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The impact of climate change on grassland—a modelling approach

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Key words : carbon sequestration , climate change , grass growth , simulation model

Introduction Grassland is the main productive driver of ruminant livestock systems in the UK and is sensitive to climate change . The effects of climate change on grassland systems are potentially complex with the effects on forage yields and quality which may affect the relative suitability of grasses and legumes and their utilisation , and would be difficult to quantitatively identify the impacts with both field and laboratory experiments . Mathematical models are potentially efficient tools for the assessment .

Method A sward growth model linked to the components of soil nitrogen cycling and soil water movement developed by SAC is used to predict the impact of climate change on grassland production utilised for livestock production . Downscaled climate data calculated for three future time-slices (2020s , 2050s and 2080s) under "medium-high" emission scenario , was taken from the UKCIP data sources (Hulme *et al .* , 2002) . Three typical areas each of which represents either beef , or dairy or sheep enterprise in Scotland was selected . Daily climatic data is produced for 50 year periods for the baseline climate and the slices using the Earwig weather generator (Kilsby *et al .* , 2006) . Cutting managements are used to mimic grazing system . First cutting in a year (equivalent to turnout) occurs when both simulated canopy height and aboveground biomass are greater than pre-defined criteria for various enterprises . Monthly cutting is made afterward until standing biomass on the scheduled date is less than a pre-defined amount .

Simulation results The model is run under three time-slices plus the baseline climate for 50yr each on the selected sites . Simulation results show that average biomass available (Figure 1) and start day of grazing in a year (Figure 2) to different livestock vary under the scenarios of climate change .

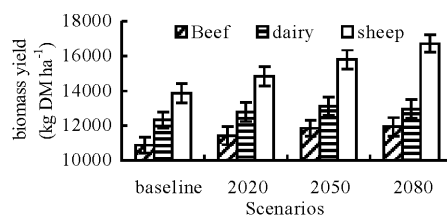


Figure 1 Average annual biomass removal for various enterprises under different scenarios .

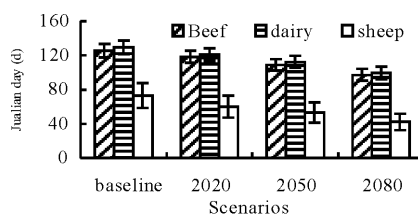


Figure 2 Average turnout day in a year for various enterprises under different scenarios .

Discussion Climate change inevitably affects livestock enterprises in the UK . In general , it would produce more biomass from grassland and increase grazing period in a year although the response of grass growth to the changes is different . The preliminary results should be considered as basic input to appraise the wider impacts of climate change on livestock systems .

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