

Intensive grazing and the use of heavy machinery can have an impact on local flood risk by reducing the amount of grass covering in fields, which can increase the speed at which water can flow over a land surface. It also leads to topsoil compaction, which reduces the ability of the soil to absorb rainfall. Further, allowing livestock to access the areas around water courses can also increase the rate at which water enters the watercourses. Using the rainfall-runoff computer model SD-TOPMODEL in three sub-catchments in the Upper Calder, the impact of intensive grazing on flooding was tested by modelling a scenario where selected regions of the catchment were modified to represent intensive grazing and compacted soil. These results were then compared with the current land management practices in the study areas.

The intensive grazing computer model run was created by identifying parts of the catchments that are grazed and where water will predominately flow during storms. An example of the locations selected to represent the intense grazing areas in the Hebden Water catchment can be seen in Figure 1. This area is 7.2 km<sup>2</sup> (720 hectares), around 6% of the total catchment area.

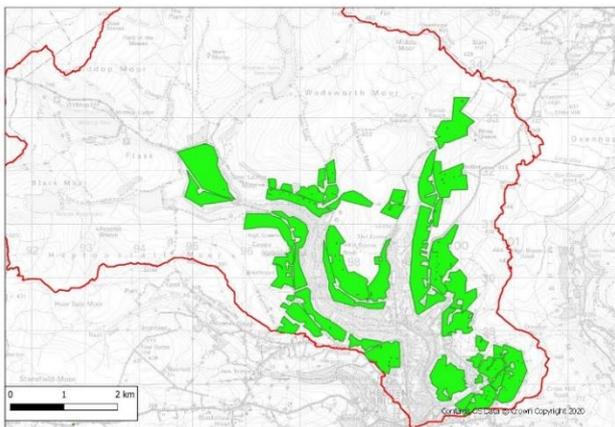


Figure 1: Location of grazed lands used in this modelling

Using measured differences between non-grazed grass cover and heavily grazed land, the model was modified from by decreasing the depth of soil (50% shallower), lowering soil permeability (40% lower) and increasing the speed at which water can flow across the surface (75% less resistance) to represent the effect of heavily grazed land in the regions highlighted in Figure 1.

The impact of the change in grazing pressure on river flow can be seen when comparing the river flow for the baseline model and the simulation of the heavy grazing model. For a synthetic 1 in 10 year, 3-hour storm event, the peak flood increased by 13% and the flood peak arrived 30 minutes earlier than the baseline model (Figure 2).

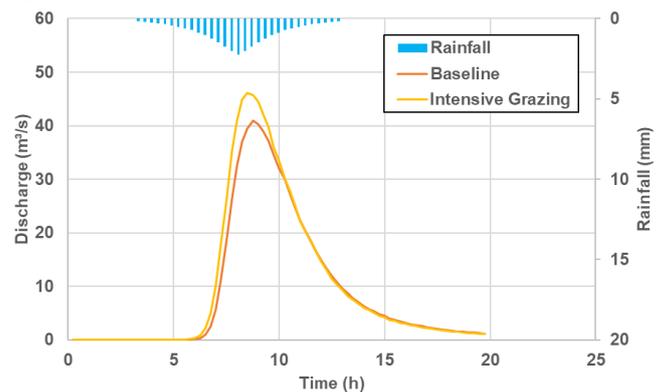


Figure 2: Comparison of the output of the baseline computer model run against intensive grazing computer model run

When comparing a baseline (current conditions) simulation against intensive grazing for 6 rainfall events, (4 synthetic storm event and 2 recorded events), the intensive grazing was found to increase local flood risk, with an average increase in the peak flow value of **6%**, an average increased in the overall volume of flood water of **2%** and the timing of the peak occurring **20 minutes** earlier than the baseline (Table 1).

Table 1: Summary of the difference in peak discharge, changes to time of the peak and flood volume increase from heavy grazing

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
<b>3 hour 1 in 10 year</b>	Increased by 7%	5 – 10 minute earlier arriving peak	Increased by 6%
<b>3 hour 1 in 100 year</b>	Increased by 5%	5 – 10 minute earlier arriving peak	Increased by 1%
<b>12 hour 1 in 10 year</b>	Increased by 4%	15 – 20 minute earlier arriving peak	Increased by 2%
<b>12 hour 1 in 100 year</b>	Increased by 1%	10 – 15 minute earlier arriving peak	Increased by 1%
<b>December 2015</b>	Increased by 4%	25 – 30 minute earlier arriving peak	Increased by 1%
<b>June 2012</b>	Increased by 4%	25 – 30 minute earlier arriving peak	Increased by 1%

These results suggest that intensive grazing can have a negative impact on flood risk with higher peak flow and a faster arriving peak. It is noted that this scenario represents a ‘worst possible case’ example of grazing practices.

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](mailto:icasp@leeds.ac.uk)