



Review

# Key challenges and priorities for modelling European grasslands under climate change



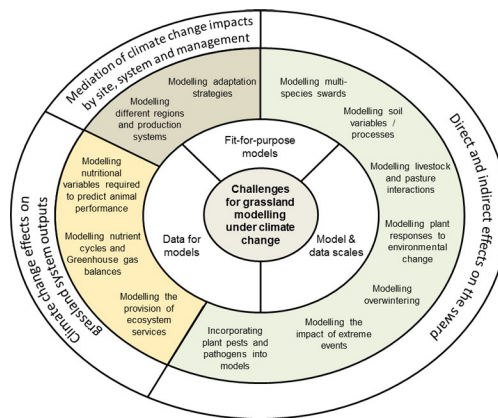
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HIGHLIGHTS

- Experts identified challenges for European grassland modelling under climate change.
- Fifteen key challenges and associated research priorities were identified.
- Challenges related to specific climate change impacts, adaptation and methodology
- Across challenges, shared resources for stakeholders and researchers were priorities.

GRAPHICAL ABSTRACT



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## ABSTRACT

Grassland-based ruminant production systems are integral to sustainable food production in Europe, converting plant materials indigestible to humans into nutritious food, while providing a range of environmental and cultural benefits. Climate change poses significant challenges for such systems, their productivity and the wider benefits they supply. In this context, grassland models have an important role in predicting and understanding the impacts of climate change on grassland systems, and assessing the efficacy of potential adaptation and mitigation strategies. In order to identify the key challenges for European grassland modelling under climate change, modellers and researchers from across Europe were consulted via workshop and questionnaire. Participants identified fifteen challenges and considered the current state of modelling and priorities for future research in relation to each. A review of literature was undertaken to corroborate and enrich the information provided during the horizon scanning activities. Challenges were in four categories relating to: 1) the direct and indirect effects of climate change on the sward 2) climate change effects on grassland systems outputs 3) mediation of climate change impacts by site, system and management and 4) cross-cutting methodological issues. While research priorities differed between challenges, an underlying theme was the need for accessible, shared inventories of models, approaches and data, as a resource for stakeholders and to stimulate new research. Developing grassland models to effectively support efforts to tackle climate change impacts, while increasing productivity and enhancing ecosystem services, will require engagement with stakeholders and policy-makers, as well as modellers and experimental researchers across many disciplines. The challenges and priorities identified are intended to be a resource 1) for grassland modellers and experimental researchers, to stimulate the development of new research directions and collaborative opportunities, and 2) for policy-makers involved in shaping the research agenda for European grassland modelling under climate change.

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## 1. Introduction

The agricultural sector is facing unprecedented challenges as it attempts to maintain food security in the context of climate and socio-economic change (Soussana, 2014; Thornton, 2010). The forecasted increase of world population, dietary changes towards increasing meat

consumption and the demand for bioenergy suggest a global requirement for agricultural products by 2050 roughly twice that of today (Foley et al., 2011). At the same time as increasing production, the livestock sector will need to improve efficiency (Thornton, 2010) to avoid increasing the 26% of global land area currently used for livestock production, and to reduce its estimated 15% share of total anthropogenic

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