

**Technical Paper 2**

**The Photography of Soils  
and Associated Landscapes**



**International Soil Museum - Wageningen - The Netherlands**

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# THE PHOTOGRAPHY OF SOILS AND ASSOCIATED LANDSCAPES

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## I. Introduction

Although many agronomists, soil scientists, extension workers and students use photographs of soil profiles and associated environments to illustrate their work, there is little guidance on this subject in the soil science literature. Photographs of good quality are a useful, or essential, part of a pedologist's records and are often needed as visual aids at lectures or for demonstrations. They are also required for publication to supplement descriptive text in order to give the reader the 'feeling' of soils, landscape, agriculture and vegetation.

It is the authors' aim in this paper to provide scientists with a basic knowledge of photography enough advice in order that they may get the best out of their equipment when attempting to portray soils and associated subject matter.

The special requirements of the scientific photography of small specimens, thin sections or laboratory environments are not considered in the following pages. Readers who require information of this kind are directed to specialized publications such as those of Blaker (1976 and 1977).

## 2. Equipment and Film

Expensive cameras and supplementary equipment are not necessarily the prerequisites of good photographs. A camera with moderate specifications is usually quite adequate, but there must be provision for accurate focussing and alteration of aperture and exposure time. For general purposes a 35 mm camera is suitable for colour work and a roll-film camera with a 6 x 6 cm or 6 x 9 cm format is best for monochrome photography. If large (>30 x 20 cm) colour photographs are required for exhibition it is essential that a large format camera be used. In these circumstances 6 x 6 cm format should be regarded as the minimum.

Supplementary lenses can be useful under certain circumstances but should not be regarded as essential items of one's equipment. The focal length of most lenses supplied as standard with a 35 mm camera is 50 mm. A lens of this kind demands a camera position 0.80- 1.60 m from the pit face in order to fill the frame with a profile of 0.75 to 1.5 m deep (Fig. 1). Bearing in mind some of the advice given subsequently in this paper, this entails digging a slightly oversize pit. This difficulty can be avoided by using a lens of short focal length; 35 mm is recommended. Where it is not possible to position the camera near to a soil profile (e.g. at a natural exposure or in a quarry), a 90 mm lens enables the photographer to fill the camera frame. Details of typical distances from a profile face when using 35, 50 and 90 mm lenses are given in Table 1.

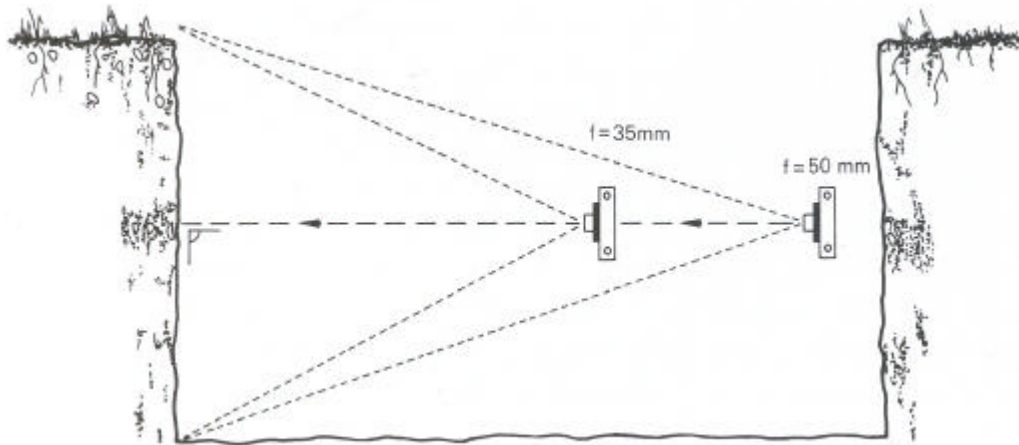


Fig. 1 Correct position of the camera with the back in a plane parallel to the profile face. Note the advantage of a lens of short focal length, which enables a photograph to be taken in a small pit.

