

Table 5. Relationship Between Burnout Subscales and Coping Subscales (n = 58)

Variable	Type of Appointment			
	Recreation	Self Care	Social Support	Rational Coping
Emotional exhaustion: Frequency	-.46	-.31	-.13	-.22
Emotional exhaustion: Intensity	-.37	-.15	-.15	-.08
Depersonalization: Frequency	-.20	-.13	.00	.00
Depersonalization: Intensity	-.11	.07	-.10	.17
Personal accomplishment: Frequency	.05	.21	.06	.27
Personal accomplishment: Intensity	-.08	.17	.00	.19

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Table 6. Analysis of Variance of Personal Accomplishment Frequency for Faculty by Type of Appointment

	Type of Appointment			F
	50% or more research Balance Instruction	100% Instruction	Less than 50% research Balance Instruction	
n:	26	12	17	
m:	33.4615	39.2500	38.1765	
SD:	7.1902	6.7572	5.3763	
Source	df	ss	ms	F
Between groups	2	373.00	186.50	4.30 ¹
Within groups	52	2257.18	43.41	
Total	54	2630.18		
Mean	Group			
33.46	50% or more research			
38.18	Less than 50% research ²			
39.25	100% instruction ²			

¹p < .02.
²Means for 100% instruction and less than 50% research are significantly different from 50% or more research at the .05 level.

Table 7. Analysis of Variance of Job Satisfaction Scores for Faculty by Type of Appointment

	Type of Appointment			F
	50% or more research Balance Instruction	100% Instruction	Less than 50% research Balance Instruction	
n:	29	13	19	
m:	4.1283	4.4577	3.8663	
SD	.6260	.9775	.6551	
Source	df	ss	ms	F
Between groups	2	2.7066	1.3533	2.602 ²
Within groups	58	30.1643	.5201	
Total	60	32.8709		

¹.....Means are significantly different.
²p < .08.

TECHNICAL REPORT

Soil Core Monoliths

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Abstract

Constructing a soil monolith requires an undisturbed soil profile sample that can be easily mounted and displayed. The collection of profile samples from pits or road cuts by traditional methods is time consuming and often expensive. An alternative solution was developed to collect the profile samples using a hydraulic probe fitted with a core tube having an inside diameter of 6.9 cm (2.7 in). The soil core is mounted on 7.6 cm (3 in) diameter plastic polyvinyl chloride (PVC) pipe that has been split longitudinally. Excess soil is removed from the core and the sample is treated with a vinyl fixative solution. The treated core is mounted on a plywood display board that contains classification, site, location, and horizonation information about the soil. Monoliths prepared using this procedure are easy to construct, durable, less expensive, attractive, large enough to show soil properties clearly, and they are comparable to those gathered by traditional methods.

Most of our food, fiber, and lumber directly or indirectly comes from the soil. As the world population increases, pressure mounts to increase production and this can be done wisely only if individuals understand the characteristics of the soil. Surface soil colors change with landscape position, and so do the internal physical and chemical properties of soils. Visible changes in soil structure, drainage, and rooting pat-

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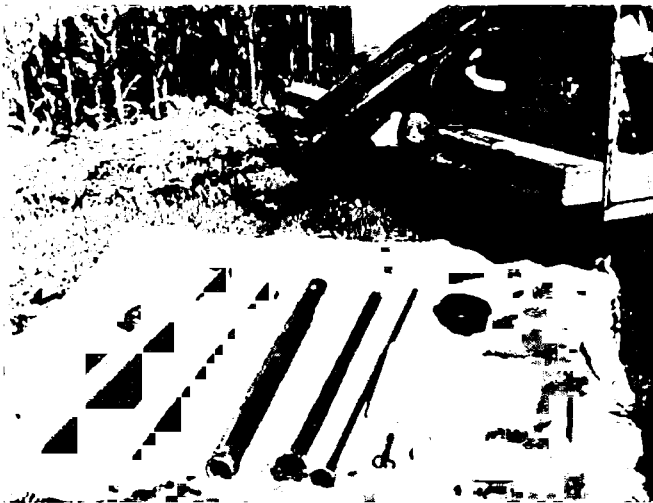


