SECTION 6

Conclusions and Implications

6.1. The Scope of this Study

The preceding parts of this case study have attempted to answer the question: what would be the impacts on Saskatchewan agriculture if the conditions represented by several climatic scenarios were experienced in the future, assuming the same technology and economic circumstances as in the 1980s? The scenarios considered included those based on an historical extreme year (HIST2), an historical 10- or 5-year period (HIST3 or HIST4), the temperature and precipitation changes implied by one of the recent climatic general circulation models (GCMs) for a doubled CO_2 atmosphere (GISS1), and the temperature changes alone from that model (GISS2). The impacts were assessed by comparing results for these scenarios to results for the 1951–1980 standard climatic normal period (HIST1).

The data on the changes in climate implied in the various scenarios were translated, using several models, into estimates of impacts on the thermal and moisture resources for agriculture, the potential for biomass productivity and for soil erosion by wind, the production levels for spring wheat, and the farm and provincial economy. Estimates were also made of the impacts on drought frequency and severity resulting from the warming due to CO_2 doubling, with or without the predicted precipitation increase (GISS3 and GISS4), in comparison with the drought severity and frequency of a 33-year period in the recent past (HIST5).

This final part of the case study summarizes the results and presents our conclusions and recommendations.

To avoid confusion we should emphasize here some of the things we have *not* done in this case study. We have not attempted to assess the likelihood of any particular climatic change, or to predict future climatic impacts, or to undertake comparative studies of different GCM scenarios, or to consider nonclimatic effects of increased CO_2 on crops, or to make a comprehensive evaluation of all the various models that might reasonably be used to study climatic impacts on

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Saskatchewan agriculture. This case study focuses on demonstrating the translation of data on changes in climate into estimates of consequent changes in agriculture. To provide this demonstration it used results from only one GCM, and employed only a few representative impact models.

We should also emphasize again that in general it is impossible to validate objectively models for climatic impacts work. The models may have been validated for other work, but such validation may not necessarily be relevant for the present application. Thus there is usually no basis for quantifying the degree of confidence one should have in impact estimates. Despite these limitations we feel it is important to try to make the best translations of climatic scenarios into estimates of likely effects that can presently be made. Impact models such as those demonstrated in this case study can and should be used for such work.

6.2. Summary of Results

The results suggest that without any fundamental change in climate (*see* HIST scenarios, *Table 6.1*), Saskatchewan agriculture can expect an occasional warmer than normal year with moisture resources so reduced that crop production is only about a quarter of normal, the potential for wind erosion is doubled, and losses to the agricultural economy exceed Can$1800 million and 8000 jobs for cereal crop losses alone. Ripple effects in sectors other than agriculture (*Table 5.9*) translate into a provincial GDP reduction of Can$1600 million and a further reduction in jobs of 17000. They also imply that an occasional period of 5–10 consecutive years with warmer than normal growing seasons will have moisture resources so subnormal that biomass dry matter production will be reduced by nearly half and spring wheat production by about one-fifth. There would be a loss to agriculture of about 2600 person-years annually, and an annual economic loss of nearly Can$600 million. This loss, resulting from effects on cereal crops alone, translates, for nonagricultural sectors, to a provincial GDP reduction of over Can$500 million and a loss of 5600 more person-years annually.

With respect to the climate inferred for a doubled CO_2 atmosphere, our results suggest that on a long-term average basis there would be a substantial increase in thermal resources, modest increases in moisture resources (according to the precipitation effectiveness index results) and in potential biomass productivity, modest decreases in the wind erosion potential and in spring wheat productivity, and losses to the agricultural industry of about 700 jobs, and about Can$160 million annually (*see* GISS1 scenario, *Table 6.1*). This amounts to a nonagricultural sector reduction of about Can$150 million in provincial GDP and 1500 additional person-years annually. They also suggest more frequent and severe droughts: under the 2 × CO_2TP scenario the return period for what we would presently call a severe drought would be only about half as long as it is now.

For a climate changed by the warming but not the precipitation increase inferred for a doubled CO_2 atmosphere (GISS2), our results imply, on a long-term average basis, modest reductions in moisture resources and biomass productivity, a moderate increase in wind erosion potential, and a moderate