Table 1 Distance of object versus focal length (35 mm camera)

Depth of profile (m)	Distance of profile (m)
	<i>35mm lens</i>
0.75	0.80
1.00	1.10
1.50	1.60
	<i>50mm lens</i>
0.75	1.20
1.00	1.60
1.50	2.40
	<i>90mm lens</i>
0.75	2.25
1.00	3.00
1.50	4.50

A 90 mm lens is often useful when portraying a selected portion of a landscape and avoids the necessity of approaching the chosen subject too closely. When a photographer is in an elevated position this is sometimes the only method, which may obtain a good photograph.

The most prevalent cause of blurred photographs is camera-shake and few persons can guarantee complete absence of movement when handholding a camera unless a fast shutter speed is used. With care a 1/125th second is satisfactory but 1/250th second is recommended if artificial supports are not used, or if it is windy. A tripod can be employed in road cuttings or near quarry faces but in a soil pit its use can be very awkward. More suitable supports in this instance are either a small sandbag, a clamp support or a short auger with a ball and socket head fitted to one end of the handle (Fig. 2). This apparatus may be screwed into a step in the pit or at the edge.

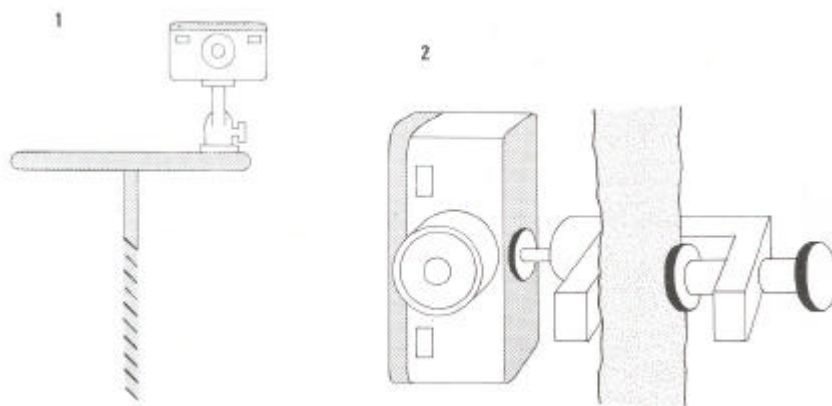


Fig. 2 Camera supports for use in the field. 1. Short auger with attached ball and socket. 2. Clamp with ball and socket.

Film of medium speed (50- 100 ASA, 18- 21 DIN) is recommended for both monochrome and colour photographs. If big black and white enlargements from 35 mm film are required, however, a slow, fine-grain film (25-50 ASA, 15-18DIN) should be used. The choice of colour film is usually a matter of personal preference. Agfacolor reversal films yield transparencies with very good renderings of yellows and browns and are especially suitable for soil photography, while the slow and medium speed Kodak with a good exposure latitude are favoured by many users. Kodachrome 25 film is generally acknowledged as having good resolution and is preferred for reproduction when a large format camera is not available. Certain colour films are very sensitive to ultra-violet light and to avoid a blue cast on transparencies a haze or ultra-violet filter should be used. This type of filter does not affect exposure times and may be left on the lens at all times with the additional benefit of lens protection.

Photographic emulsions are very sensitive to extremes of climate. They deteriorate rapidly in high temperatures and, when accompanied by high humidity, fungal growth can ruin relatively new film stock. (Remember that, even in temperate climates, the interior temperature of a car can reach 75°C on a sunny day) Fluctuating temperatures in a cold environment can produce condensation problems by coating optical systems with moisture and it is a wise precaution, therefore, to protect both film and camera from climatic extremes. Soil and photographic equipment do not make good partners. Field workers cannot be reminded too often that they must avoid mechanical damage to their equipment, particularly in muddy or dusty conditions.

### 3. Soil photographs

Photographs of soil profiles are seldom successful unless the frame is filled and all extraneous subject matter, other than a small amount of surface vegetation, excluded. The authors wish to emphasise this recommendation very strongly. We have seen many otherwise excellent photographs spoiled by lack of attention to this precept.

