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 …

Definitions; background and method of survey

Parts of the diploma thesis; purpose of research stations

Lysimeter types and lysimeter errors

Internet platform for lysimeter stations

Research results, Future developments

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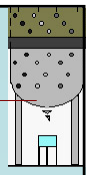
What are Lysimeters?

Definitions



- „lysimeter“ = combination of Greek words:
  „lusis“ = „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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Background and Methods

Diploma thesis

- 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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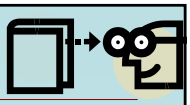
Parts of the Thesis

Contents



Lysimeter Stations in Europe

Basics of Soil Hydrology	Lysimeter Types	Stations in Europe	Research Results	Future Develop-ments	Concept for the Internet Platform
Measuring methods and probes used in the unsaturated zone (comparison of techniques)	• Seepage water samplers (SWS) • Lysimeters • Comparison of types → ERRORS	• Overview • Classification according to their vegetation type(s) and countries/ only examples → Descriptions (tables)	• Classification according to their vegetation type(s)/ only examples • Summary	• Statements reported in the questionnaire • Summary and general developments	• Goal and target group • Usability • Layout • Contents • Example

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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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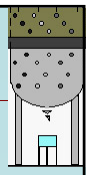
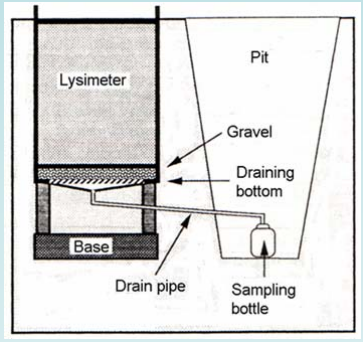
Gravitation lysimeter

Lysimeter Types



- percolating water is collected gravimetrically = **gravitation lysimeter**

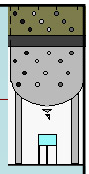


Principle sketch of a gravitation lysimeter

MULLER 1996

Weighable lysimeter (monolithic)

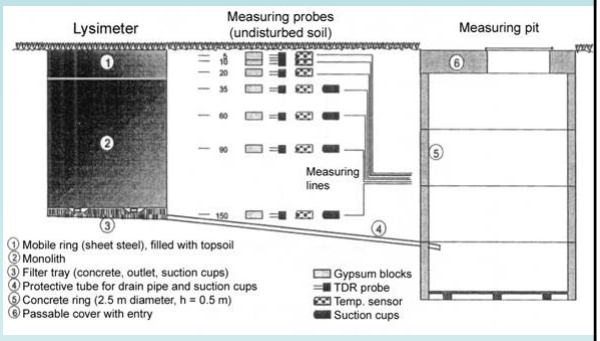
Lysimeter Types



- lysimeters are either **weighable** or **non-weighable**

Weighing equipment (3 load cells) in Wagna

picture: C. Lanthaler, August 2004

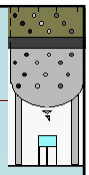


Equipment of a measuring site including a non-weighable monolithic field lysimeter and soil hydrology measuring probes

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

Groundwater lysimeter

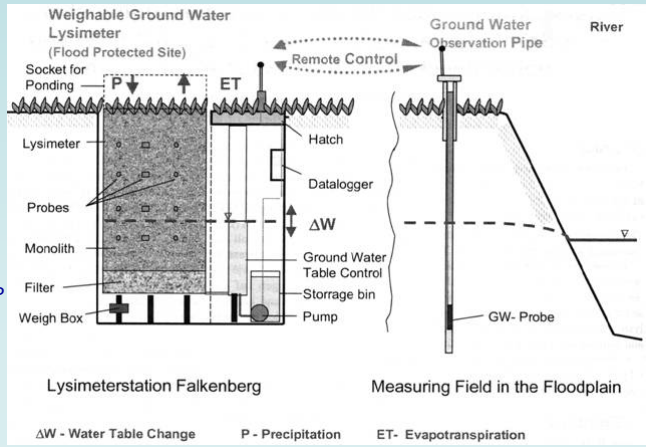
Lysimeter Types



- 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



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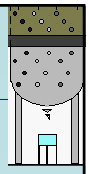
Seepage water samplers

SWS Types

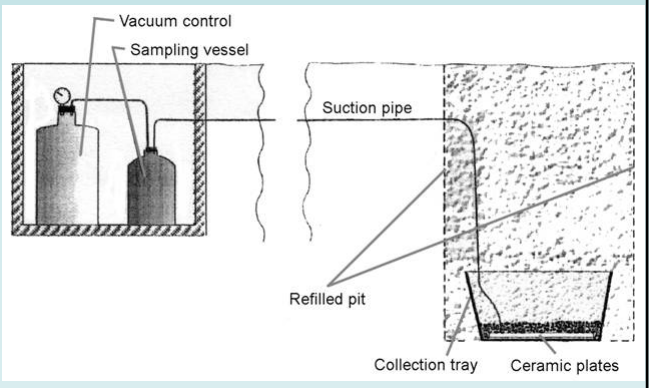


SWS do NOT reach the earth‘s surface!

