

Updated information about lysimeter and soil hydrology measuring sites in Europe

(current as of April 12, 2006; Christine Lanthaler)

277 data records, compared to 268 records in November 2004, are stored in the database providing information of active and inactivated lysimeter stations and soil hydrology measuring sites of **20 European countries**. Data of nine stations were added in 2005 and 2006 after the diploma thesis had been finished but only two measuring sites were newly installed in 2004 or 2005; the other stations have already existed. Information for 15 measuring sites has been **updated** since March 2005, after the homepage of the European Lysimeter Platform/EuLP <http://www.lysimeter.at> – *Research stations in Europe* was set online. Mainly contact details were updated or new photos were added during the last months.

Active stations can now be found at **151 locations**; these stations carry a certain map number (e.g. **AT 27**) but several measuring sites were summarised (see **DE 29** with 34 vessels or **FR 10** with 13 sites, for instance) and therefore it is assumed, that soil hydrology measuring equipment is installed at about **233 different locations/sites**. The number of 151 locations **excludes** sites in Estonia (**EE A**), Finland (**FI A**, 16 sample plots with mainly suction cups), Italy (**IT A**), Spain (**ES A**) and Sweden (**SE A**) and United Kingdom (**UK A**) where no details were available on one hand and on the other hand **all inactivated sites**—some of which may also be indicated by map numbers and signs in the maps on the EuLP).

According to the survey in 2004 and updated information in 2005 and 2006, ca. **122 institutions** are/were operating lysimeters but **146 operators in 20 countries** are stored in the database because at some institutes/universities several persons are in charge of lysimeter sites (e.g. JOANNEUM RESEARCH, Austria) or one organization and its various research centres are operating lysimetric sites (for example INRA in France).

Table 1 provides figures of all **lysimetric/soil hydrological measuring sites and vessels** operating in European countries. The number of sites, figures without brackets, shows the exact amount of sites implemented with an ID and map number provided on the homepage. Figures shown in parentheses () indicate inactivated sites or sites with more locations, figures with square brackets [] sum up existing stations without further information. As also numbers of vessels implemented at several stations are missing, exact figures cannot be provided and the total number of vessels and sites has to be higher.

The **oldest** vessels still operating were installed around **1880** at the site of **Rothamsted Research, United Kingdom, UK 6** (two non-weighable monolithic gravitation lysimeters/in situ), and at the **Limburgerhof** facility, **Germany, DE 33**, 234 non-weighable back-filled gravitation lysimeter vessels built in the years 1927/30 are still working.

Table 1: All lysimeter sites, numbers of vessels, seepage water samplers/SWS and soil hydrology measuring sites/SHMS in Europe according to the survey 2004 and updated information of 2005 and 2006, current as of April 12, 2006 (<http://www.lysimeter.at> – *Research stations in Europe*)

Alle Messplätze, Anzahl der Lysimeter und SWS sowie der bodenhydrologischen Messstellen/SHMS in Europa; Stand 12. April 2006

| Country | Lysimeter/ SWS Sites | Number of All Vessels (Lysimeters and SWS) | Number of Lysimeters | Number of SWS | Number of SHMS Only |
|-----------------------|-------------------------|---|-------------------------|------------------|---------------------------|
| Austria | 29 (6) | 134 | 96 | 38 | 8 |
| Belgium | 1 | 7 | 7 | - | - |
| Croatia | 3 | 43 | 8 | 35 | - |
| Czech Republic | 18 | 138 | - | 138 | - |
| Estonia | [1] | ? | ? | ? | - |
| Denmark | 1 | 8 | 8 | - | - |
| Finland | 2 [16] | 108 | 108 | - | - |
| France | 24 (12) | 218 | 194 | 24 | 17 |
| Germany | 45 (40) | 1462 | 1269 | 193 | 3 |
| Hungary | 2 | 368 | 368 | - | - |
| Ireland | 1 | 125 | 125 | - | - |
| Italy | 4 [1] | 92 | 86 | 6 | 1 |
| Poland | 1 | 25 | 25 | - | - |
| Republic of Macedonia | (2) | ? | ? | - | - |
| Slovak Republic | 1 | 6 | 6 | - | - |
| Slovenia | 6 | 66 | 17 | 49 | 1 |
| Spain | 1 [1] | 2 | 2 | ? | - |
| Sweden | [1] | ? | ? | ? | - |
| Switzerland | 4 | 88 | 88 | - | - |
| United Kingdom | 8 [1] (1) | 72 | 45 | 27 | 2 |
| Total number | 151 [(82)] | 2962 | 2452 | 510 | 32 |