As a general rule, black and white photographs of soil profiles are not very satisfactory unless there is strong structure present. Photographs of the surface of soils in monochrome however can be useful and often indicate stoniness or structure well. Similarly, portrayals of arable soils before and after cultivations or winter frost can be of

value. These exceptions apart, soils should always be recorded on colour film and the following notes are applicable mainly to colour work:

- Exposure must be determined accurately with a hand-held or camera light meter. Exposure for mineral soils is simply determined by holding the meter approximately 50 cm from the lit face of the soil pit. In organo-mineral soils the light readings from the mineral and organic parts are very different, and in such cases the exposure should be determined using the reading from the paler, mineral horizons. When photographing peat, or dark coloured soils, a light reading from the surrounding vegetation is usually a good guide as very little light is reflected from these soils. Cameras with automatic exposure control must be handled with caution and should usually be operated in manual mode. To obtain optimum results with colour reversal film it is often necessary to 'bracket' the measured exposure with two additional pictures taken at apertures  $\pm 1/2$  stop (e.g. if f5.6 is the calculated aperture, take photographs at f6.6, 5.6 and 4.7). Exposure with monochrome and colour negative film is much less critical and such precautions are not required.
- Careful attention should be paid to accurate focussing if all parts of the profile are to be sharply rendered. The depth of field in which sharp focus is maintained, even when using small apertures, is very narrow especially at distances of less than 2-3 m (see Table 2). If the camera has no coupled rangefinder or focussing screen, measurement should be taken from the soil face to the back of the camera and transferred to the focussing scale on the lens.

Table 2 Depth of field (cm) for 35 mm camera with 50 mm objective

Focussing distance (cm)	Aperture			
	f 2	f 4	f 8	f 16
80	59 - 61	78 - 83	75 - 86	71 - 92
100	98 - 102	96 - 104	92 - 109	86 - 120
150	145 - 155	141 - 161	132 - 173	119 - 205
200	191 - 210	183 - 220	170 - 240	150 - 320

- The intensity of lighting must be high and light must fall almost directly on to the soil face to be photographed. Slight side lighting to show up structure is often preferable, but strong shadows, particularly those cast by the edge of a pit, must be avoided. If dense shadow at the side or base of the pit cannot be avoided it is often advisable to shield the profile from direct sunlight and take a picture with diffuse lighting of lower intensity. Bright sunlight usually ensures good colour renderings but hazy sun or bright diffuse light from thin cloud can often be used with complete success. If the whole profile face is evenly illuminated by direct sunlight then the photograph may be taken with a reasonable likelihood of success but, under diffuse lighting conditions, even with adequate care and correct orientation of the profile pit, the base of the profile may be insufficiently lit, especially if the pit is short. When these circumstances arise it will be necessary to supplement the lighting near the bottom of the pit with a card or white object as shown in Figure 3.

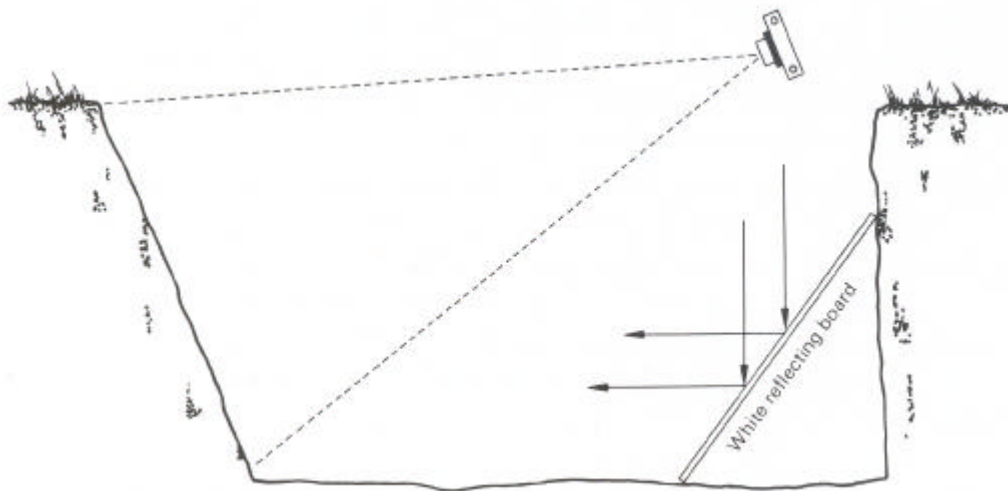


Fig. 3 A slanted profile face permits an angled viewpoint. Note the reflecting board to improve the lighting of lower horizons.

