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A BULK PRECIPITATION SAMPLER FOR USE IN A GEOCHEMICAL
CYCLING PROJECT

A description of the construction, installation and
operational problems.

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PREFACE

The apparatus described in the following note was constructed for use in a project studying geochemical cycling in an upland grassland catchment near Plynlimon, mid-Wales (ITE Project 594). A general introduction to this project is available as Bangor Research Station Occasional Paper No. 4.

BULK PRECIPITATION COLLECTOR

Introduction

This device was designed to collect samples of precipitation falling as rain for chemical analysis but in addition it may be used as a reasonably accurate rain gauge.

Rain collector designs used by other workers have in general relied simply upon a funnel mounted above a collection bottle (Gorham, 1955, Likens et al, 1977, and many others). In order to fulfil the design criteria for a rain collector for the Geochemical Cycling Project a more complex collector was necessary. The resulting design was based upon that by Miller and Miller (1976), although the overall dimensions were increased, resulting in the use of somewhat different components and construction.

The main design criteria were:-

- (a) The collector should be relatively cheap and simple to construct, relying upon readily available but chemically inert materials.
- (b) The collector should be robust in order to survive extreme weather conditions and weekly handling for sample collection.
- (c) The process of sample collection should be simple, allowing easy removal of the sample container for transport to the laboratory and replacement with a new container.
- (d) The funnel diameter and collection bottle capacity

should be suitable for rain collection in a relatively high rainfall area (1968 - 75 annual average 2230 mm/88"), assuming weekly sample collection.

- (e) The funnel assembly should be detachable to allow replacement with a clean assembly in the event of fouling by bird droppings etc., or more frequent as felt necessary.
- (f) As far as possible the sample should be kept dark while present in the collector to inhibit microbiological activity?
- (g) As far as possible insects, vegetation and other extraneous matter should be excluded.

Description

The basis of the construction is a 160 mm (6") diameter polythene funnel discharging into a 2 litre polypropylene bottle, both of which are housed in 160 mm (6") diameter PVC pipe available from builders' merchants (see Fig. 1).

The main body of the collector (which contains the 2 litre bottle) is constructed from 160 mm diameter pipe, the length depending upon the place and method of installation but needing to be a minimum of 40 cm ($15\frac{3}{4}$ ") long in order to accommodate the bottle. A plastic or metal disc is supported by the bolts in the pipe to provide a platform for the collection bottle. A pad of foam rubber glued to this disc acts as a light spring to keep the mouth of the bottle in close contact with the stem of the funnel. The disc should not form too tight a fit with the inside