Fig. 1 shows that the **majority of lysimeter vessels** (2113 vessels/86.2 %) are **non-weighable**. This strengthens the “disadvantage” of ponderable lysimeters as the weighing equipment is more expensive and in fields, weighable lysimeters are more difficult to build in. Approximately **70 %** of the **non-weighable lysimeters** are **backfilled**, whereas **44.4 %** of all **ponderable lysimeter** vessels are filled **monolithically**; to get better and more precise data (parameters of the water balance, for example), soil should be excavated monolithically when using weighing equipment. Weighability of 78 vessels (3.2 % of the total number) could not be determined. **239 groundwater lysimeters** are in use around Europe—236 of them in Germany, three in Scotland, **UK 4**; most of the groundwater lysimeters are non-weighable (weighable ones are used in **Falkenberg, DE 8**, for example).

The largest number of lysimeters at one site was counted in **Szarvas, Hungary, HU 1**, where **320** non-weighable backfilled vessels are implemented, and at **Limburgerhof, Germany, DE 33**, (**252** backfilled and monolithic lysimeters). More than 100 lysimeters exist in **Falkenberg, DE 8**, and **Paulinenaue, DE 13** (both Germany), and **Johnstown Castle, Wexford, Ireland, IE 1**. **New vessels** which have been operating since 2004 or 2005 are listed in Table 2. In April/May 2006, the station Maribor Tezno, **SI 4**, is going to be reconstructed and equipped with new measuring instruments.