Photographs taken under poor lighting conditions are usually a waste of time and material, but flash photographs are a possible alternative. Photographers are warned that there are many variables involved and it is difficult to obtain satisfactory results. A flashgun manufacturer's calculator is computed for indoor use where there are reflective surfaces around the subject. If flash must be used in poor outdoor lighting conditions experiments must be undertaken to determine new flash factors when natural lighting is (a) virtually absent (e.g. in woodland), (b) very dull, (c) dull. (Useful starting points for these experiments are: (a) + 2 stops, (b) + 1.5 stops and (c) + 1 stop). Most flashguns emit light bluer than sunlight, which results in "cold" colour pictures. The best results are likely to be obtained by using guns with gold tube reflectors and light diffusers, and by displacing the gun 20- 50 cm from the optical axis of the camera. Colour correction may be necessary with some flashguns and trials should be made with 818 or CC20Y filters.

- In a normal profile pit with vertical sides the back of the camera should also be vertical or as nearly so as possible. Failure to carry out this precaution will result in distorted perspective and loss of definition over parts of the photograph (Fig. 4). Alternatively, the profile face may be slanted so that an angled viewpoint may be taken, in which case illumination is often improved. On the other hand there will be a distortion of scale and vertical ped faces may be obscured. If the profile face is slanted the film plane must be kept parallel to the profile face (fig. 3) in order to avoid distortion and poor focus in parts of the photograph.
- A scale should almost always be included at the side. When close-up pictures are taken, at distances of 50 - 80 cm, an ordinary expanding rule may be included but a more versatile aid is a cloth tape 5 cm wide and 150 cm long with alternate black and white, or red and white, sections of 10 cm length. This is easily carried when rolled up and can be hung or pinned in the correct position on the profile face. An alternative is a 15 cm pocket-ruler with 5 cm coloured sections. A scale of known length, or marked intervals, is always preferable to a pencil, pocketknife, or coin.



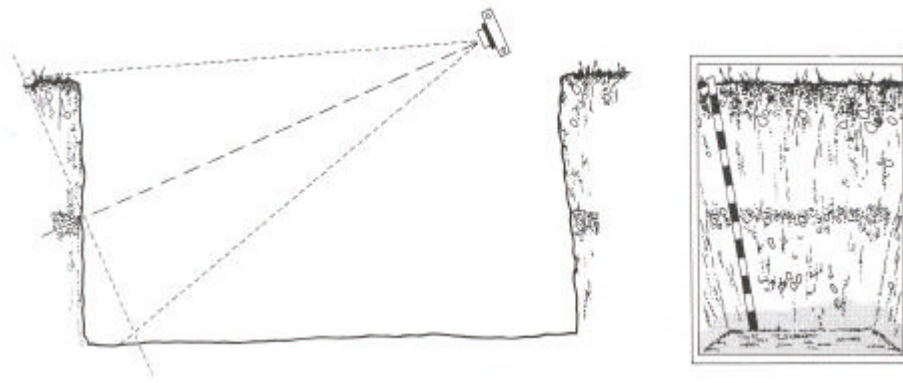


Fig. 4 Misalignment of camera results in distorted perspective and, if depth of field is small, loss of definition over parts of the photographs. Note the shadow caused by the edge of the profile pit.

- Usually the profile face should be carefully prepared before any photographs are taken. The soil may be "plucked" with a knife or trowel from the top downwards to reveal structure, root development, colour and mottling which may have been smeared or obscured. In sandy profiles a soft brush can be used to reveal textural or sedimentary features. In certain soils some features such as structure, or a weakly developed E horizon, show up well in weathered cuttings or on dried surfaces. When preparing a profile face under such circumstances it is often preferable to clean down only part of the profile and to include both weathered and prepared surfaces in the photograph, or to take two photographs -one of the freshly prepared face and another of the partially dried surface.
- Close-up photographs of special features such as mottling, concretions, fine structure, thin lamellae, iron-pans, etc. are necessary in order to portray a profile completely. In such instances a scale, such as a 15 cm rule, must always be included.