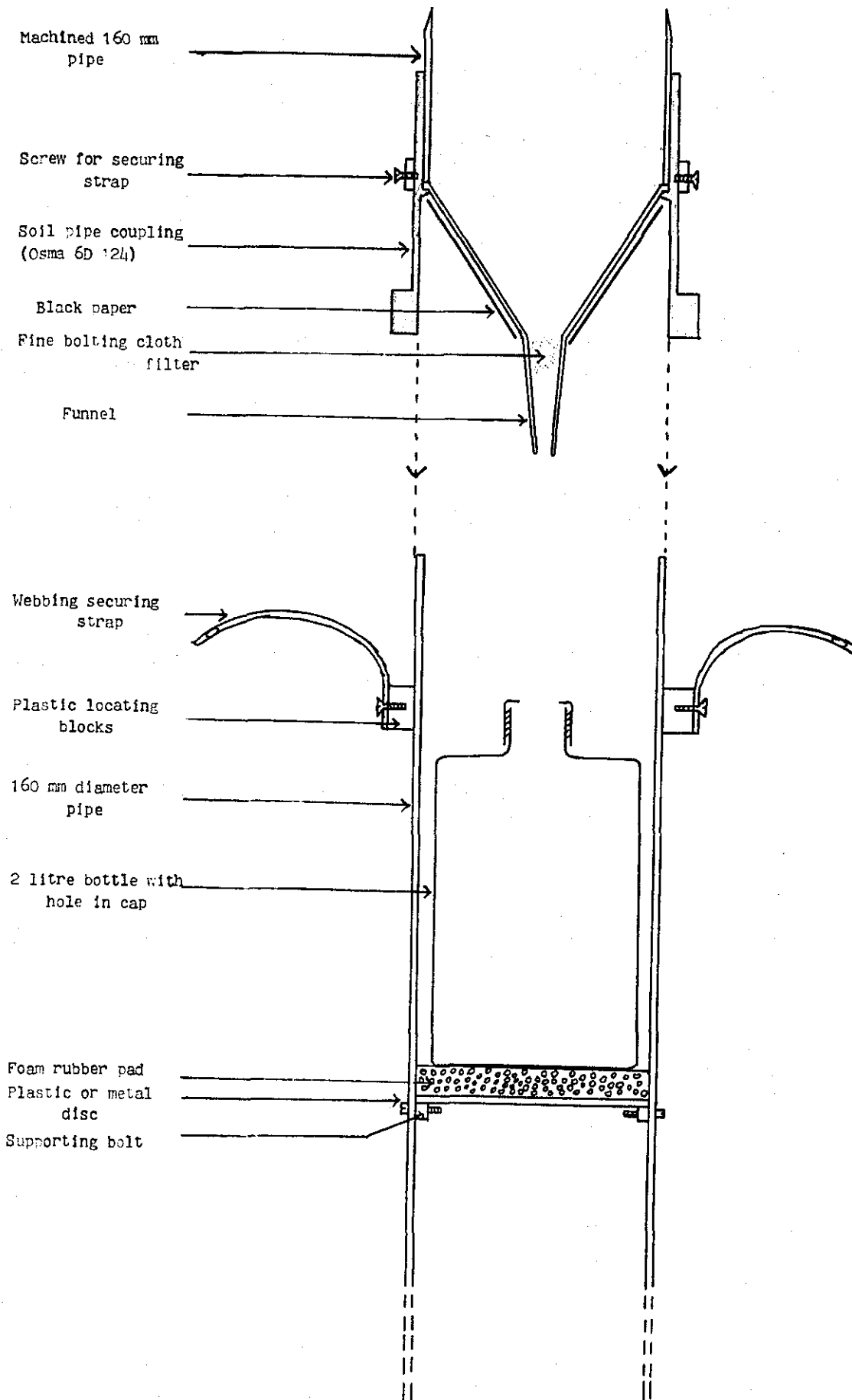


Figure 1. Construction details of bulk precipitation collector used at Plynlimon

of the pipe, otherwise overflow from the bottle (a rare event it is hoped) will not be able to escape.

The funnel assembly is composed of a 160 mm (6") diameter polythene funnel which fits neatly into a particular 160 mm soil pipe fitting (Coupling - Osma 6D 124) with its rubber sealing ring removed. A short length of plain 160 mm pipe (with its outside diameter reduced slightly by machining), is glued in the plain end of the fitting and holds the lip of the funnel tight against a rim running round the inside. The upper edge of the machined pipe is bevelled to allow accurate measurement of the collection area.

The funnel assembly fits neatly onto the plain pipe forming the main body of the collector, allowing easy removal of the assembly and replacement of the collection bottle. Three small blocks of plastic (cut from a spare ring of 160 mm pipe) are glued near to the top of the outside of the main body of the collector in such a position as to ensure that when the funnel assembly is slid on a tight fit is made between the neck of the funnel and a 27 mm diameter hole in the cap of the 2 litre bottle.

Short lengths of fabric-reinforced rubber upholstery webbing attached to the three small blocks of plastic can be hooked over three protruding screws in the funnel assembly, ensuring that the latter is held firmly in place.

A piece of black paper is held on the underside of the funnel with PVC tape (and is removed before washing in the laboratory) in order to exclude light from the sample

bottle.

A folded square polyester bolting cloth (200 micron aperture is suitable) is located in the neck of the funnel to prevent insects and debris from entering the collection bottle.

The collector may be constructed in a small workshop equipped with a lathe capable of handling the 6" pipe used.

