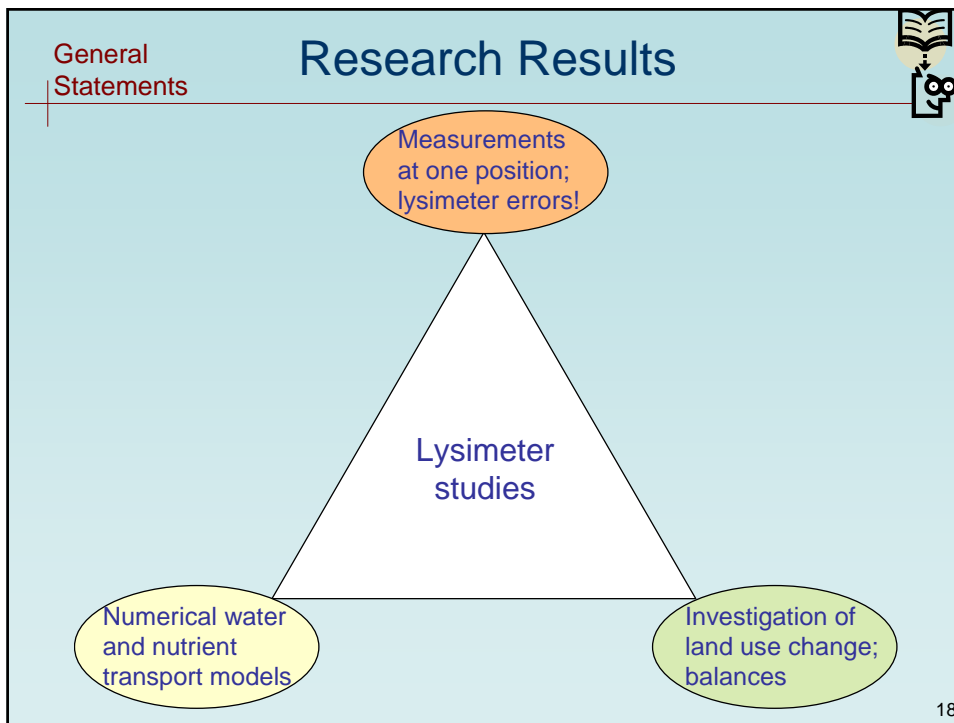
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to investigate soil & groundwater protective cultivation systems and

land use changes; to monitor the fate of pollutants in soil

to determine water & nutrient balances; to calibrate and verify soil hydrological or solute transport models

to improve measuring methods; to determine hydraulic parameters; to compare lysimeter data with data of surrounding undisturbed soil and to compare different soil types



Lysimeter station Wagna, Southern Styria (Austria)
→ description and first results: <http://www.lysimeter.com>
pictures: C. Lanthaler, 2004

The lysimeter that is built in best is the one you don't see!!!

Thank you for your attention!