Fig. 1. Equipment and materials to collect the soil core shown (left to right): longitudinally split PVC pipe, meter stick, slotted core tube with quick relief bit, drive rod for hydraulic probe (in background), push rod, 35 mm camera, information sheet, tape, scissors, and plastic covers (under tape).

terns are often noted. In order to describe and analyze these changes, it is necessary to examine soil profiles (vertical slices of soil from the soil surface downward).

Since it is sometimes difficult to visit and examine profiles in the field, it is desirable to have an inexpensive method to collect and preserve soil profiles. The process of permanently mounting a vertical slice of soil is called soil monolith construction.

Soil monoliths and soil cores have a variety of uses as teaching aids in the classroom, at workshops, and at extension meetings, as soil displays for research, and for comparison of soil properties (Wells, 1953; Wright, 1971; Belford, 1979; Stenhardt et al., 1981; Cooper, 1983; Lemme, 1983). Often, monoliths are not constructed because traditional methods for obtaining an undisturbed soil profile are time consuming, expensive operations that require considerable labor (Berger and Muckenhirn, 1945; Smith and Moodie, 1947; Smith et al., 1952; Berger, 1965; Donaldson and Beck, 1973; Post et al., 1976; Ursu, 1982).

This study describes an alternative method of sampling using a hydraulic soil coring machine fitted with a core tube having an inside diameter of 6.9 cm (2.7 in). Earlier workers have described the use of hydraulic soil coring machines for obtaining an undisturbed soil sample and preparing soil monoliths (Wells, 1959; Springer, 1963; Runge, 1965; Yost, 1970). The problems of sample transport from the field, sample storage, mounting, preservation, display, and soil property recognition for educational purposes were also examined in this study.

Methods and Materials

Collecting Soil Cores

Step 1. Equipment.

The equipment and material needed to collect the soil core are shown in Figure 1 and include

(a) Hydraulic soil coring machine.

(b) Core tube and push rod. The tube has an inside diameter of 6.9 cm (2.7 in) and is 121.9 cm (48 in) long. The tube should be fitted with a quick relief bit for



Fig. 2. Hydraulic soil coring machine fitted with core tube taking a sample.



Fig. 3. Checking for soil compaction in the soil core tube by comparing soil level inside the core tube with soil level outside the tube.



Fig. 4. Use of push rod to extract soil from the core tube onto PVC pipe section.

most soils. Viewing slots should be present along the length of the tube so the operator can observe the soil core for compaction as the tube is inserted into the soil. The push rod is used to remove the soil core from the tube.

(c) Plastic polyvinyl chloride (PVC) pipe. A section of PVC pipe having an inside diameter of 7.6 cm (3 in) and length of 121.9 cm (48 in) is split longitudinally prior to gathering the soil monolith core. The semicircular pieces of pipe serve two functions. They are used as trays for soil core inspection and to encase the samples during transportation and storage.

(d) Plastic wrap and masking tape. Two pieces of heavy duty 0.15 to 0.20 mm (6 to 8 mil) thickness plastic are required for each soil monolith core. One piece of plastic wrap is secured with masking tape on each end of the soil core.

(e) Filament tape. Fiber tape is used to hold the halves of PVC pipe together when the soil core is inside for transportation and storage.

(f) Information sheet and label card. Profile and site information are recorded on an information sheet. A label card is used to identify the soil core.

(g) Camera. A 35 mm camera is used to take photos of the sample site, landscape, and soil core sampled.

Step 2. Selecting sample site and determining soil moisture conditions.

Possible sample sites should be examined to locate a soil profile that is typical for the soil wanted. Avoid taking soil monoliths from convenient areas because soil cores gathered in this manner often are not representative of an area or the soil taxon desired and usually are of limited educational value.

