

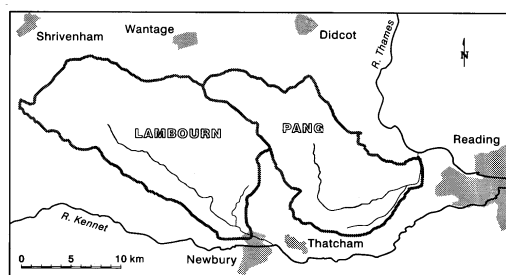
# WATER AND RIVER LIFE RESEARCH IN THE PANG AND LAMBOURN CATCHMENTS OF THE THAMES VALLEY

## The Natural Environment Research Council's Lowland Permeable Catchment Thematic Research Programme (LOCAR)

### Introduction

In southern Britain, land-use changes, possibly drier summers and other environmental pressures increasingly change water quality and sediment loads and also affect water supplies from chalk groundwater resources. Summer water shortages have led to headwater streams drying out. Prolonged winter rains have caused groundwater flooding. Expanding housing and business areas raise water demands and increase competition between rural, urban and ecological water demands.

Wise management of these complex problems requires accurate knowledge of all facets of the water cycle. Good scientific understanding of the relationships between rainfall, recharge of groundwater stores, and runoff to rivers is needed. To help provide the basic and applied science needed to achieve this better management of water and river and wetland life, the Natural Environment Research Council (NERC) has initiated the five-year LOCAR programme of intensive research in three areas, the Pang and Lambourn catchments in Berkshire, the Frome and Piddle catchments in Dorset and the Tern catchment in Shropshire. The emphasis of this programme is on the interactions between surface water and groundwater, and between groundwater and rivers, and the effects of these interactions on the fish and other organisms in the rivers.



*The Lambourn and Pang Catchments*

### The LOCAR Programme

New instrumented sites have been set up within the study catchments to measure rainfall, evaporation, infiltration, groundwater levels and river flows so that all the components of the water cycle can be measured automatically. Samples of water are taken at regular intervals and during storms to monitor the movement of chemicals and sediments. The new

instrumentation adds to the existing data collection system operated by the Environment Agency. As a result, the Pang and the Lambourn, along with the other two areas, will be among the best understood rivers in the country. Annual surveys of the habitat conditions in the rivers and of the land use examine how changes within the catchment areas affect conditions in the river. The administration of the data collection and the annual surveys are the responsibility of a catchment service team based at the Centre for Ecology and Hydrology at Wallingford.

Following a national competition, research grants for detailed investigations have been awarded to bring together the best possible research expertise to carry out projects over the period 2002-2006.



*Automatic weather station, Pang catchment*

### The LOCAR projects

Eight individual projects are being conducted in the Pang and Lambourn catchments. Two of them examine aspects of rainfall and evaporation, two deal with river flows and chemicals and sediment transport, four with groundwater, especially with the characteristics of the chalk aquifer and the return of water from the chalk to the rivers. All these projects use data from the main set of instruments but will also carry out additional investigations in the field.

One project determines the evaporation over the catchments, using measurements of radiation made

both on the ground and from satellites. It shows how different land uses (forestry, arable or grassland) affect water losses by evaporation and transpiration so affecting the amount of the rain available for recharge of the groundwater aquifers.

A second project examines how small patches of woodland and hedgerows affect the amount of evaporation. As there are strong wind effects on the edges of woodlands and hedges, there may be higher rates of evaporation from a series of small patches of woodland than from a similar total area of woodland forming a single block. This again helps in establishing evaporative losses from the catchment.

A major project then examines the water arriving at the ground surface and assesses its infiltration into the soil, the chemicals that it carries with it, the movement of the water into the ground and the fluctuations of the groundwater table, the chemistry of the groundwater, the emergence of groundwater along and underneath the stream beds, where groundwater and surface waters mix and the complex chemical changes that then take place. The way this mixing of waters affects the quality of life in rivers is being investigated in detail, with another project at key sites along the Pang and the Lambourn. This study will then create computer models to forecast what ought to happen in similar catchments. These models will be tested in the other two LOCAR study areas in Dorset and Shropshire.

Linked to this is a study of the movement of fine sediment and the chemicals attached to the sediments, into the rivers. It assesses where the sediment comes from, how it is temporarily stored whether in the river channel or on the floodplain, and what happens to the chemicals attached to the sediments. The sediment budgets so calculated will help the forecasting of sediment problems in other catchments.

The chalk is geologically complicated with fine pores through which water moves slowly and fissures through which it moves relatively rapidly. Two projects are establishing how much of the groundwater moves through the fissures and how much through the pores and consequently how quickly rivers will rise when groundwater reaches them after extremely heavy rain. This will help to predict the impacts of long dry periods on discharges from springs and low flows in rivers and the contaminant movements in the groundwater.

Another groundwater project examines the fracture network in the chalk of the Pang catchment, using boreholes at three different sites to find out how the water moves down through the chalk to the river. Tests of this water movement will be carried out and then the data obtained will be used in a computer

model of the way water moves through the chalk fracture network.

The final project in the Pang-Lambourn looks at the interactions between the river and the groundwater aquifer. At low river flows, most, if not all, the water is entering the river from the aquifer, but at high flows, water may be seeping out of the river into the groundwater. The places where water flows out into the river are probably determined by variations in the permeability of the chalk. This will again provide data for computer models that will enable the ways similar rivers behave to be predicted.

### **Project outcomes**

While operationally separate, these eight projects interlink to provide inputs for sound water resources management and understanding of the impacts of land use changes. They will help in the management of the ecologically important wetlands along these two rivers and will add to the understanding of future risks of droughts and floods.



*River Lambourn at Shaw weir*

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