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AGRESEARCH

Spatial layer of *Haemonchus contortus* risks in New Zealands under changing climates

HOW TO USE THIS INFORMATION

New Zealand farmers face threats from a number of animal health issues which can be described as 'occasional-acute' i.e., when outbreaks occur, they are intense, causing severe clinical disease, but outbreaks are sporadic and only occur in some locations and when specific climatic and/or biophysical conditions are met. One such health issue is haemonchosis, which is caused by the highly pathogenic intestinal nematode *Haemonchus contortus* and is historically restricted to the North Island of New Zealand.

A simple model (Leathwick, 2013) was used to estimate the risk of haemonchosis in New Zealand for past and future climate scenarios, using published response estimates of free-living *Haemonchus contortus* stages to temperature. The development of the egg, first and second larval stages of the parasite is modelled as a single process, i.e. without differentiation of individual pre-infective stages.
Two rate functions describe the progression of individuals through the pre-infective stages to the infective larvae on an hourly basis, a development rate and a survival rate. The model calculated the percentage of *H. contortus* eggs successfully developing to infective stage larvae over a 30 day period (= one month) using maximum and minimum daily temperatures.

The cumulative model output for September, October and November was used as a proxy for the spring increase in parasite population with a spatial resolution of 0.05 degrees.
The results for the 1981-2000 period were related to expert knowledge to establish risk levels for the likelihood of haemonchosis related health issues i.e.,
1 = *H. contortus* present;
2 = occasional outbreak, but unlikely;
3 = regular outbreaks;
4 = high probability of outbreaks.
These risk levels were then transferred to the model outputs for the future climate scenarios to estimate the impact of changing climate conditions.

The risk of haemonchosis in New Zealand was estimated for past and future climate scenarios, i.e.
BCC-CSM1.1 (Wu et al., 2014),
CESM1-CAM5 (Neale et al., 2010),
GFDL-CM3 (Griffies et al., 2011),
GISS-E2-R (Schmidt et al., 2014),
HadGEM2-ES (Martin et al., 2011) and
NorESM1-M (Bentsen et al., 2013),

predicted under four Representative Concentration Pathways (RCP), i.e.
a scenario with high mitigation resulting in a peak and decline before 2100 (RCP2.6),
two increasing scenarios of stabilization without overshoot after 2100 (RCP4.5 and RCP6.0), and
a high emission scenario with continuous rise during the 21st century (RCP8.5).