

Plynlimon

WHY: MONITOR UPLAND CATCHMENTS?

This project is directed through the topic Variability and Change in Water Systems (Topic 1; Objective 1.1) within the CEH Water Programme

Mixed forest ages in the Upper Severn catchment
(Photo: Simon Grant)

BECAUSE:

Traditionally exploited for livestock grazing, timber production and salmonid fisheries, the uplands are of intrinsically high conservation and amenity value. Less well-known is that one of the most important values of the uplands is in terms of water resources.

In addition, as a result of their high rainfall and low permeability soils, a disproportionate amount of floodwaters can be generated from upland catchments. In the autumn of 2000, the worst flooding for over 50 years devastated the floodplain of the River Severn, was associated with prolonged and heavy rainfall over the Welsh uplands. Serious floods will be of increasing importance in the light of climate change predictions of increasing extremes. The relative lack of human disturbance in the uplands also means that they are potentially important for detecting and quantifying ecosystem responses associated with climate change and climate instability.

The uplands are sparsely populated and often economically marginal making them vulnerable to a range of pressures arising from land use change as traditional livelihoods continue to decline. Wise land and water management require accurate knowledge of the components of the water cycle.



Hafren forest:
newly created river corridor
(Photo: Simon Grant)



Location of the CEH upland catchments monitoring sites



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Mixed land cover in the Severn catchment: moorland, brash and forest (Photo: Simon Grant)

Focus on the Wye and Severn

These two major British rivers have their sources under 3 km apart on the eastern slopes of Pumlumon Fawr (Plynlimon), in the Cambrian Mountains of mid Wales. The River Severn (Welsh: Afon Hafren) is the longest river in Great Britain, and flows to the North, and the Wye (Welsh: Afon Gwy) is the fifth-longest river and flows to the South and for parts of its length forms part of the border between England and Wales. The headwaters of each catchment (circa 10 km²) provide a land use contrast between the two major upland land uses: moorland (Wye) and plantation forest (Severn). Land use changes affect the overall catchment water balance by influencing evaporation rates. It is well established that evaporation from forests in upland areas may be double that from grassland, leading to reductions in annual stream flow of 10-15% and forest management can impact on flow regimes.

The monitoring programme

Measurements began in the early 1970s at a time of growing concern about the sustainability of the Nation's water supplies and ambition plans to expand large-scale conifer plantations in what were seen as economically underdeveloped upland areas.

Measurements relating to the hydrological cycle in the Severn and Wye catchments currently include:

- Stream flows: gauges record flows every 15 minutes in these 'flashy' catchments.
- Meteorological measurements: automatic weather stations record hourly rainfall as well as temperature, relative humidity, wind speed, incoming and outgoing radiation and atmospheric pressure.
- Earlier hydrological and hydrometeorological measurements included: Soil Water Stations: arrays of instruments provide measurements of soil moisture down to 2m below ground level. Lysimeter and interception plots to distribute rainfall to transpiration and wet canopy evaporation. Flux stations: using specialist micrometeorological instruments and an 'energy balance' technique to estimate actual evaporation rates.

These measurements enable us to estimate how much water infiltrates into the soil and is available to plants, how much is evaporated, and how much runs off as streamflow. Long-term measurements reveal changes in these components and their timing with growth and harvesting of the forest, as well as between forest and moorland.



Monitoring headwater stream flow: the upper Hafren (Photo: Simon Grant)