

Reducing the number of grazing animals and improving the structure of top surface soil has multiple benefits for reducing the peak level of flood waters in catchments. One benefit is it increases the coverage of grass which will slow the rate at which water can flow across a field. It can also increase both the rate at which rainfall can be absorbed into soil, and increased the available space for storing rainfall within the soil structure. Using the rainfall-runoff computer model SD-TOPMODEL, and three test sub catchments in the Upper Calder Valley, the benefits of improving the soil structure has been tested by identifying parts of the catchment where soil improvements may be beneficial in reducing overland flow and creating a simulation that compares this to the current land coverage.

The regions of the catchment to be tested for reduced grazing were selected based parts of the catchments that are grazed and where water will predominately flow during storms. An example of the regions selected for this scenario in the Hebden Water catchment can be seen in Figure 1. The average targeted area for the Hebden test catchments is 7.2km² (720 hectares), around 6% of the catchment surface

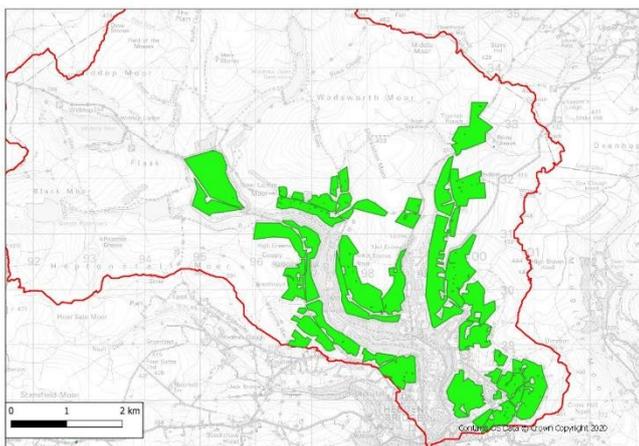


Figure 1: Map of modelled reduced grazing and soil improvement locations for Hebden Water

Using measured differences in soil properties under heavily grazed and lightly grazed areas, the model was modified to these interventions. Model parameters used to signify reduced grazing included a greater soil depth (up to 50% deeper), improved soil permeability (by up to 20%) and an increased resistance to water flowing across the land surface (water flows up to 20% slower)

Table 1: Summary of the difference in peak flow, changes to time of the peak and flood volume reduction from reduced grazing across the three catchments

Event	Change to the peak flow as a result of the intervention	Change to the time of the peak as a result of the intervention	Change to the volume of water as a result of the intervention
3 hour 1 in 10 year	Reduction of 2%	5 – 10 minute delay	Reduced by 1%
3 hour 1 in 100 year	Reduction of 1%	5 – 10 minute delay	Reduced by 5%
12 hour 1 in 10 year	Reduction of 2%	5 – 10 minute delay	Reduced by 3%
12 hour 1 in 100 year	Reduction of 1%	15 – 20 minute delay	Reduced by 1%
December 2015	Reduction of 2%	15 – 20 minute delay	Reduced by 2%
June 2012	Reduction of 2%	15 – 20 minute delay	Reduced by 4%

These results indicate that soil improvements and reduced grazing could have a positive benefit to flood risk. This could be understood in more detail with specific information about the types of soil improvements possible in the catchment.

For more information about the results presented in this fact sheet please refer to the technical document hosted on the iCASP website or contact icasp@leeds.ac.uk

The impact of reduced grazing and soil improvements can be seen by comparing the river discharge values at the outflow of one of the catchments for the two simulations. For a synthetic 1 in 10 year, 3-hour storm event, the peak flood decreases by 4% and the peak is delayed by 5 minutes, which can be seen in Figure 2.

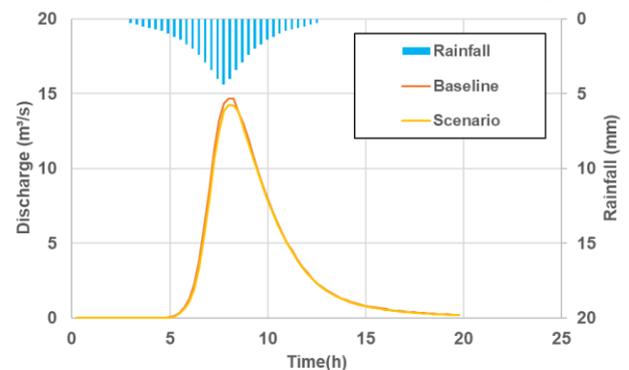


Figure 2: Comparison of the baseline computer model run vs the reduced grazing and soil improvement computer model run

When comparing the current land use baseline simulation against reduced grazing and soil improvement scenarios across 6 rainfall events, (4 synthetic storm events and 2 recorded events), land management improvements were shown to reduce the impact of flooding, with an average decrease in the peak flow value of **2%**, an average reduction in the overall volume of flood water of **3%** and an average delay of **10-15 minute** to the timing of the flood peak (Table 1).