Chapter 1
Introduction

1.1 Context

Considerable uncertainty surrounds the effects of changes in climate and vegetation on upland rivers in the UK over the Holocene. Upland catchments can introduce large quantities of sediment into the fluvial system, and their steep slopes and high elevation make them especially sensitive to such environmental changes. This is important, as increased sediment delivery from upland river systems can lead to downstream aggradation and changes to channel form and stability. In the increasingly populated uplands, such changes can represent a considerable hazard to both civilisation and agriculture. Previous studies (e.g. Brown 1992, Macklin and Lewin 1993, Knox 1993, Harvey 1996, Rumsby and Macklin 1996, Merrett and Macklin 1999, Macklin 1999) have linked periods of river erosion and deposition preserved in stratigraphic records to wetter past climates and the human removal of forest cover. But although these studies have provided useful long-term data, they are usually not precise enough to unequivocally establish a direct relationship between environmental change and river response. Numerical modelling would seem to offer a solution to this problem, especially if real catchments and the recent geological record could be used together to validate model predictions. Furthermore, such model simulations could be used to predict the effects of global warming upon the UK's upland catchments and identify any potential risks or hazards.

1.2 Aims

The aims of this thesis are to:

1. Investigate the effects of climate and vegetation change on upland river response.
2. Examine the role of catastrophic flood events and floods of different frequency and magnitude.
3. Model the Holocene evolution of an upland catchment in the UK.

1.3 Approach

The approach that will be followed to address these aims will be a combination of numerical simulation with a limited field study to provide validation data.

1.4 Summary

This thesis has ten chapters, and following this introduction, chapter two reviews previous field based studies that have examined the relative roles of land use and climate change on fluvial systems. From this review contemporary issues and the context for this study are identified allowing precise objectives for model developments to be determined. In Chapter three, contemporary fluvial, slope and landscape evolution models are reviewed and discussed. This allows an appropriate technique for modelling Holocene river catchments to be decided. The development of this model and a detailed description is provided in chapter four, along with validation data and a sensitivity analysis. Chapter five describes the field area used for this study and details its alluvial history. Chapters six, seven and eight address the three main aims outlined in 1.2, modelling the effects of climate and vegetation cover changes, extreme flood events and Holocene evolution respectively. Chapter nine discusses examples of non-linear behaviour that became apparent during the model development and in chapters six, seven and eight. Finally, chapter ten completes this study, by gathering conclusions from all the results chapters and outlining future directions for research.