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# The resiliency of the Canadian crop insurance system under climate change: testing quantitative methods

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Resilience is a key attribute identified for systems that can respond to climate change and this includes programmes that help farmers manage risk. Farmers deal with weather variability and extreme events as part of their day-to-day operations. In Canada, they utilize a number of risk management tools provided by the Government with AgriInsurance, Canada's crop insurance programme, being a cornerstone of the suite of business risk management programmes that are available to farmers. A key policy question is whether crop insurance can continue to provide a robust response when the effects of climate change alter the prevailing weather patterns. This analysis employs a number of models to test methodologies to determine if we have the capacity to undertake this type of policy analysis and to provide at least some preliminary findings.

Using an integrated assessment framework, regionally downscaled climate data from two Global Circulation Models (GCM) – the Canadian GCM and the Hadley GCM – were used to generate daily data for the period 2040 to 2069. The EPIC (Environmental Policy Integrated Climate) crop growth model was calibrated to better reflect growing conditions in the Prairie region and used to generate a new set of yields for the principal Prairie crops for each of the 22 crop districts based on the GCM-derived weather data. To establish a baseline, EPIC was also run on weather data for 1971 to 2000. From this annual yield data, both means and variance-covariances were generated for the baseline and the scenarios with climate change, with and without a CO<sub>2</sub> fertilization effect. These data were incorporated into a regional, partial equilibrium, optimization model (CRAM), developed by Agriculture and Agri-Food Canada (AAFC) to undertake policy analysis. A risk version of the model is employed for this analysis to reflect the fact that farmers would respond to relative change in expected yields owing to climate change, as well as to the expected change in the variance of those yields. To ascertain how resilient crop insurance would be with climate change, a Monte Carlo simulation with CRAM was run with draws from the generated yield data, allowing farmers to continue to employ crop insurance to manage yield risk related to weather.

Based on 10 000 simulations for each experiment, Canada's crop insurance programme proved to be resilient in that the average annual deficit for the programme (extent to which

payouts exceeded premiums paid by both producers and government) remained similar when the results for the historic period were compared to the future climate change scenarios. In fact the deficit declined slightly with climate change, in part owing to lower average yields and therefore slightly lower exposure. The modeling system employed here can help to analyse real policy questions, but further developmental work is required to ensure all the complexities related to this type of analysis are dealt with, for example that weather patterns can exhibit longer run dry and wet cycles that should be reflected in the experimental design. A key advantage of the approach here is a risk framework with changes in means and variances effecting production decisions for a cropping rotation at the regional level.