#### 4. Photographs of landscape and vegetation

Photographs of landscapes, vegetation and surface features are often required for illustrating scientific papers, soil survey publications or to form part of a demonstration of agricultural or forestry operations. Do not forget to photograph a subject matter with which you may be very familiar but your colleagues or readers are not. Examples are irrigation operations, market gardens on soils with few physical limitations, dust clouds on soils susceptible to wind erosion, contour ploughing to avoid erosion, multiple wheeled or crawler tractors on poorly drained or peaty soils with low bearing strength, "wet" vegetation on poorly drained soils, crops with special soil requirements, soil surface and erosion phenomena, rock outcrops on shallow soils and stone walls formed from stones removed from fields. Whether such photographs are in colour or black and white, they must be clear and distinct. This means they must be sharp, well-composed and of adequate contrast. Not all scientists have a flair for photography but with the observation of a few rules good photographs may be obtained.

- Determine the exposure correctly with a light meter and take light readings for each and every photograph. In cases where there are dominant zones of light and shade an average of readings should be taken.
- Take notes to accompany every photograph.
- Use a tripod whenever possible. If a tripod is not available and the camera must be held in the hand then use an exposure of at least 1/125th or preferably 1/250th second. When a longer exposure must be employed prop one's elbows on a wall or lean against a post to minimise movement.
- Compose the picture carefully. Generally this can be done most satisfactorily with the aid of a tripod. Avoid small scale, i.e. standing too far away from the main centre of interest. Always try to fill the frame with useful subject matter and avoid bare unrelieved foregrounds such as a grass field without livestock, fences or varied relief.
- Always focus carefully on the main subject of the picture, even if this means the background or foreground is made unsharp. Objects must be sharp then a small lens be selected.
- Choose suitable lighting conditions whenever possible. Many "flat" black and white photographs are due to direct lighting, which casts few shadows. Fine details of landform are best portrayed with low, oblique lighting. Colour photographs can be taken with the sun directly behind the camera, but usually better results are obtained with slightly oblique lighting. Do not take photographs in poor light; it is usually a waste of film.

## 5. Photographs for publication

Monochrome photographs should be made on glossy paper approximately twice the size of the final reproduction. Avoid "soft" or "flat" photographs; prints should have "punchy" contrast but good gradation. That is, the highlights should not be bald and white and the shadows a clogged black. Do not be afraid to trim the original print so that only useful material is reproduced. A pair of L-shaped pieces of card is useful aids to good composition in this operation.

Colour transparencies are always preferable to colour prints for publication purposes. It is much easier for a block-maker to produce sharp pictures with correctly registered colours from large originals than small ones. 6x6 cm or 6 x 9 cm formats are ideal. This does not mean that sharp reproduction cannot be made from 24 x 36 mm transparencies but they must be on film with high resolution, accurately focussed and without blurring due to camera shake. Transparencies, which are slightly denser than those ideal for projection purposes, yield the best results when reproduced.

## 6. Miscellaneous Notes

The following suggestions may be of value to the reader:

- Sometimes valuable films are lost by the processing laboratories. This may be avoided if the first exposure is made of a sheet of paper with the date and your name and address.
- Some security equipment at airports emits X-rays, which can 'fog' photographic emulsions. Do not pack films in your suitcase and ensure that your camera and

film containers are examined manually. X-ray protection bags are available but even these may not give full protection to your film.

- Keep your processed colour-slides free from dust and avoid finger marks on the emulsion. Always store in a dry, dust proof environment. Slides which are in frequent use should be mounted between glass but ensure that no internal condensation occurs once mounted.
- Never leave a camera with an uncapped lens lying on its back in full sunlight. The sun's rays can burn a hole in the camera shutter.

## **7. References**

Blaker, A.A. 1976. Field photography beginning and advanced techniques. W.H. Freeman: San Francisco. 451 pp.

Blaker, A.A. 1977. Handbook for scientific photography. W.H. Freeman: San Francisco. 319 pp.