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What lessons can be learnt from the examples discussed in this book?

First, time is essential if the hydrologist is to develop a mental picture of the area of study, and the processes which dominate the hydrology of the area. Admittedly, the author has been fortunate to have started his career when time constraints were not as severe as they have become more recently, and in the Nile basin where basic hydrological data had been measured since the beginning of the twentieth century. He was able to spend four years getting to know the wetlands of the upper Nile, which is admittedly a complex area, as a member of a multi-disciplinary team of specialists, and to return to an academic environment to work out the implications of various interactions.

It is unfortunate that less and less time has become available for hydrological investigations, while the basic infrastructure of river flow measurements has become less reliable in many parts of the world. However, the author has made it a rule not to pontificate about the hydrology of an area which he has not seen, though experience has perhaps made it easier to observe the key features in a rapid visit. He believes he shares this habit with his colleagues, though it is not always easy to explain what has been learnt during a visit.

The need may be described briefly as a requirement to observe the hydrological data together with the physical environment, and after talking to local observers to let the combination dictate a narrative account of the hydrology, a procedure which may be best illustrated by reference to some of the examples discussed above.

In several cases—the Tehran area and Varamin plain in Iran, Bahrain island, Oman and Abu Dhabi, and the Betwa basin in central India—it was possible to study areas where the water resources and the traditional water use were, or had been recently, in equilibrium; it was possible to compare the natural surplus—recharge, groundwater flow or runoff—with crop water use.

In the case of the rainfall regime of the Tongariro basin in New Zealand, the fact that the direction of heavy storms had been misinterpreted in drawing up the isohyetal map of the region came to light in discussion with a local geography teacher who happened to be a keen fisherman; this discussion was followed by a visit from the Meteorological Department. In western Iran, the rainfall regime of the Zagros mountain range was explained by a combination of the recorded data and observation of the woodland vegetation. With the Alborz range between Tehran and the Caspian Sea, where both the rainfall regime and the vegetation distribution were more complex, the problem was illuminated by discussion with experienced local meteorologists after a field visit.

The importance of evaporation losses from palm plantations in Bahrain and Oman, and the part this played in the water balance of these areas became clear from tours with colleagues, while the key role of evaporation from the wetlands of the Sudd in the

southern Sudan was illuminated by discussion with team colleagues and by a chance meeting with a distinguished Egyptian botanist who had taken part in experimental work nearly 40 years earlier. The role of soil moisture regime in the hydrology of the Betwa basin in central India was made clear in a multi-disciplinary research programme, and this in turn contributed to an archaeological investigation.

The groundwater regime of the Tehran aquifer may have been relatively simple, but its main elements could be observed in reconnaissance with geological colleagues; this led to initial estimates and a recommended measurement programme. The relative simplicity of water balance studies in humid climates has been illustrated by examples from New Zealand, Sarajevo and Patagonia, where the vegetation showed that soil moisture stress was rarely a factor. Although monsoon climates with an extreme contrast between seasons of water surplus and shortage present at first a more complex problem, the deciduous vegetation suggests a simplified approach to the rainfall season as a single storm. The semiarid or arid environment is the most difficult to treat in physical terms and, as in Botswana or Yemen, it may be necessary to treat the area with an empirical model. Water resources projects may be designed to overcome problems of hydrological variability; in addition to seasonal and annual variability it will increasingly be necessary to consider longer-term climate change.

The incidence of floods may be approached either statistically or physically, but the links between flood variability and climate are strong. Environmental factors introduce another dimension to hydrological problems, but a combination of observation, measurement and analysis is as important as in other topics.