Impact of Climate Change on the Spatial & Temporal Distribution of Precipitation within the River Usk Catchment

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Introduction to Project: Sediments in streams can cause a variety of negative impacts; from the sealing of interstitial habitats to the coating of respiratory organs and even the introduction of toxic chemicals into the environment[1,2]. With changes in climate, it can be expected that there will be changes in sediment influxes into river systems due to changes in both frequency and intensity of precipitation events, and changes in land use and crop type[3,4,5]. This project aims to assess how climate-driven sediment fluxes may alter the biotope quality of the River Usk using a physically based model of soil erosion. As a part of these efforts, we assessed the potential effect of recent climate change on spatial and temporal patterns of precipitation.

Introduction to the Problem:

Precipitation is perhaps the singular driver for short-term fluctuations in sediment loading throughout a catchment, influencing both the frequency of mass wasting and the rate of granular transport of soil material[5]. It is for this reason that we sought to determine whether recent climate change was affecting the spatial and temporal distribution of precipitation and thus potential catchment-wide sediment flux.

The River Usk is ideal for this study because sediment is the principal pollutant for its river habitat, which is varied throughout the catchment. The river is home to a number of keystone species, such as *Salmo salar* and various species of stone and mayfly.

The precipitation data for this study came courtesy of the British Atmospheric Data Centre. Five precipitation gauges, distributed across the ~900 km² catchment, were used in the investigation. The gauge recorded total daily precipitation from the 1960's to today.

Figure 1: The Location of the River Usk catchment

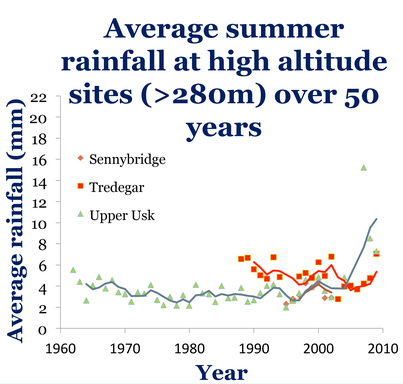
Discussion

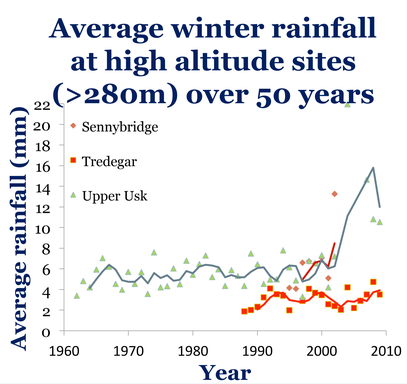
From the graphs (Fig. 2) it is evident that there is no obvious alteration in the average seasonal precipitation up until the turn of the millennium. After the year 2000, the average precipitation appears to increase dramatically and fluctuate more erratically.

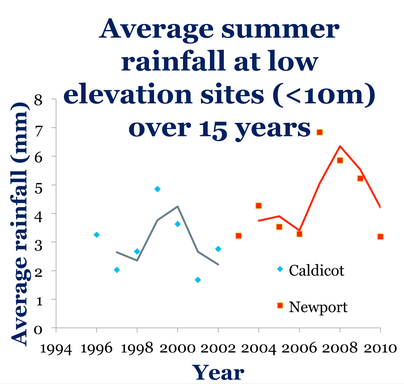
This change in precipitation pattern at high and low altitudes may be a result of the North Atlantic Oscillation (NAO), which occurred at the same time.

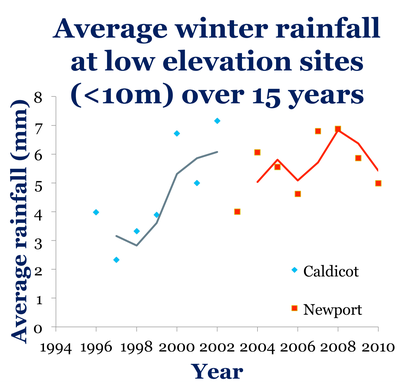
It may therefore be concluded that the NAO is a key component in the alteration of precipitation patterns in this region, and that it is therefore a primary driver in sediment flux in the catchment of the River Usk.

Figure 2: Temporal and Spatial Precipitation Patterns









References: 1) Scheurer *et al.* Climate and land-use changes affecting river sediment and brown trout in alpine countries—a review. Environ Sci Pollut Res (2009) 16:232–242. 2) Inman and Jenkins. Climate Change and the Episodicity of Sediment Flux of Small California Rivers. The Journal of Geology, 1999, volume 107, p. 251–270. 3) Thodsen *et al.* The influence of climate change on suspended sediment transport in Danish rivers. *Hydrol. Process. 22, 764–774 (2008). 4) Allan.* LANDSCAPES AND RIVERSCAPES: The Influence of Land Use on Stream Ecosystems. Annu. Rev. Ecol. Evol. Syst. 2004. 35:257–84. 5) Kattan *et al.* SUSPENDED SEDIMENT LOAD AND MECHANICAL EROSION IN THE SENEGAL BASIN -- ESTIMATION OF THE SURFACE RUNOFF CONCENTRATION AND RELATIVE CONTRIBUTIONS OF CHANNEL AND SLOPE EROSION. *Journal of Hydrology, 92 (1987) 59-76*