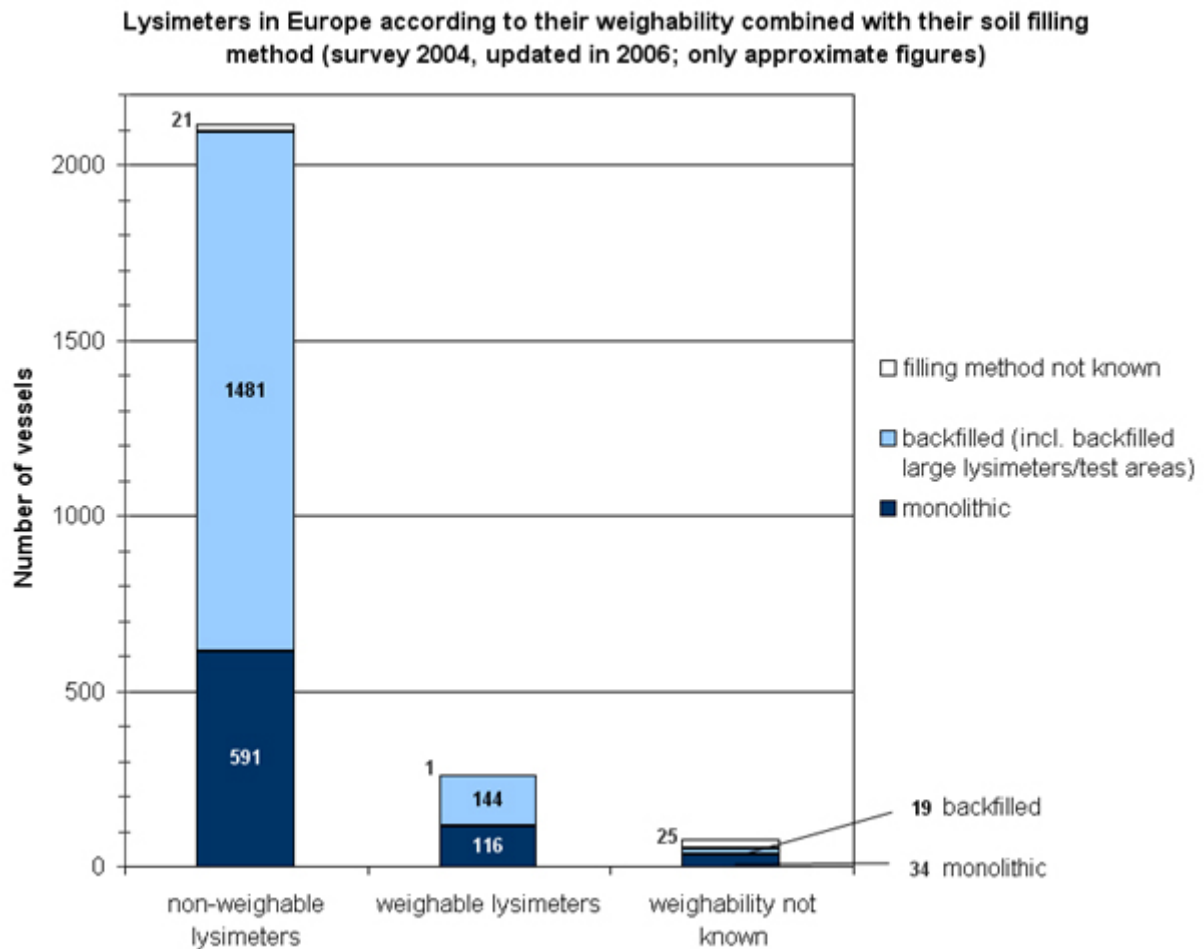


Fig. 1: Division of non-weighable and weighable lysimeters and their soil filling method (backfilled and monolithic, according to the survey 2004 and updated information of 2005 and 2006; current as of April 12, 2006)

Aufteilung der Lysimeter nach wägbar und nicht wägbar Gefäßen kombiniert mit der Art der Bodengewinnung (monolithische oder wiederbefüllte Lysimeter); Stand 12. April 2006

Table 2: Lysimeters/SWS and SHMS installed in Europe in 2004 and 2005 according to the survey 2004 and updated information of 2005 and 2006, current as of April 12, 2006
2004 und 2005 eingebaute/in Betrieb genommene Lysimeter/SWS und SHMS; Stand 12. April 2006

| Country (Site) | Number of Vessels and Lysimeter/SWS/SHMS Type | Map (Number) |
|---|---|----------------|
| Austria (Wagna) | 2 Weighable monolithic field lysimeters, standard size and a SHMS (agricultural fields) | AT 27 |
| Austria (Stoderzinken) | 1 Weighable monolithic gravitation lysimeter, 1 non-weighable monolithic lysimeter and SHMS (grassland) | AT 29 |
| Austria (Kitzeck) | 1 SHMS (vineyard) | AT 30 |
| France (Villié-Morgon) | 4 Capillary wick samplers/soil hydrology measuring site (grassland) | FR 19 |
| Germany (München/ Freimann) | 1 Non-weighable backfilled gravitation lysimeter, standard size (compost) | DE 42 |
| Germany (Braunschweig-Völkenrode) | 8 Weighable backfilled lysimeters, large (agricultural fields) | DE 11 a |
| Ireland (Johnstown Castle, Wexford) | 75 Non-weighable monolithic gravitation lysimeter, small (grassland/herbage and arable land/fallow) | IE 1 |
| United Kingdom (Allt a'Mharcaidh Experimental Site) | 3 Seepage water samplers (grassland/heathland), 5 plots | UK 3 |

Lysimeters/SWS in Europe are used predominantly for **agricultural research**, see Fig. 2. Ca. **55 % of all vessels** (1638 of 2962) and **63 % of all lysimeters** (1550 of 2452) but only **17 % of all SWS** are installed in **arable land/fields**, or crops, vegetables, etc. are cultivated on the lysimeters. As the use of many SWS is not known, the number of SWS installed in arable land could be much higher.

On about one **fourth** (722) of all vessels and on ca. one **fifth** (520) of the lysimeters, different types of **grass** are planted (including natural/peatland vegetation) and 5 to 6 % of the lysimeters are used under **bare soil**. The figures change from season to season because of crop rotation (e.g. bare soil is then cultivated) and the **purpose of 104 vessels is variable**. In **forests**, only **1 %** of all lysimeters (including several large lysimeters/test areas) are employed but the proportion of **SWS used in forests** is much higher (9 %). A reason for this might be that smaller trays are easier to install in forests than large lysimeters. **10 % (300)** of the vessels were **not classified**.

Lysimeter and seepage water samplers/SWS installed in Europe according to their main vegetation type (survey 2004 and updates in 2005 and 2006)

