THE CASE FOR SOIL REFERENCE

COLLECTIONS

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2 REVIEWS AND ARTICLES

2.1 THE CASE FOR SOIL REFERENCE COLLECTIONS

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Abstract

For nearly a century, soil profile bodies have been collected in the field and put on display. The development of relatively easy methods of impregnating soils with suitable chemicals, and the increasing awareness that soil is a natural resource of prime importance are stimulating national institutions in both developed and developing countries to set up modern soil reference collections. These collections include soil monoliths (impregnated and hardened soil profiles), information on soil and site, photographs, maps, etc.

This contribution describes what a soil reference collection should contain and the various uses it can serve (training, reference, information, education). The presentation and storage of soil monoliths is also discussed. The support ISM is able to provide is mentioned, and information is given about the course given at ISM annually on the establishment and use of soil reference collections.

Early developments

The first soil reference collection was made in Russia in the late 19th century and comprised a series of natural soil profile bodies which were kept in wooden boxes. Examples of these Russian soil profile bodies were first displayed outside Russia at the Colombian Exhibition in Chicago (1893-1894). These profiles were probably not impregnated and hardened into what we now call ‘soil monoliths’. Subsequently, 18 soil profiles from Latvia and 10 from Hungary, all preserved as soil monoliths, were put on display at the First International Congress of Soil Science in Washington in 1927, and a large collection of about 60 profiles was also shipped from the USSR for this congress.

Techniques of collecting soil profile bodies, and especially of impregnating and preserving them, have improved greatly since the 1930’s and have been particularly used in the Soviet Union, Germany, Hungary, Poland and China. Among the first soil museums to be established were the Central Dokuchaev Soil Museum in Leningrad and the V.V. Williams Soil Museum of Timiriazev in Moscow both, of which have exhibited soil monoliths since their inception. The soil museums in Oxford, England; Warsaw, Poland; Budapest, Hungary and Peking, China should also be mentioned.

Recent developments

Interest in removing soil profiles from the field and setting them up for study is growing, thanks to the improved techniques for impregnating the soils with readily available chemicals (both mineral and organic soils can now be properly impregnated and preserved for display and study). Nowadays, at many
international gatherings, such as international congresses of soil science, impregnated soil profiles are displayed. But only occasionally have these collections been retained and put on display. Nevertheless, there has been a vast increase in the number of institutions (e.g. universities, soil survey institutes, natural history museums) around the world with collections of soil monoliths.

Not only industrialized countries but also developing countries such as Colombia, Ghana and Kenya have started collections of soils and countries that have expressed keen interest in the establishment of soil reference collections include Brazil, Indonesia, Mexico, Mozambique, Oman, Sri Lanka, Uruguay and Vietnam.

Many of these developments have occurred since 1966, which was the year in which the International Soil Museum (ISM) was established in the Netherlands in response to international support for the setting up of an international reference collection of the world’s soils to complement the FAO-UNESCO Soil Map of the World. The ISM advises and assists in the collection of the soil monoliths and in displaying and using them.

The use or soil reference collections

Soil profiles are collected for many reasons. The type of reference collection, the way it is presented, and the number of soils shown can serve a variety of purposes. The most important goal of a soil collection is to increase awareness of the importance of soil as a natural resource to sustain life for present and future generations, and to highlight the pressing need for its conservation.

Use for scientific training

Education, especially in natural sciences, benefits greatly from the use of examples from nature. Biology students should have access to flora and fauna in the field and in the laboratory; geology students to rocks and fossils. Many herbaria and geological collections have been set up all over the world.

For students in soil science it is particularly useful to have the various types of soil to hand. In many institutions where training in environmental sciences is given, such as universities, agricultural schools and soil survey institutes, collections of loose, usually disturbed soil material are used as teaching material. Some institutions have a collection of ‘soil correlation boxes’; a few have lacquer peels or soil monoliths. Such displays of lacquer peels and monoliths are very helpful in revealing the variety of soil and differences between them on the regional, national, or international scale. Also, sequences of soils in the landscape and over time, and the influence of different soil management techniques, or of various soil degradation features, etc. can be shown to students who have an interest in soil. Too often, students in developing countries still have to make do with examples (slides, drawings, maps, textbooks) from industrialized countries, instead of being trained on local soils.
Use for soil classification and correlation

Once a national soil survey organization has been established and an exploratory inventory of a country or region has been made, it is particularly useful to start building up a soil reference collection. This helps soil classification, correlation and soil interpretation. The collection also forms a basis for discussion and co-operation between the soil surveyor and the soil scientists and laboratory technicians working at headquarters. Foreign soil scientists on a short visit to the country, may exchange useful information about the classification of the soils on display and their production potential.

