

## Case study 6.1 - Impact of summer flooding on floodplain biodiversity from nutrient deposition



The fluvial floods of June/July 2007 were some of the largest on record in the UK. They deposited substantial amounts of sediment across many of our floodplains and raised questions about whether floodplain habitats would be impacted by eutrophication through phosphorus enrichment. In particular, did summer floods deposit sediments with high phosphorus content due to waste-water treatment works being overwhelmed by intense rainfall? A research project was established to examine this question in more detail with objectives to:

1. estimate the amount per hectare of total phosphorus, available phosphorus and basic cations delivered as sediment following a substantial summer flood;
2. assess the importance of summer-flood delivered sediment in the context of a floodplain grassland's nutrient budget; and
3. assess the likely impact of higher frequency summer flooding on biodiversity.

In order to do this, species-rich floodplain meadows at potential risk from eutrophication in five catchments that had experienced floods (Thames, Severn, Trent, Ouse, Derwent) were visited. Ten sites were visited in August 2007 to collect a total of 100 samples of sediment, soil and hay as soon as possible after the floodwaters retreated. Samples were dried, then analysed to measure concentrations of phosphorus and major cations (calcium, magnesium and potassium).

The survey found that concentrations of total phosphorus levels varied widely. Some sites received no measurable sediment, even though they had been inundated, whilst other sites received as much as 500 kg P per hectare in total (see Figure 1). On these sites, deposition of Olsen-extractable phosphorus varied from 1 to 32 kg P/ha and deposition of potassium ranged from 2 to 270 kg K/ha.



Small pieces of astro turf (weighed in advance and pinned down with pegs), called 'sedimats' are used to capture sediment deposited during a flood. They must be placed on site before a flood and then collected and removed to a lab

Previous data have shown that phosphorus export out of a meadow in the form of hay typically accounted for  $6 \text{ kg ha}^{-1} \text{ yr}^{-1}$ , suggesting it would take about five years to balance just the readily available phosphorus ( $30 \text{ kg/ha}$ ) in the new sediment. Considering the total phosphorus deposited, a proportion of which would become mobilised in future, the time frame could be much longer (up to 35 years) and therefore regular floods on this scale would threaten the conservation value of the grassland.

The concentration of total phosphorus in the summer-flood sediments was not significantly different from winter-collected samples overall, but the extreme values were higher.

Floodplain meadows provide an important ecosystem service by trapping sediments during floods. The results of this study showed as much as 40 tonnes of sediment per hectare were retained by the meadows, which avoids a considerable amount of material from silting up channels or fouling structures downstream. The phosphorus contained in that sediment is effectively trapped by the meadow from where it is and then gradually exported in terms of an agricultural product, the annual hay crop, for several decades. In this way, floodplain meadows serve as an ideal cleansing filter turning a potential problem (nutrient-laden sediment) into a useful product (hay).

**Figure 1. The total phosphorus deposited in sediment per unit area across a range of sites.**