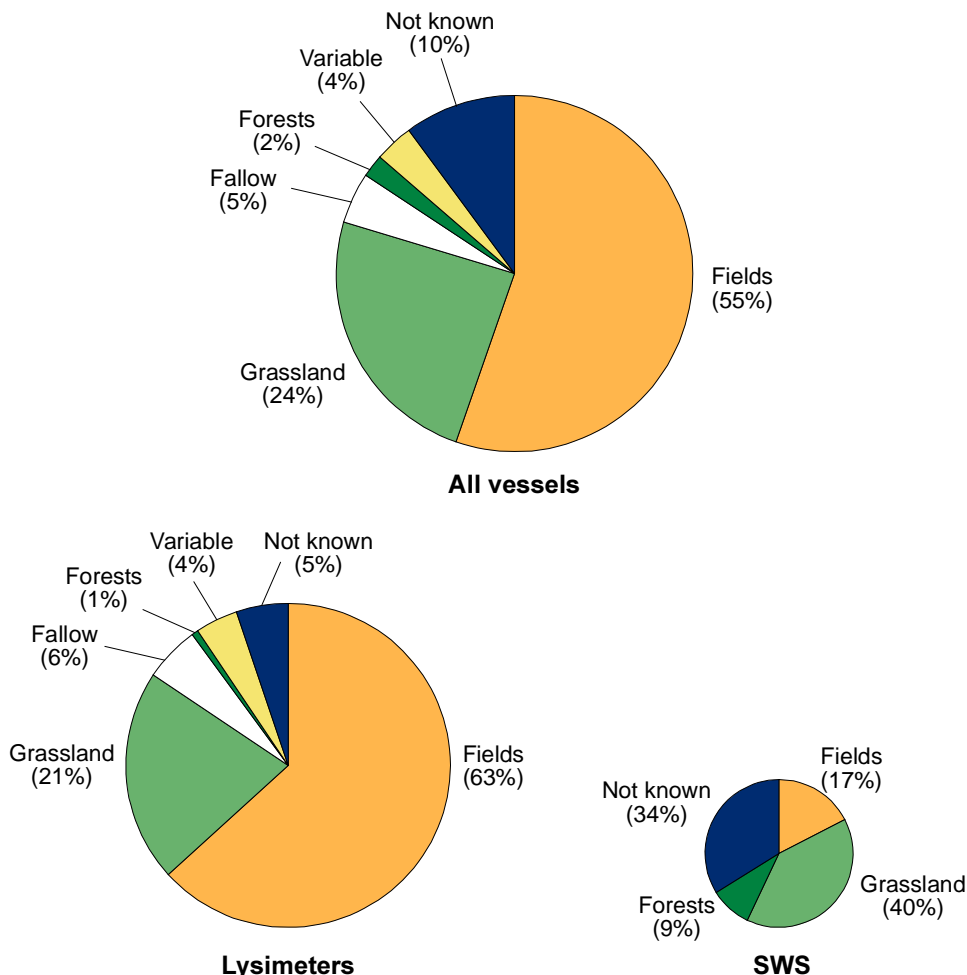


Fig. 2: Charts of all lysimeters and seepage water samplers in Europe, classified according to their main vegetation type (according to the survey 2004 and updated information of 2005 and 2006; current as of April 12, 2006)

Circle areas of the two lower pie charts are proportional to the total number of vessels (first chart)
 Diagramme aller Lysimeter und Sickerwassersammler in Europa, eingeteilt nach ihrem Bewuchs;
 Stand 12. April 2006

Comparing figures of November 2004 and April 2006, we can determine an **increase** of vessels included in the database and on the homepage: in 2004 about 2930 vessels were counted, in 2006 approximately 2962 containers, after several new and existing stations had been implemented. The division into non-weighable and weighable vessels (Fig. 1) could be optimised and weighability of only 78 containers is still not known (in 2004 the figure was 117). According to their main vegetation type (see Fig. 2), **more vessels**, lysimeters and SWS, are **now used for agricultural purposes** than in 2004; containers in fields gained about 1 % of vessels installed in grassland.

At **soil hydrology measuring sites/SHMS**, probes for measuring soil water content, matric potential or for gaining samples of soil water such as TDR/FD probes, gypsum blocks, tensiometers or suction cups etc. are installed. These SHMS aim at investigating groundwater/hydrological conditions, mainly under **fields (including vineyards) and grassland**, or are employed **to study climate change on soil water** (see *UK 1*). The SHMS at the Ljubljana Union Brewery, **SI 6**, is the only measuring site installed directly in an **urban area** under asphalt and an industrial railway. At this measuring site, the purpose is to measure infiltration parameters within a Pleistocene alluvial gravel aquifer in a **highly urbanised and industrialised environment** and to study the possible contamination in the area of the brewery and to study the role of the unsaturated zone.

References:

Lanthaler, Ch. (2004): Lysimeter Stations and Soil Hydrology Measuring Sites in Europe—Purpose, Equipment, Research Results, Future Developments. – Unveröffentlichte Diplomarbeit am Institut für Geographie und Raumforschung der Universität Graz, S.: 1-145, download: <http://www.lysimeter.at> → „Publikationen“

European Lysimeter Platform (2005/2006): <http://www.lysimeter.at> → *Research stations in Europe*, April 2006