Installation

At Plynlimon the rain collectors have been installed in existing pits 138 cm (4' 6") square by 92 (3') deep. The collectors are arranged such that the upper rim of the funnel assembly is 30 cm (1') above ground surface level.

The main body of the collector is approximately 90 cm (3') long and a framework of 5 cm x 5 cm (2" x 2") timber braced across the pits supports the collectors such that the rim is parallel to the slope of the ground surface, as in the rain gauges. Anti-splash grids (formed from painted aluminium louvre ceiling material) surround the collectors at ground level forming a cover to the pit. These prevent soil and rebounding raindrops from entering the collector, and also prevent cattle and sheep from approaching it.

Arranging the collector with its rim 30 cm above ground largely avoids problems with windblown debris, such as dead *Molinia* leaves, which might become caught in ground-level collectors. The air turbulence around the proposed collector would reduce its value as a rain gauge, however.

The collector is equally suitable for driving into the ground in the absence of suitable pits although there is a slight possibility of rainsplash from the surrounding ground surface if anti-splash grids are not used, even with the collector mouth 30 cm above ground. Grazing animals could be excluded by suitable fencing but this should be at least 2 metres away to avoid contamination from the wire, fence posts etc.

Operational problems

A difficult problem to solve is that of preventing insects and vegetation debris from entering the collection bottle. Fine mesh bolting cloth prevents these from reaching the bottle, but the trapped insects etc., are reached by the incoming rain as it passes through the bolting cloth. The tops of the collectors are raised above ground level and may therefore be considered as suitable perches by certain birds (an earthworm found in one collector may have been dropped by a bird perching on the rim of the funnel assembly). The hill grazings at Plynlimon are devoid of such perches and it has been found that additional perches in the form of short fence posts driven in close to the collector are insufficient to divert birds from the collector rim. A successful deterrent has been found, however, in the use of a collar composed of plastic cocktail sticks attached to the outside of the funnel assembly. The cocktail sticks are held approximately 3 cm apart and with their tips about 3 cm above the collector rim by two strips of PVC or masking tape.

Acknowledgements

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Appendix - materials list and prices

The following items are required to construct one rain collector. Prices are those current in January 1980 VAT is excluded.

<u>Number</u>	<u>Description</u>	<u>Comments</u>
0.6 to 1.2 m (2 to 4 ft)	OSMA PVC Soil pipe, 160 mm (6 inch) (Cat. No. 6D073 or 6D076) or RYMWAY PVC Soil pipe 160 mm (6 inch) (Cat. No. 6S20)	£3.60 per m (£1.10 per ft) From Builders Merchants
1	OSMA PVC Soil pipe 160 mm (6 inch) (Cat. No. 6D124)	£2.10 each (Rubber sealing ring discarded before construction) From builders merchants.
1	EMBEE PRODUCTS Polythene funnel, 160 mm (6 inch) diameter.	Bought from a local hardware shop, £0.45 each
0.02 m ² (approx) or	HENRY SIMON Polyester bolting cloth PE600	£5.50 per m ²
0.01 m ² (approx)	HENRY SIMON Polyester bolting cloth PE200	£5.50 per m ² Henry Simon Ltd., PO BOX 31, Stockport Cheshire.
0.3 m (1ft)	PIRELLI (?) fabric reinforced rubber upholstery webbing, 5 cm wide.	£0.75 per m
1	AZLON 2 litre polypropylene narrow mouth bottle. Cat. No. 1382	£0.94 each

In addition, PVC adhesive, plastic numberplate screws, a pad of foam rubber, short metal bolts, and a plastic disc are required but these are normally available either from "scrap" or as normal workshop stores. If required metal egg-crate louvre ceiling material may be obtained from H & T Ceilings Ltd., Ridgeway Industrial Estate, Iver, Bucks.
Suitable sizes are 4' 6" x 2' 3", 2" cells.

Total cost of 1 collector (excluding louvre) is in the order of £9 (+ VAT) with a main body length of around 1 metre.