An undisturbed soil core sample is the primary goal in the construction of the soil monolith. In order to obtain an undisturbed sample, soil moisture content and soil texture must be taken into consideration. Soil often becomes compacted within the core tube when the soil moisture conditions are at or near field capacity, especially in medium- and fine-textured soils. Compacted core samples are difficult to remove from the tube and the sample's natural structure is usually destroyed or altered. However, soil cores taken when moisture conditions are at, near, or below the wilting point usually are brittle and difficult to dress down. Unfortunately, there is no exact moisture content that yields an undisturbed soil core for every soil. Soil properties such as texture, clay mineralogy, and organic matter content influence the soil moisture content which yields an undisturbed core. A loose sandy soil high in soil moisture will give a better core sample than one which is low in soil moisture. Conversely, a soil high in clay content will yield a better core sample at lower soil moisture conditions. It is necessary to monitor the soil moisture conditions and core samples may have to be taken on different days to ensure satisfactory results.

Step 3. Obtaining soil core.

Core samples are obtained using the hydraulic soil probe equipped with the core tube described earlier (see Figure 2). The core tube is pushed into the soil to a depth of 121.9 cm (48 in). While inserting the core tube



Fig. 5. Soil core enclosed with PVC pipe, ends covered with plastic, labeled, and ready for transport.

the operator should observe the soil level in the core tube to make sure soil compaction is not occurring (see Figure 3). The core sample is extracted from the core tube and inspected for compaction and other possible damage. If the core is undisturbed it is photographed and morphologically described to determine horizonation, horizon depth, texture, structure, and soil classification.

A second core, for the monolith, is then extracted adjacent to the first core site (within 50 cm). The selected core is laid in one-half of the split PVC pipe (see Figure 4). The other half of the split PVC pipe is fitted over the top of the core and secured with filament tape to the lower section of PVC pipe (Figure 5). The ends of the core are sealed with heavy duty plastic wrap to protect the core sample and prevent moisture loss during transportation and storage. If the core is less than 121.9 cm (48 in) long, filler materials should be inserted in the ends to hold the core stationary in the PVC pipe. Masking tape can be used to prevent moisture loss along the seams of the PVC pipe. After securing in the PVC pipe, the pipe should be labeled.

Step 4. Landscape photo.

Before leaving the sampling site, a photograph (color or black and white) of the landscape should be taken. A print of the landscape is used in the information section of the monolith (see Figure 6).

Monolith Mounting Board Construction

The monolith display board is a 20.3 x 145 cm (8 x 57 in) piece of 1.6 cm (5/8 in) thick plywood (Figure 6). A rectangular slot 7.2 x 114.3 cm (2.8 x 45 in) is cut in the mounting board 25.4 cm (10 in) from the top and 5.1 cm (2 in) from the front right edge. A recessed groove of 1 cm (3/8 in) deep by 0.6 cm (1/4 in) thick is cut into the back of the mounting board along the core slot. This recessed groove is used to hold the PVC pipe that supports the core sample (see Figure 7). Quarter round molding, 1.3 cm (1/2 in) thick, is glued and nailed to the front of the board along the edges of the core slot.

Preparation of Soil Core for Plastic Fixative

Step 1. Materials.

The materials needed to mount the soil core sample are:

(1) PVC pipe. A section of PVC pipe 114.3 cm (45 in) long with an outside dimension chord length of 8.4 cm (3.3 in) is prepared. This mounting pipe can be cut from one of the sections encasing the core sample or from a new piece of PVC pipe.

(2) Cement. An adhesive material is used to secure the soil core to the mounting pipe for permanent display. Usually this adhesive is a clear drying glue like cellulose acetate or nitrate wing dope (used in airplane construction).

(3) Cheese cloth, 15.2 x 121.9 cm (6 x 48 in).

(4) Masking tape. Masking tape is used to secure the mounting pipe to the soil core during the fixing process.

