Derry Burn, Aberdeenshire

[NO 035 970]

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Highlights

The upper Derry Burn displays an excellent example of progressive downstream variation in channel morphology, demonstrating adjustment to a local base level in an upland environment.

Introduction

The upper Derry Burn, in the upper River Dee catchment, with its upper reaches draining Loch Etchachan and Derry Cairngorm (1155 m), flows through an alluvial basin. The reach under study is approximately 1.3 km in length. As the channel progresses downstream it displays an interesting range of channel planform types, in response to a rapid downstream decline in channel slope, bed material size, bedload transport and width : depth ratios. It therefore provides an opportunity to study controls on form and rate of adjustment of channel morphology.

Description

Upstream, the channel is a wandering gravel-bed river with local division. With downstream variation in controls, the channel displays a number of planform types, ranging from a sinuous channel through to irregular and tortuous meanders. The planform controls (i.e. sediment size, sediment availability and channel slope) all vary downstream. Sediment size (D_{50}) in the lower reaches ranges from 16 to 33 mm, while the slope is 0.005–0.007. The sediment is derived from the alluvial basin as the river reworks the surficial deposits, with a locally restricted base level imposed by the lower bedrock section (at the downstream end of the site). Large numbers of palaeochannels, especially tortuous meander neck cutoffs, frequently with standing water, indicate extensive past reworking of the floodplain. These are evident from map, aerial photograph and field evidence (Figure 2.19).

Interpretation

The upper reach of the Derry Burn is particularly instructive, as the river planform is close to the braiding/meandering threshold (see Leopold and Wolman, 1957; Ferguson, 1984). The lower sections allow assessment of small-scale meandering and its pattern of development.

Changes in channel sinuosity and degree of channel division over the past 150 years have been reconstructed by McEwen (1986). In addition, the rates of channel adjustment in response to floods of varying magnitude and frequency have been established, to an extent rare in upland environments. It is known, for example, that the catastrophic 4 August 1829 floods affected this catchment. The estimated recurrence interval for this event within the neighbouring Spey basin was 50–100 years (Werritty and Acreman, 1984). It is likely that the channel underwent considerable widening and large reserves of sediment stored within the floodplain were accessed at this time. There was considerable downstream variation in subsequent modes of channel adjustment to this disruptive stress.

Between 1866 and 1900, in upstream reaches, there was large-scale activation of channel-side sediment and channel avulsion, while downstream reaches were typified by the cutting through of three tortuous meander necks. The major August 1956 flood, described by Baird and Lewis (1957) in the neighbouring Luibeg catchment, also affected the Derry Burn. For example, the bridge at the downstream end of the site was damaged and heavy flood deposition was recorded downstream. This flood also disrupted the channel planform within the site, mainly increasing the width of the active area by up to three times on some cross-sections, rather than precipitating major cutoffs. Clearly, a time lapse must occur

before channel planform can build up to a subsequent incipient threshold condition following a major stress, as occurred in 1829 when major process thresholds were exceeded.

Even in such a remote catchment, the impact of human activity cannot be ignored. It is known that the river was dammed in the 19th century (see OS 1 : 10 560 Second edition 1900) linked to the logging industry. Deforestation of the catchment and floodplain occurred over a similar timespan (see Steven and Carlisle, 1959), with likely impacts on runoff regime, sediment supply and floodplain stability.

This site is of value because of the progressive downstream change in channel morphology and the influence of a local base-level control. It provides an opportunity to study the controls on channel form and interrelations of characteristics, and to study the rate and sensitivity of adjustment of morphology. In addition, the impact of major flood events has been documented in detail.

Conclusion

This site is exceptional in terms of the rapidity of its downstream change in morphology, the intensity of its small-scale meandering and its documented history of meander adjustment to floods and sediment inputs. The suite of palaeochannels, indicating periods of much greater floodplain utilization and reworking, deserves further investigation, including dating.

References

(Figure 2.19) Derry Burn: a downstream reach displaying tortuous meanders and numerous abandoned channels. The alluvial basin is terminated by a bedrock control (to the bottom left of the photograph). (Photo: Royal Commission on the Ancient and Historical Monuments of Scotland; print 4188, 106G/SCOT/UK/58: Crown Copyright.)