A collection of soils also enables specific research programmes to be set up. These may be of a comparative character (e.g. the study of Nitosols in various environments) or may be problem-oriented (e.g. salt-affected soils). An important research application is the use of collections of soil monoliths for the transfer of agro-technology.

Use for planning purposes

Although in many instances the nature and behaviour of the soil is taken into account in the planning process, there is room for improvement in the communication between the soil scientist and agronomist, the extension officer, the land use planner, the farmer, the policy maker, and the administrator.

Soil monoliths and related data and information on climate, physiography, land use, and other ecological factors can convey convincingly the differences in soil characteristics and their use limitations, especially if the collection is accompanied by a series of maps, schematic cross-sections, colour photographs, etc.

Planners are not easily enticed to join the soil surveyor/land evaluator on extensive field travel, and to dirty their clothing by jumping in and out of pits. Agronomists and conservationists working in a certain area will want to have a quick overview of conditions in other parts of the country for comparison. In the case of large countries with underdeveloped transportation facilities and at the same time a great variety of natural regions and farming systems, it is often impossible to organize guided tours to field reference sites. A national soil reference collection at a centrally located site is the next best source of soil information.

Use for educating the general public

In many developed and developing countries there is an increasing awareness of the importance of soil as a natural resource that merits conservation. The media, especially television, can play a major role in making the public more 'soil-conscious'. To arouse public interest, soil reference collections should be established, and material from them conveniently displayed. Such collection could form part of a natural history museum, either integrated with other aspects of the environment or presented as a separate topic. Or a national soil museum could be established, especially if a large collection of monoliths is available.

Attention should not only be focussed on the soils as such but also on the place of soil in the physical and biotic environments, and the link between soil and farming system. As well, aspects of soil conservation and soil degradation features
such as salinization and desertification can be very instructively illustrated in a collection cum exhibition.

Contents of a soil reference collection

Items that could be included in a soil reference collection are mentioned below. Obviously, the aims and purposes of the collection (see earlier) will largely determine what the collection contains. The aims do change, however, and some of the items mentioned below may be not have an immediately obvious purpose, but could be very useful at a later date.

Monoliths or lacquer profiles

Monoliths are soil profiles, collected in boxes and impregnated indoors. They are usually 25 cm wide and 125 to 150 cm long. The thickness of the impregnated soil varies, but is usually from 2 to 5-8 cm. Monoliths show many of the natural soil characteristics such as colour, structure, horization, rooting depths.

Lacquer profiles are soil profiles impregnated in the field. They may be the same size as a soil monolith but are usually much thinner and the structural characteristics of the soil cannot be observed as well as in a monolith.

Both methods of taking soil profiles and the resulting impregnated products have theirs advantages and disadvantages. Details are given in ISM Technical Paper 1 (Van Baren & Bomer, 1979). To allow physical, chemical, mineralogical, and micromorphological analysis to be done, samples of the soil should be taken (bulk samples, pH samples, and undisturbed micromorphological samples). If the soil is taken to show a specific feature, (for example, laterite, plinthite, a cemented pan, a surface crust, or carbonate nodules) specimens of these features should also be collected.

As a matter of course, a complete description of site and soil has to be made according to internationally accepted standards (e.g. FAO Guidelines for Soil Profile Description; FAO, 1977). This description includes data on climate, vegetation and land use, farming systems, landforms, parent material and other data important for assessing soil-related land qualities.

