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Energy crops on floodplains – flood risk or benefit?

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Land use and land management on floodplains have increasingly come into focus, particularly in relation to their impact on flooding. To date, research and modelling has explored the impact of land use changes such as floodplain afforestation, changes to management of upland moorlands or re-establishment of wet meadows on floodplains. However, no such investigation has been carried out into the impact on floodplain flows of growing energy crops.
In the UK, a strong emphasis is being given to promotion of renewable energy. Farmers are encouraged to plant energy crops such as Miscanthus or Short Rotation Crops (e.g. Willow) in suitable locations, which typically exclude farmland in Flood Zone 3 (i.e. areas likely to be flooded by an event with a 100-year return period). However, there is a lack of understanding as to what impact, if any, the dense character of these crops planted on floodplains might have on flooding. This gap in knowledge currently prevents energy crops from being planted in areas where they could provide high economic and environmental benefit, and even possibly contribute to flood mitigation. At present, no guidance or policy exists to advise whether allowing farmers to establish energy crop plantations in Flood Zone 3 could alter the existing flood risk. Consequently, if energy crops could provide a coupled benefit of renewable energy source and flood mitigation, this benefit is not being utilised.
To help fill in this gap in knowledge, a short term project was carried out in order to investigate, using suitable hydraulic modelling, the possible scale of impact of growing energy crops on river and floodplain flows, flood depth and overall impact on flood risk locally as well as downstream. 2D hydraulic modelling using TUFLOW was deemed to be the most appropriate approach for these investigations.
The methodology included gaining an understanding of the life cycle and planting regime of Miscanthus and Willow, review of current knowledge on the likely behaviour of mature energy crops when flooded, their likely hydraulic roughness and selection of suitable existing hydraulic models. This informed establishment of feasible modelling scenarios, which represent the plantations in terms of their size, location, orientation to flow and percentage cover on the floodplain. A baseline scenario was included to enable comparison of results. Two case studies were selected for this project; the River Severn at Uckinghall, in the Environment Agency's Midlands Region, and the River Isle at Ashford Mill, in South West Region. Additionally, a theoretical model was set up in order to help define scenarios which produced the biggest impacts, but excluding the effect of local subtleties that are different in each case study.
This paper will demonstrate the methodology and the modelling approach adopted for this study. The outputs of the modelled scenarios (compared to baseline) will be presented in context of flood risk and flood mitigation, bearing in mind the assumptions and limitations that had to be introduced in order to carry out this project. The results will include changes to river flow, flow on the floodplain, flood depths, flood velocities and overall likely impact of the energy crops upstream and downstream of the plantations. Finally, the conclusions will discuss how the findings may be used to change guidance and practice regarding energy crops, and how such change could inform national policy in the UK.