River Lyn, Devon

[SS 702 442] and [SS 721 492]

Highlights

The River Lyn, draining the northern slopes of Exmoor, north Devon, illustrates the impact that rare, high return period flood flows can have on the morphology of a steep catchment. The 1952 flood, with a return period of at least 150 years, transported massive amounts of sediment and boulders, the impact of which is still persistent in the present-day channel morphology.

Introduction

The Lyn catchment was the scene of a unique storm rainfall sequence and flood event in Britain, which demonstrated the effects of short-term processes and long-term changes in sea level on river development. Fluvial landforms have often been attributed to events of moderate magnitude and frequency, but it is known that very large rare events can have a significant effect. It is important to know not only what effect a catastrophic event had, but how the landscape recovers subsequent to the event. Parts of the Lyn basin reflect both aspects: the response to a catastrophic event and the recovery of the landscape afterwards.

Description

The combined drainage area of the East and West Lyn is 95 km^2, the East Lyn catchment being 71 km^2 and the West Lyn 24 km^2. The drainage area of the two rivers consists of gently sloping moors, draining into narrow steep-sided valleys. The West Lyn and its tributary at Barbrook have very steep profiles. The broad lines of the drainage of the Lyn river catchment are proposed, by Simpson (1953), to have been superimposed on a Mesolithic surface in Tertiary times. The following period of falling sea level initiated a new coastline, its rapid retreat, and successive stream captures. Evidence suggests that coastal retreat is continuing presently. The resulting topography of the northern edge of Exmoor, where a wide stretch of country falls from 450 m to the Bristol Channel in 6.4 km, contributed to the power of the East and West Lyn during the flood event of 1952.

The rainfall of 15 and 16 August 1952 was the third highest on record, and followed heavy rain on 13 of the previous 14 days. The rainfall observer at Longstone Barrow recorded 228 mm from 11.30 hours on the 15th to 09.00 hours on the 16th, with 178 mm estimated between 17.00 hours and midnight. Bleasdale and Douglas (1952) considered that significant percolation was minimal due to antecedent rainfall conditions, and subsoil drainage contributed a low proportion of the total runoff. Reports of eyewitnesses describe field slopes being 150–200 mm deep with surface runoff during the torrential periods. It seems probable that this happened in many parts of the Moor, with sheet flow over extensive surfaces. By the time the rain reached its greatest intensity, the rate of runoff was probably almost equivalent to the rate of rainfall, and had been maintained for some hours.

The upper site is in the upper Cannon Hill valley (Figure 6.20), where interference by man and animal has been minimal and features resulting from the event persist (Anderson and Calver, 1977). The volumes of water and sediment moved were enormous; 50 000 tonnes of boulders (Kidson, 1953), some more than 10 tonnes each (Delderfield, 1981), were moved by a volume of water in the order of twice the average daily discharge of the Thames (Kidson, 1953). The lower site in Glen Lyn Gorge contains a suite of huge boulders lying where they came to rest, and demonstrating the magnitude and power of the flood event. If the event is measured according to the power expenditure per unit area of channel (Wm^{-2}), then the event had a greater unit power than the Mississippi or the Amazon in flood. The event was exacerbated by the bridges crossing the river. Debris accumulated upstream, causing temporary dams that gave even larger flood flows when they burst successively down the tributary valleys to Lynmouth.

Interpretation

In their study of the recovery of the landscape from the flood event, Anderson and Calver (1977) considered three sections (Figure 6.20): the upper, middle and lower reaches.

Upper valley reach

Before the event, the wide flat valley floor was apparently largely vegetated and contained several small channels incised into peat deposits (Figure 6.21). During the flood, these channels were overtopped and widespread overland flow occurred over most of the valley floor. The combination of dense vegetation and shallow overland flow effected little surface erosion. However, two shallow slides occurred, and the debris and extent of the slip are still in evidence.

Middle reach

The passage of the valley on to grits in this reach results in steeper valley sides (30–35° slope) which restrict channel width. The event formed a flood channel by removing bed material which was coarse in places. The high flood stage left continuous small bank-side scars which are still in evidence, although slumped in places. Vegetation has grown below the scars, revealing the reduced dimensions of the present channel. Channel infilling since 1952 seems to have been effected by discrete bank-side failures accompanied by slower, more continuous degradation of flood and slumped forms. Channel debris is minimal and in places bedrock forms the channel bed: any debris found is likely to be from slumping. Little evidence exists of channel pattern change during the flood, although severe undercutting has taken place.

Downstream reach

This reach has a similar wide valley floor and relatively shallow valley sides to the upper reach. The flood dispersed over the floor, giving rise to widespread deposition. The boulder fields deposited where the valley widens out during the flood are now largely covered with vegetation, but within them is evidence of former water courses. The receding flood revealed a discrete channel through the boulder fields, which has suffered some measure of subsequent infill by downhill movement of fines and small-scale slumping of the banks.