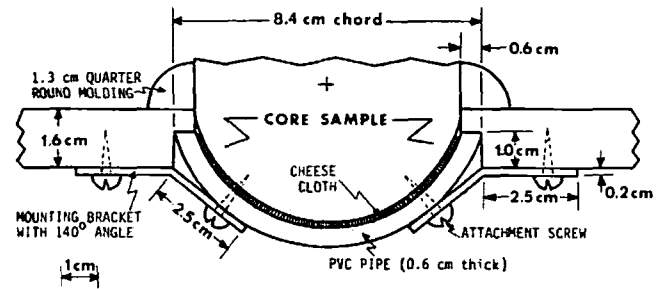
(5) Knife. A knife is used to remove excess soil and expose soil characteristics (structure, color, mottling) in the core.

Step 2. Mounting soil core on PVC pipe.

The soil core is exposed by removing half of the encasing pipe. The exposed core surface is covered with a double thickness of cheese cloth, 7.6 x 121.9 cm (3 x 48 in). The cheese cloth is then saturated with the clear adhesive and the mounting pipe is laid on the saturated cheese cloth (Berger, 1965; Smith and Moodie, 1947; Buntley, 1967; Post et al., 1976). The mounting pipe is taped tightly to the remaining pipe section used to encase the sample. The adhesive is allowed to dry at least 16 hours to ensure a tight bond between the mounting pipe and the soil core sample (see Figure 8).

Step 3. Dressing down mounted core.

The remaining section of encasing pipe is removed after the adhesive has dried. The core sample is carefully trimmed from the bottom to a length of 114.3 cm (45 in). The mounting board is placed over the core to aid in determining how much excess soil needs to be removed. The core sample should not be attached to the mounting board at this time. Avoid handling the



MONOLITH CROSS-SECTION

Fig. 7. Cross section of mounting board plus soil core illustrating monolith construction.

soil core. With the soil core in the mounting board, the excess soil is carefully removed by knife point to the height of the protective molding (Figure 7). Remove the mounting board and use air blowing to remove loose soil and expose the undisturbed soil structure, color, and other profile characteristics (see Figure 9).

Moisture content of the core sample is important when removing the excess soil. If the core is too dry it will be hard to pick away the excess without damaging the core sample. Moisture can be added to the core by laying moist towels over the core and allowing the moisture to penetrate. It may take several days to raise the moisture content to the desired level if the core is extremely dry. Wetness is not usually a problem since it is difficult to take soil cores in the field when soil moisture contents are greater than field capacity.

Step 4. Drying the soil core.

After removal of the excess soil the soil core should be allowed to air dry for a few days. This will prevent a white discoloration from forming on the soil surface when the plastic resin is applied (Post et al., 1976).

Step 5. Painting the mounting board.

The mounting board is painted with a flat light gray (Munsell color N 7/0 or N 8/0) paint.

Application of Plastic Fixative

Step 1. Material.

- (a) Acetone.
- (b) Methyl Isobutyl ketone.

