

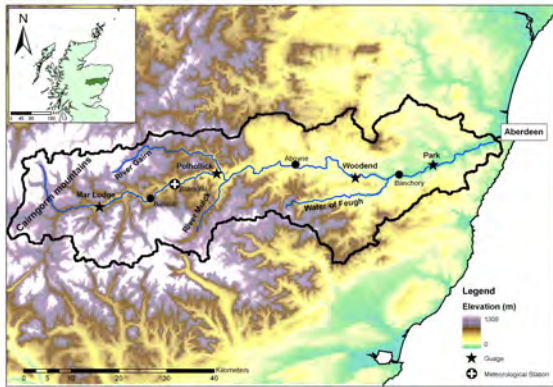
INTRODUCTION

We investigated the validity of anecdotal evidence from people living and working in North East Scotland that there have been long-term changes in river flow. We analysed trends in the flows of the River Dee, which has the longest continuous flow record of any river in Scotland (1929-2005) to test two hypotheses:

- That the flows in the river are changing,
- That these changes in flows are linked to climate, specifically snow accumulation in the Cairngorm Mountains.

THE DEE CATCHMENT

The River Dee rises in the Cairngorm Mountains at 1309 m above sea level and flows 141 km east to the sea at Aberdeen.



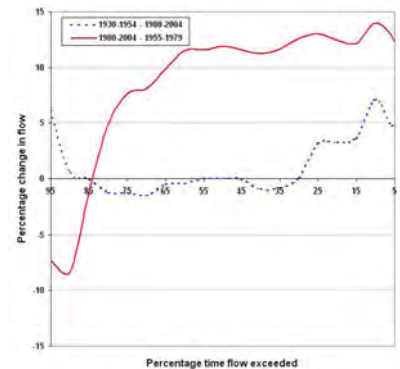
Geology:
Granite

Soils:
Blanket Peat Bogs,
Peaty Podzols
Humus Iron Podzols

Main land uses:
Upland – Heather Moorland
Lowland – Agriculture and
Forestry

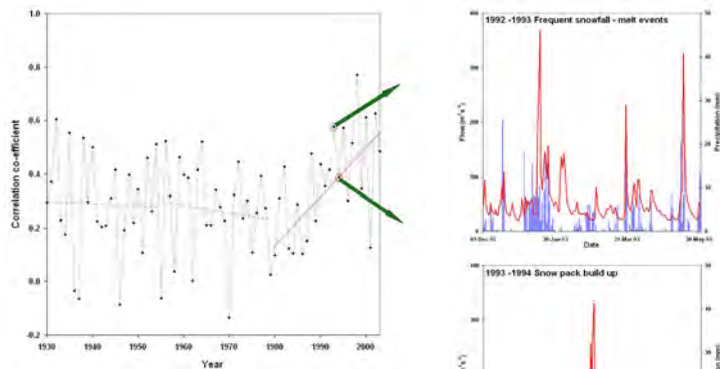
Economy:
Game fishing
£5-£6 million/year

FLOW CHARACTERISTICS



There are no significant trends in flow magnitude over the whole period of record but comparison between three 25 year periods suggests that low flows are decreasing and high flows are increasing. Changes are statistically significant between 1955 – 1979 and 1980 – 2004.

SNOW MELT IN SPRING

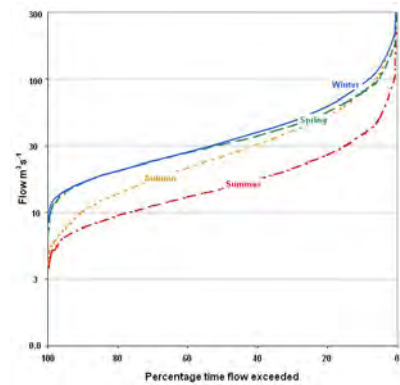


Warmer winters and springs, with less snow fall, appear to lead to a more flashy river response, with an increase in the cross-correlation between the previous day's precipitation and flow.

This is seen in two years of contrasting snow accumulation:

- 1992 – 1993 Frequent snowfall melt events,
- 1993 – 1994 Snow pack build up.

Further evidence that the increase in correlation between precipitation and flow is linked to snow accumulation is the positive relationship between January, February and March temperatures and the cross-correlation between precipitation and flow.



The flows in the River Dee show distinct seasonality and this seasonality appears to be increasing. Statistically significant differences between 1955 – 1979 and 1980 – 2004 show that:

- Spring flows are increasing.

CONCLUSION

Between 1929 and 2005 the River Dee has seen:

- A change in seasonality of flow,
- An increase in the difference between high and low flows,
- Changes in spring flows linked to evidence of the changing snow conditions in the Cairngorm Mountains.

IMPLICATIONS

- A greater risk of flooding
- Possible drought effects on water supply
- A change pollutant loadings
- A negative impact ecological status of the river
- A need for integrated catchment management to mitigate against the effects of climate change