Publications and photographs

To give a complete picture of site and soil it is very useful to assemble publications (including maps) on the soil and on the geology, vegetation, land use, climate, and other relevant subjects. Yield data, infiltration rates, hydraulic conductivity of the substratum and other data should also be collected. Obviously, colour photographs and/or colour slides are very helpful in showing the landscape, vegetation, land use, etc. Also, the site where the profile was collected should be photographed. For information about photographing soil profiles and landscapes, see ISM Technical Paper 2 (Ragg & Creutzberg, 1981).
Presentation

There are many ways in which the material collected can be presented. The method chosen depends on such aspects as the aim and purpose of the collection, the number of monoliths/lacquer profiles, facilities available, the staff available to present and maintain the display, etc. Some examples are given below.

- A collection of soils for education/study at an agricultural university, soil survey institute, or similar.
This collection should be displayed in a permanent set-up. The monoliths and/or lacquer profiles should be tilted backwards some 10-15 degrees, with their bases on a table or, preferably, on specially designed staging equipped with bench-hooks. Since the lacquers used for the impregnation usually decompose under the influence of ultraviolet light, the monoliths should not be exhibited in full daylight. Aim for the best artificial illumination. It is very useful to present colour photographs of the landscape and site, graphs, tables and other relevant information near the monolith. The soils can be arranged in various ways, e.g. by region, or by catena, or by soil-related land qualities, or by taxonomic aspects.

- A collection of soils for the information of the general public.
A soil collection is regarded as a useful addition to natural history and earth science museums. Since soil profiles, especially soil monoliths, are unfamiliar items, they need explanation. It is also useful to show the place of soil science in relation to other natural sciences and to point out the variety of uses that can be made of soil data. The soil can then be presented as an important part of the ecosystem, highlighting aspects such as the formation of the soil from the parent material by the action of soil-forming factors. Different kinds of rocks and soil material can be shown for comparison. Soil material is also used for manufacturing various types of bricks and earthenware and is needed for the construction of roads and even of mud-houses, and therefore these aspects could also be touched on, as they emphasize the general utility of soil material.
The soil monolith or lacquer profile itself should be supplemented with relevant information about vegetation, land use, location in the landscape, and other geographical information. Agricultural aspects such as the crops grown and the various land qualities are also of interest to many visitors. If feasible, free hand-outs should be available on the material presented.

If there are too many monoliths for the exhibition space, adequate storage facilities should be available. Lacquer profiles can be hung on walls or hooked onto runners sliding along a track fixed to the ceiling or onto wooden beams, thereby considerably increasing the storage capacity of a room. Soil monoliths, which are much heavier, are best stored horizontally in sturdy wooden or metal racks. The maximum weight that the floor can bear must be taken into account. It is best to keep the soils in the dark. For further information see ISM Technical Paper 1 (Van Baren & Bomer, 1979).
The role of the International Soil Museum

Since its inception and especially since the establishment of a formal annual course, ISM has given written and oral information, advice and training on taking and preserving soil profiles and on the use of soil reference collections. This information ranges from the technical aspects of displaying and storing soils and data, to the best ways of providing different types of information to people who visit such collections.

a. It can advise on

- taking and preserving soil monoliths and collecting relevant information and data (including which chemicals and equipment to use, etc.).
- how to display soil reference collections and the associated relevant information and data on soils (including advise on illumination, handling of photographs, etc.).
- Storage of soil monoliths.

Visitors to the ISM (preferably by appointment) can receive this advice verbally. Written information can also be given, but this is normally of a more general nature, unless the question is specific. The advise is usually provided free of charge, especially to people from, or working in developing countries.

b. At the request of some developing countries and with the support of Unesco, the ISM now gives a short course every year entitled: ‘International Course on the Establishment and Use of Soil Reference Collections’.

The course is given during 4-5 weeks in April/May of each year. Preference is given to participants from developing countries who will be engaged in setting up soil reference collections. Some Unesco fellowships are available for persons attending this course. After the course, participants will be able to set up a soils collection and be familiar with all the related activities mentioned earlier. The ISM can provide further technical back-up to such projects.

c. ISM personnel have had practical experience in collecting and preserving soils and setting up soil reference collections in a number of countries and they are available for consultancy work.

References


Examples of soil profile display.
Soil Museum of the Nanking Institute of Soil Science, China (above).
Exhibition Hall of the International Soil Museum, Wageningen, The Netherlands (below).