In conclusion, I would be in favor of characterizing soils in a dynamic manner in terms of transport characteristics. Indirect characterization by means of equivalent pore-size distributions is less relevant except for communication purposes. In that context, selection of one particular classification scheme, as advocated by Luxmoore, is indeed important. Because of the arbitrary character of the criteria involved, I would be in favor of adopting an existing system, such as the Brewer (1964) system (Table 1).

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Literature Cited


Micro-, Meso-, Macroporosity and Channeling Flow Phenomena in Soils

This letter refers to the previous correspondence from Bob Luxmoore (1981) in which he suggests definitions for three classes of soil porosity in terms of capillary potential, $\psi$ ($\psi < -30 \text{ kPa}$), mesopores ($-30 < \psi < -0.3 \text{ kPa}$), and macropores ($\psi > -0.3 \text{ kPa}$). Luxmoore suggests that the introduction of such terms is timely because of the widely different usage that the term macropore has received in past soil physics literature. He also suggests that different size ranges are associated with different types of soil water phenomena. Luxmoore is quite realistic about the limitations of the strict definition of classes being applied to a wide range of soils but feels that there would be advantages in terms of uniformity of criteria in reporting different experiments on water flows in field soils.

The present writer has recently been working on the problem of soil macropores using a different (but related) type of criterion than that of Luxmoore (see Germann and Beven, 1981; Beven and Germann, 1981). Our concern was flow dynamics, and we suggested that one important feature of soils with noncapillary macroporosity was that hydraulic gradient in continuous macropores might be different from that in surrounding smaller pores. This leads to a breakdown of traditional Darcian concepts of water flow in soils. We did suggest a size range for noncapillary macropores, but our main concern was the macro pore channeling referred to by Luxmoore (1981).

In fact, much of the recent work in macropores has been stimulated by the recognition that channeling of flows may take place in field soils. Such channeling has been demonstrated in a wide range of soils and pore sizes (e.g., Kissel et al., 1973; Bouma et al., 1977; Bouma and Dekker, 1978; Omoti and Wild, 1979) and is undoubtedly dependent on the initial moisture conditions in soil and the rate of water supply as well as pore size alone. Much of the fascination of the study of soil water lies in the dynamic nature of flow processes. The demonstrated occurrence of channeling suggests that the dynamics may be more complicated than we previously wished to think. I would like to suggest that we concentrate our attention directly on the nature of the dynamics of channeling flow rather than on indirect measures of pore-size class ranges. Luxmoore suggests, for example, that macropore and mesopore channel flow might be usefully distinguished but that channeling flow is a function of pore structure as well as pore size. Size alone will therefore be, at best, an approximate indication of the likelihood of such flow.

It would be better to allow that there may be some continuity in channeling phenomena over different scales in the same way that there is a theoretically continuous change in equilibrium capillary potential with change in pore size. The point at which capillary potential becomes negligible is an arbitrary one. Similarly, the point at which a mesopore channeling flow becomes a macro pore channeling flow must be equally arbitrary unless there is a distinct change of process. Such a change may occur where there is an instability in the water/air interface resulting in film flow down the sides of a large pore. Such instabilities will be dependent on rates of supply and characteristics of pore structure such as constrictions or "necking" (Luxmoore et al., 1977).

Channeling flow is a dynamic, nonequilibrium behavior. At this stage it may be counter-productive to an advance in knowledge of channeling phenomena to try and define static terms such as micro-, meso-, and macroporosity. I suggest that we try and avoid the use of such terms altogether until perhaps the nature of the processes involved in soil water movement in the field are better understood. Where an indication of size is necessary, the size or size range should be stated explicitly.

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Literature Cited