- SWS with applied vacuum (backfilled)

Seepage water sampler (SWS) according to E. STENITZER

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



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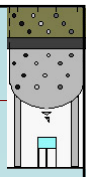
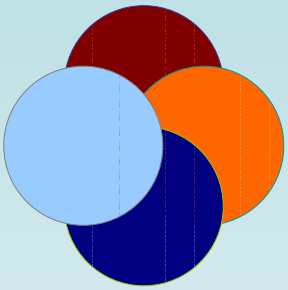
Lysimeter Types

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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Measuring

Lysimeter Errors

- ✓ 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**!

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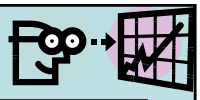
Facts & Figures

Lysimeter Types

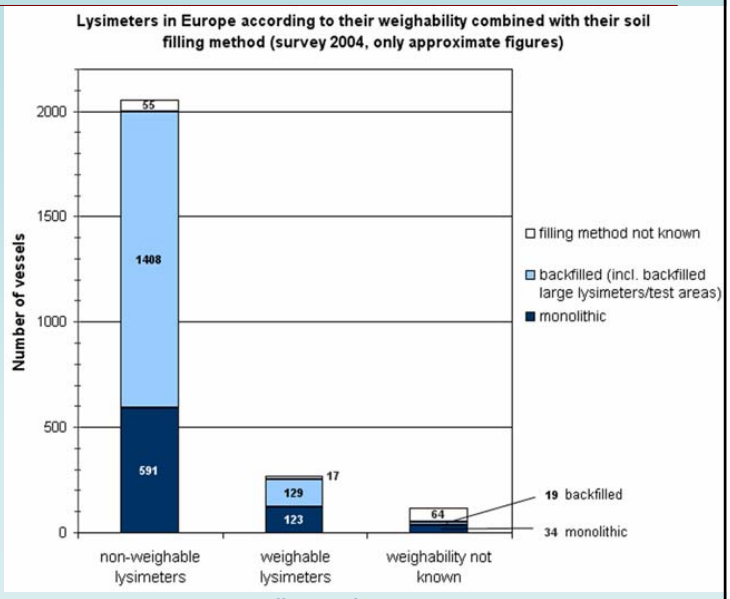


2930 vessels

→ 2440 lysimeters
490 SWS

→ 178 sites (ca.) in 18 countries

operated by 117 institutions



According to the survey 2004

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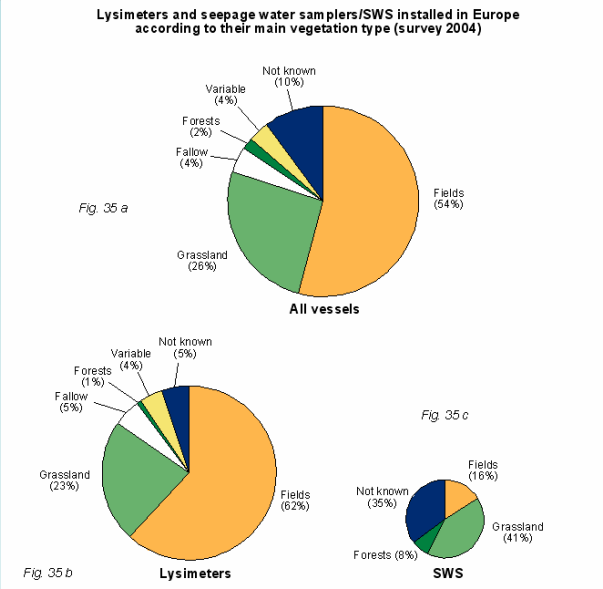
Facts & Figures