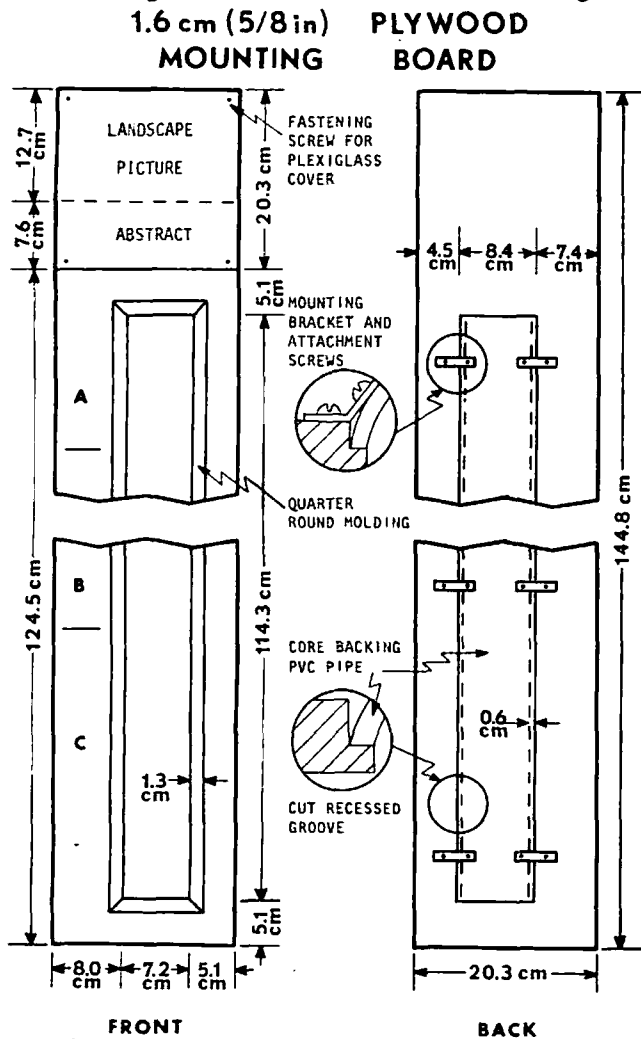


Fig. 6. Mounting board construction plans.



Fig. 8. Attachment of mounting pipe to soil core using cheese cloth and clear adhesive.



Fig. 9. Removal of excess soil to show soil characteristics.

(c) Vinyl plastic resin (powder form). It is referred to as Vinylite or Bakelite Carbosylated Vinyl Resin VMCH (Springer, 1963; Buntley, 1967; Post et al., 1976).

Step 2. Preparation of vinyl plastic resin solutions.

Two vinyl plastic resin solutions are prepared in advance. The solutions are: solution A (12% by weight vinyl resin dissolved in acetone); and solution B (12% by weight vinyl resin dissolved in methyl isobutyl ketone). A mixture of $\frac{2}{3}$ solution A and $\frac{1}{3}$ solution B is desirable for most medium-textured solids. Sandy or coarse textured soils will require a mixture containing more solution A and less solution B. Clayey or fine textured soils, however, require a mixture containing less solution A and more solution B. The exact ratio needed should be determined by testing various mixtures on soils similar to the core being prepared.

Step 3. Vinyl fixative addition.

A one-liter mixture of solutions A and B should be prepared for the soil core based on the trial soils tested. The soil core is impregnated with the plastic fixative. The mixture is poured slowly over the sample from either a beaker or a wash bottle dispenser and allowed to saturate the soil (see Figure 10). This step should be done in a well ventilated area. Avoid adding too much mixture, as this will cause glossy patches to occur on the face of the soil core before drying. Once the vinyl fixative has been applied the core is allowed to dry for at least 24 to 36 hours. If glossy patches appear they can be removed with light brushing with pure methyl isobutyl ketone or similar solvent. Be careful that the soil does not loosen if you need to do this process.

Mounting the Soil Core

Step 1. Materials.

The materials and equipment needed to mount the soil core are shown in Figure 11.

(a) Finished mounting board and mounting supports. Four mounting supports 20 x 5 x 10 cm (8 x 2 x 4 in) are needed.

(b) Soil core impregnated with plastic fixative.

(c) Hand operated electric drill and 2.4 mm (3/32 in) diameter drill bit.

(d) Mounting brackets and attachment screws. Six 2.5 cm (1 in)/side 90° mounting brackets and 12 round head wood screws 0.4 cm (1/6 in) diameter x 1.3 cm (1/2 in) long.



Fig. 10. Addition of plastic resin fixative to the soil core.

Step 2. Attaching soil core to mounting board.