The contrast between the valleys of the lower and middle reaches arises from a recent strong rejuvenation which has extended only a limited way upstream. The lower reaches are V-shaped gorges, so narrow there is no room for a road, and Lynmouth has been built on the river bed. The middle reaches are relatively broad and open, and there is always a floodplain. The valley sides reveal a valley within a valley resulting from an earlier rejuvenation, more extensive than the recent one that created the lower reach gorges.

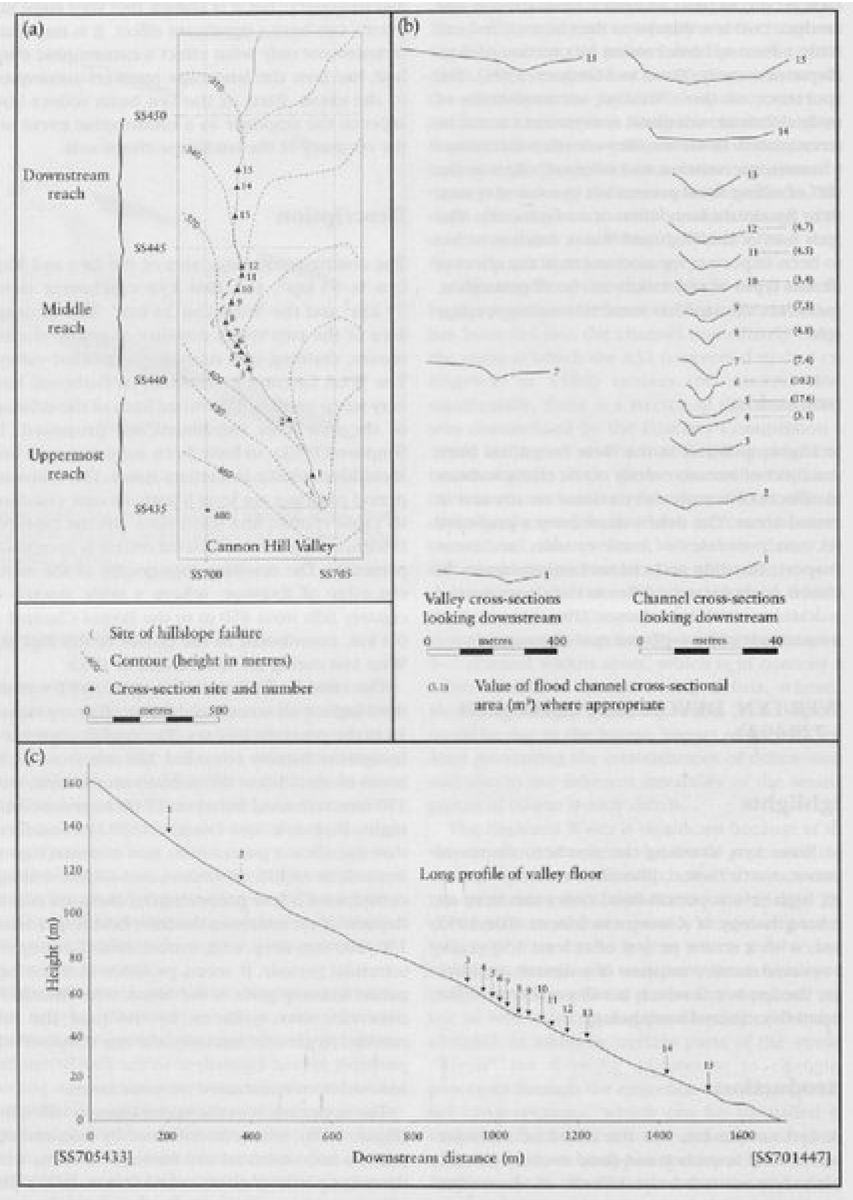
Under natural conditions, the erosional features of the 1952 flood have since degraded. Where erosion was dominant, the effects are still apparent. Depositional features are also very much in evidence and have, in general, suffered less degradation, although vegetation is obscuring their extent. The 150-year flood has produced some landscape modification that is likely to last at least for the mean recurrence interval of the event. However, the relationship of such events to landscape form is complicated by the fact that recurrence intervals vary, and that some of the persisting features are less recognizable than the overall aggradation or degradation of parts of the valley.

The floods in the Exmoor region, their effects in the Cannon Hill valley, and the suite of boulders in the Glen Lyn Gorge, re-emphasize both the nature of the processes by which rivers shape their valleys, and the significance of rare and powerful floods. It is important to have a record of the type of features that can be produced by such floods, and to know how long they survive in the landscape. The detailed investigations of such features and their subsequently monitored geomorphologi-cal significance make the upper site unusually valuable. The change of course of the West Lyn in Lynmouth (Figure 6.22), by the transport of immense quantities of boulders and smaller material, is a spectacular characteristic feature of valley development in the broader context of fluvial system adjustments to sea-level changes and coastal retreat.