Lysimeter Sites



According to the survey 2004

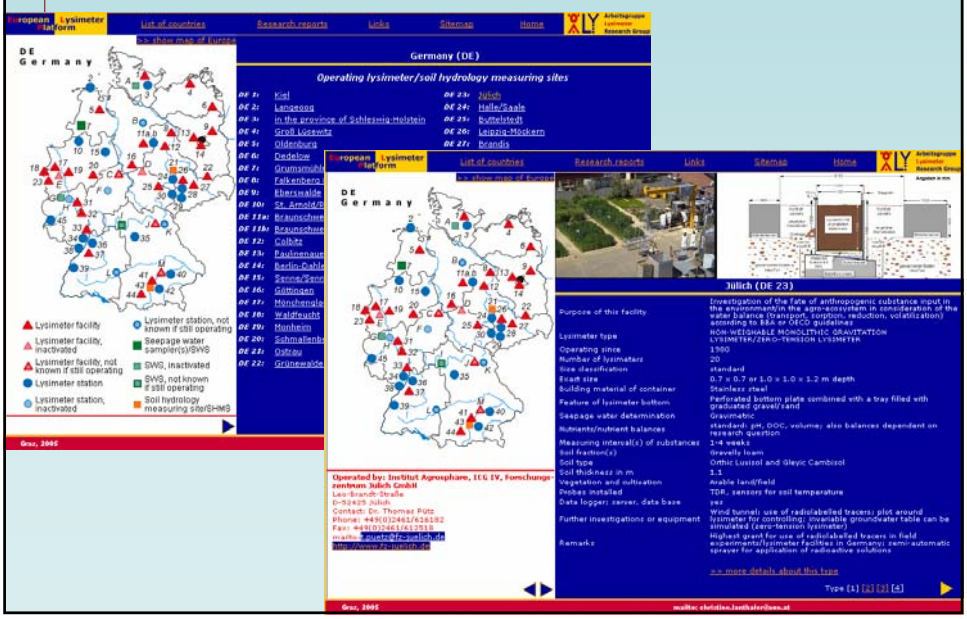
Lysimeter sites in Europe

Internet Platform

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

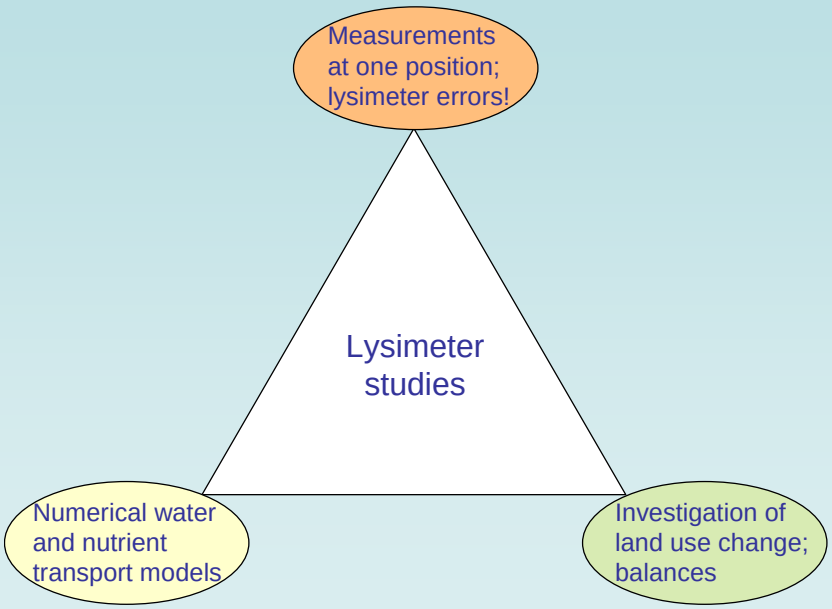
Country/
Station

Internet Platform



General
Statements

Research Results



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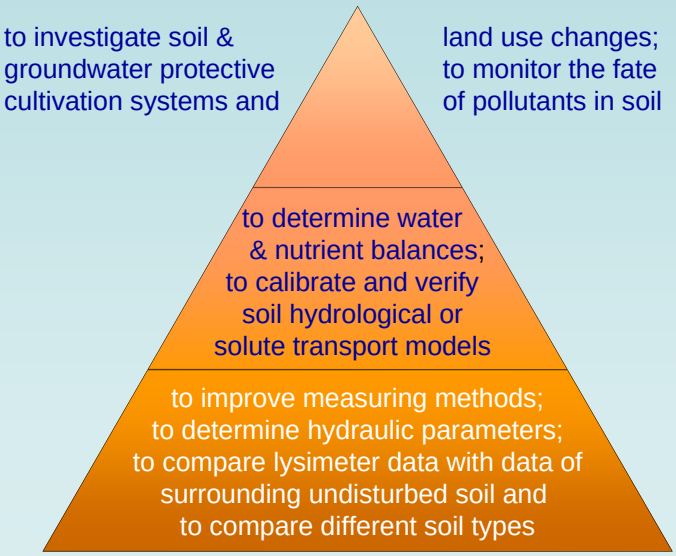
Future Developments

Challenges



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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!

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