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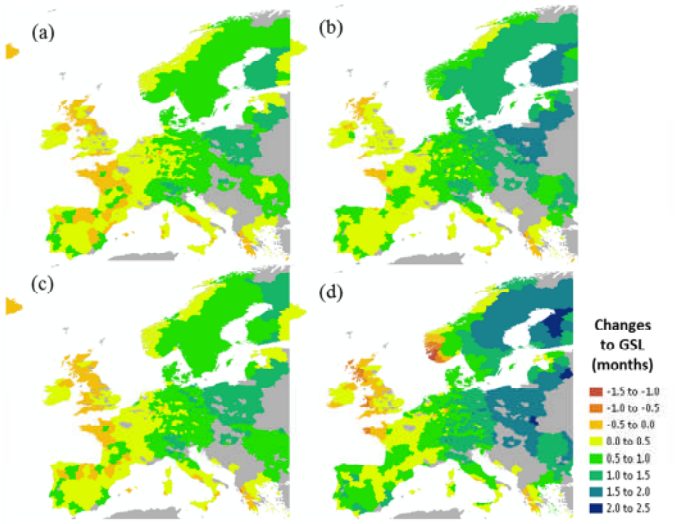
GLOWORM: Innovative and sustainable strategies to mitigate the impact of global change on helminth infections in ruminants



Predicted changes to grazing season length (GSL) on beef farms under climate change scenarios for 2050 (a, b) and 2070 (c, d) under representative concentration pathways 2.5 (a, c) and 8.5 (b, d).

Key external stakeholders:

Dairy, beef and sheep farmers, veterinarians, policymakers.

Practical implications for stakeholders:

Infections with parasitic worms (nematodes and trematodes) represent a large economic and welfare burden to the European ruminant livestock industry. The GLOWORM project investigated the potential impacts of climate change scenarios on grazing management and parasitic worm infections in cattle and sheep. By 2050, grassland farms in many European regions (particularly northern Europe) are likely to have longer grazing season lengths and increased parasite burdens in sheep and cattle. Furthermore, changes to timing of the grazing season are likely to result in changes to the timing of helminth parasite burdens for which current farm management practices are unprepared. This project has developed improved parasite transmission models that can be used to improve on-farm decisions in mitigating against the negative effects of these parasites.

Main results:

- A large database on current grazing management on dairy, beef and sheep farms across Europe was constructed from farmer questionnaires and existing data sources such as the Farm Accountancy Data Network (FADN) and Eurostat.
- Across Europe, grazing season length was positively associated with the mean temperature of the coldest quarter and negatively associated with precipitation in the wettest month.
- Extrapolating these results to climate change scenarios for 2050 and 2070, grazing season length is likely to increase in much of Northern and Eastern Europe but may decrease in some parts of Western Europe due to predicted increases in winter rainfall.
- These results were used to parameterise models of parasite infections under current conditions and climate change scenarios and suggest that the timing of parasite infection rates is likely to change in many regions.

Opportunity / Benefit:

Improved predictive models of parasite infections in ruminants (both current and future) have been developed and these can be used to mitigate against the negative effects of these parasites.

Collaborating Institutions:

Ghent University, Avia-GIS, University of Bristol, University of Florence, Free University of Berlin, Laboklin, University of Liverpool, Moredun Research Institute, Swedish University of Agricultural Sciences, Uniform-Agri BV, University College Dublin, University of Naples, University of Zürich.

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1. Project background:

Infections with helminth parasites (e.g. gutworm, liver fluke) represent a significant economic and welfare burden to the European ruminant livestock industry. The increasing prevalence of anthelmintic resistance means that current control programs are costly and possibly unsustainable in the long term. Furthermore, recent changes in the epidemiology, seasonality and geographic distribution of helminth infections have been attributed to climate change, and further climate change impacts on these infections are likely. However, climate-driven changes in livestock farming practices (e.g. grazing season length) can also have an impact on these infections. Sustainable control of helminth infections in a changing world requires detailed knowledge of these interactions. GLOWORM developed new, sustainable strategies for the effective control of ruminant helminthoses in the face of global change.

2. Questions addressed by the project:

- What are current grazing management practices (relevant to helminth parasite transmission) on grassland farms across Europe?
- How are these practices likely to change in the future?
- What implications do these changes have for parasite transmission?

3. The experimental studies:

A database of typical farm management variables was established using data from FADN, the Eurostat survey on agricultural production methods, paper surveys of farmers in Ireland, Switzerland and Italy, and online questionnaires of farmers in Ireland, the UK, France and Belgium.

4. Main results:

Current grazing season length on grazing dairy, beef and sheep farms across Europe was found to be highly correlated ($P < 0.001$; $R^2 = 0.66$) with bioclimatic variables in a multiple regression using 986 European regions (NUTS 3 regions) as observations. Grazing season length was positively associated with the mean temperature of the coldest quarter and isothermality and negatively associated with precipitation in the wettest month. Extrapolating these relationships to future climate change scenarios, most European countries were predicted to have a net increase in grazing season length with the increase being largest (up to 2.5 months) in the north-east of Europe. However, there were also predictions of increased variability between regions and decreases of up to 1.5 months in some areas such as the west of France, the south-west of Norway and the west coast of Britain. Current grazing management data were used to parameterise current transmission models, resulting in improvement in the ability to predict transmission rates.

5. Opportunity/Benefit:

The project has resulted in improved understanding of the implications of climate change for parasite transmission in grazing livestock across Europe. As a result, a number of predictive parasite transmission models have been produced that can inform regional and on-farm management to reduce the negative effects of these parasites.

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6. Dissemination:

Main publications:

Phelan P., Morgan E. R., Rose H., Grant J. and O'Kiely P. (2015) 'Predictions of future grazing season length for European dairy, beef and sheep farms based on regression with bioclimatic variables.' *Journal of Agricultural Science, Cambridge* (in press)

Phelan P., de Waal T., Selemetas N., Patton J., and O'Kiely P. (2015) 'Relationships between land drainage status, grazing management and liver fluke prevalence in Irish dairy herds.' *Irish Journal of Agricultural and Food Research* (under review)

Selemetas, N., Phelan, P., O'Kiely, P. and de Waal, T. (2015) 'The effects of farm management practices on liver fluke prevalence and the current internal parasite control measures employed on Irish dairy farms.' *Veterinary Parasitology*, 207: 228–240

Conference proceedings:

Phelan P., Morgan E., Rose H. and O'Kiely P. (2014) 'Multiple regression analysis of the relationship between bioclimatic variables and grazing season length on European dairy, beef and sheep farms.' *The Future of European Grasslands; Proceedings of the 25th General Meeting of the European Grassland Federation, 7-11 September, Aberystwyth, Wales.* p 100-102

Phelan P., Morgan E., Rose H. and O'Kiely P. (2014). 'Grazing season length on dairy, beef and sheep farms in Europe.' *The Future of European Grasslands; Proceedings of the 25th General Meeting of the European Grassland Federation, 7-11 September, Aberystwyth, Wales.* p 187-180

Phelan P., Morgan E., Rose H. and O'Kiely P. (2014). 'Grazing season length, stocking rate and grazing intensity on Irish dairy, beef and sheep farms.' *Proceedings of the Irish Agricultural Research Forum, 10-11 March, Tullamore, Offaly, Ireland,* p 80

7. Compiled by: Dr. Paul Phelan and Dr. Padraig O'Kiely

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