Conclusion

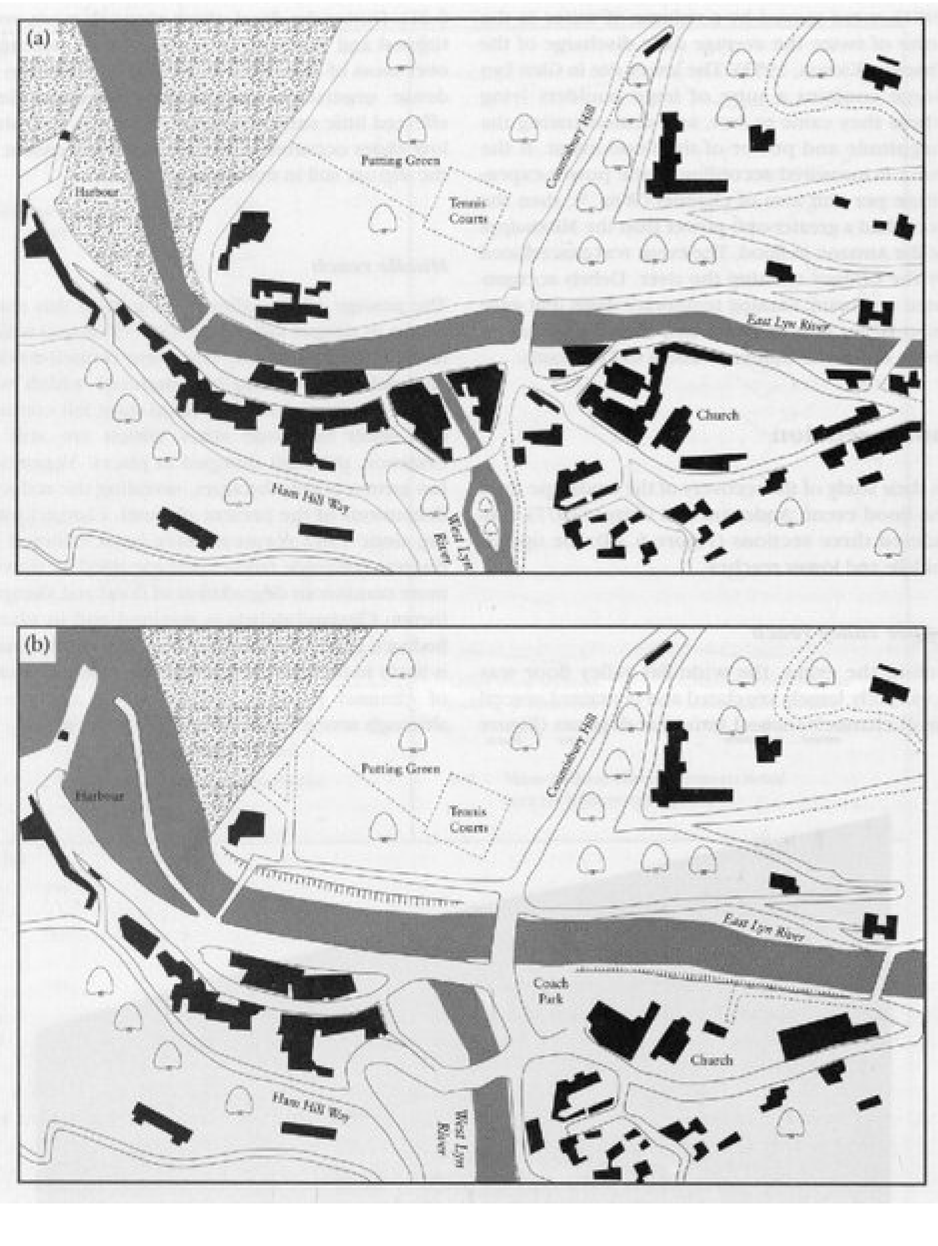
This is the site of one of the most extreme flood events in recent British history. The large flow had devastating effects on the valley of the River Lyn, including the formation of slope scars and the movement of very large boulders. Not only are the effects of this flood, which vary in different parts of the river system, well recorded, but the longterm persistence of the changes has been assessed. This has become a classic site, exemplifying the significance of large events in small upland catchments.

[References](#)



(Figure 6.20) Topographical features of Cannon Hill Valley, Exmoor. (After Anderson and Calver, 1977.)

(Figure 6.21) A channel (flowing top right to bottom left) incised into peat deposits, Cannon Hill Valley. (Photo: RJ. Davis.)



(Figure 6.22) Channel changes on the River Lyn after the 1952 flood: plans of Lynmouth: (a) before the flood, (b) today. (After Dobbie and Wolf, 1953.)