The mounting board is placed face down on the mounting supports. One support is placed at each end and one on each side of the core slot in the middle of the mounting board. The soil core is inserted into the mounting board and is supported by the groove cut in the back of the mounting board (see Figure 12). The soil core is attached to the mounting board by using the mounting brackets. The mounting brackets are bent from 90° angle to approximately 140° so that they fit snugly to the PVC mounting pipe and mounting board. A hand operated electric drill fitted with a 2.4 mm (3/32 in) diameter drill bit is used to drill a 1.3 cm (1/2 in) deep pilot hole in both the mounting board and the soil core. Attachment screws (round head) are used to fasten the mounting pipe and attached soil core to the mounting board. The screws that attach the mounting bracket extend into the core sample and provide additional support.

Completion of Monolith

The information section and soil horizon designations are placed on the mounting board last. The information section consists of two parts (Buntley, 1967). The landscape picture is fastened to the top of the mounting board using rubber cement or contact photo mounting adhesive. The abstract section contains the soil series name, location, classification, environmental setting, date collected, and the name(s) of the collector(s) and preparer(s). This information is placed below the landscape picture and should be no larger than 7.6 x 20.3 cm (3 x 8 in). The information section is protected by a piece of 20.3 x 20.3 x 0.25 cm (8 x 8 x 0.1 in) plexiglass. The plexiglass is attached to the mounting board with four small flathead wood screws. The soil horizons and boundaries are identified on the left-hand edge of the mounting board using stencils or pressure-sensitive lettering (see Figure 13).

Summary

The soil monoliths developed from this procedure were comparable to those gathered by traditional methods. The soil core samples were easily obtained (only one person is needed) and large enough to show soil properties clearly for classroom and small group use. The monoliths were easier to construct and handle, required less time to complete, were less expensive, and weighed much less than those gathered by traditional methods. The mounting procedures

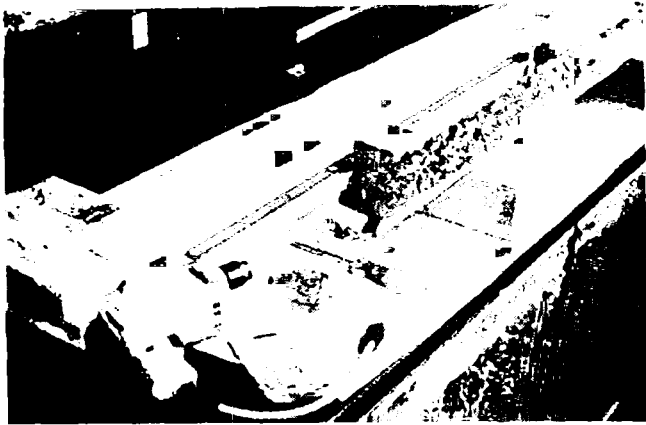


Fig. 11. Equipment and materials used for mounting the soil core.

described produced a securely mounted, attractive soil monolith that can be transported easily.

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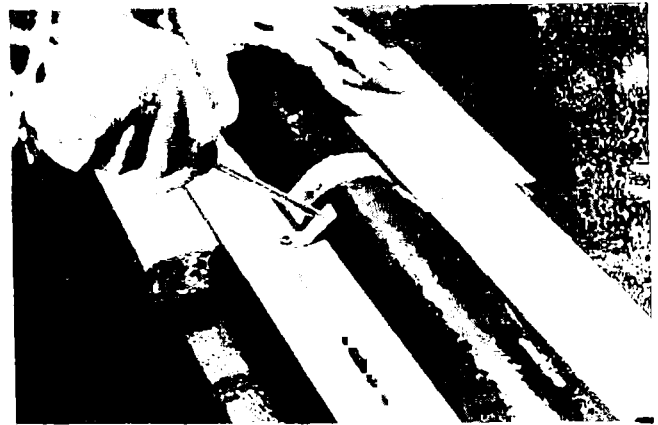


Fig. 12. Securing the soil core and mounting pipe to the mounting board.

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Fig. 13. Completed soil monolith.