Abstract. The impacts of climate change on the agricultural, energy, forestry, and water sectors of MINK would reverberate negatively throughout the regional economy. Allowing for sectoral adjustments to the new climate, however, the decline in regional income and production would not likely exceed 1-2%. The largest economy-wide impacts would be by way of the agricultural and water sectors. The impacts by way of forestry and energy would be negligible, unless the nation adopts a program of massive reforestation to capture CO₂, which would positively affect the regional economy.

1. Introduction

In this paper we analyze the regional economic impacts of climatic change in the Missouri-Iowa-Nebraska-Kansas (MINK) region. The analysis is based on the findings of the several sectoral studies described in the previous papers. The economy of the MINK region, like that of any other region, consists of a collection of interdependent economic activities. Climate-induced changes in the productivity of the region's natural resources will inevitably lead to changes in the broader economy. For example, the resource sectors are themselves consumers of products and services, and changes in their productivity will lead to adjustments in the use of these inputs. In addition, outputs of the resource-based sectors become inputs to processing industries, and climate-induced changes in the resource sectors will trigger adjustments within the processing industry. Each such response can itself trigger another round of changes, felt by suppliers and linked industries.

In order to investigate the full economic consequences of climate change there must be some explicit accounting for these interindustry linkages within the regional economy. Input-output models, econometric models, and general equilibrium models are among the various techniques that are employed in regional economic studies to account for linkages among sectors of the economy. In this study, we have relied primarily on a regional input-output model, IMPLAN, developed by the U.S. Forest Service (Alward, 1986, 1988). With the model we estimated the overall economic impact of simulated climate-induced changes on the productivity of the MINK region's agricultural, forestry, energy, and, to a limited extent, water resources. These are the resource sectors we believe most likely to be affected by climate change. As in the other papers of this series, we concern our-
selves with the impact of the 1930s analog climate on both the current economy of the region and on a scenario of the economy of 2030.

As a tool for regional impact analysis, input-output models offer both strengths and weaknesses. One immediate reason for choosing the input-output approach was the ready availability of the IMPLAN model. One of our goals in the overall study was to develop a methodology that could be applied in subsequent studies at a reasonable effort. The IMPLAN model is available at modest cost and is easily structured to represent any regional economy within the United States. More importantly, despite simplifying assumptions underlying the model, we feel that the input-output approach does not do great injustice in an analysis of small scale changes to the economy. As will be shown, the changes in the MINK economy we deal with are small. Like all regional models, problems arise in using IMPLAN for estimating impacts on a future economy, the technical and economic conditions of which will surely have changed so that coefficients thought valid today may not be applicable to the future.

In what follows, we briefly review some of the features of input-output models and of the IMPLAN model itself. Then we turn our discussion to the impacts of climate change on the current and on the future economy of the MINK region. In our discussion, we also try to account in some degree for those impacts that are not adequately reflected within the input-output framework.

2. Approaches to Modelling Regional Economic Impacts

In the 1930s, Wassily Leontief developed the idea (for which he subsequently won the Nobel prize for economics) of representing interindustry relationships through an input-output model. An input-output matrix details each industry's purchases from other industries. Each column of this matrix lists the purchases of the various inputs needed in the production of one dollar's worth of a particular commodity. An accounting identity shows overall production of each commodity going either to satisfy these intermediate demands, as inputs into the production of other commodities, or going to meet final demands, such as for household consumption or export.

As described above, the model provides a simple 'snapshot' of current economic flows. But we need a predictive tool, telling us what happens as the economy moves from its current position. Use of the input-output model as a predictive tool requires an assumption that the matrix detailing the rates of input use in production does not change, even as the overall production levels do. The input-output model can then be solved to determine how the overall economy must adapt to accommodate any adjustments in the final demand for outputs. It is solved for the interindustry flows and the overall level of economic activity necessary to meet any mix of final demands. In particular, the input-output model can be used to show the economy-wide ramifications of changes from the current level of final demand for the products of any one industry or group of industries.