

## Impact of Climate Change

TI: Regional Climate Change: Trend Analysis of Temperature and Precipitation Series at Selected Canadian Sites

AU: Clark,-J.-Stephen, et-al.

SO: Canadian-Journal-of-Agricultural-Economics; 48(1), March 2000, pages 27-38.

AB: Global climate change does not necessarily imply that temperature or precipitation is increasing at specific locations. The hypothesis of increasing temperature and precipitation trends associated with global climate change is tested using actual annual temperature and precipitation data for nine selected weather stations, spatially distributed across Canada. Vogelsang's (1998) partial sum and Woodward et al's (1997) bootstrap methods are used for testing for trend. Both methods suggest no warming in the Canadian temperature series except for Toronto, Ontario, which had significant increase over time, along with Moncton, New Brunswick, and Indian Head, Saskatchewan, which had marginal increases. There is no evidence of increasing trend in precipitation except for Moncton, New Brunswick, which had a significantly increasing trend. Thus, public policies designed to address the regional effects of climate change need to be adapted for a particular ecological zone, based on knowledge of the climate trends for that region, rather than on general global climate change patterns.

TI: Climate Change, Catastrophic Environmental Effects and Overlapping Generations

AU: Moretto,-Michele; Tamborini,-Roberto

SO: Rivista-Italiana-degli-Economisti; 4(3), December 1999, pages 335-58.

AB: In this paper the climate change effect is an unforeseen earth temperature level above which a negative externality on technology and hence on society's welfare is exerted. We use a dynamic overlapping generations model to develop a positive analysis of the growth path of an economy with the negative temperature spillover leading to a structural breakdown in capital productivity. Two scenarios for the impact of climate change on intergenerational equity are analyzed: the first is consistent with a state-of-nature framework in which atomistic agents cannot influence the probability that a particular event (productivity collapse) will occur. In the second, according to the maxim "that everybody does what I am doing . . .", agents recognize that their choices may influence the probability of productivity collapse occurring in their lifetime.

TI: An Econometric Analysis of the Costs of Sequestering Carbon in Forests

AU: Plantinga,-Andrew-J.; Mauldin,-Thomas; Miller,-Douglas-J.

SO: American-Journal-of-Agricultural-Economics; 81(4), November 1999, pages 812-24.

AB: The Kyoto Protocol and the U.S. Climate Change Plan recognize afforestation as a potential means of reducing atmospheric CO<sub>2</sub> concentrations. To examine the cost-effectiveness of afforestation, we use econometric land use models to estimate the marginal costs of carbon sequestration in Maine, South Carolina, and Wisconsin. Our findings include the following: (a) earlier studies of afforestation programs tend to underestimate carbon sequestration costs, (b) afforestation still appears to be a relatively low-cost approach to reducing CO<sub>2</sub> concentrations, (c) Wisconsin offers the lowest-cost

opportunities for carbon sequestration, and (d) projected population changes have the largest effect on costs in South Carolina.

TI: Water Resources: Meeting Future Demand

AU: Love,-Patrick

SO: Foresight; 1(3), June 1999, pages 275-78.

AB: Water has occupied an increasingly important place on the international agenda since 1993, with questions about the impact of climate change on water resources, the possibility that disputes about access to water might exacerbate regional tensions, and whether large-scale planning and projects are the best way to meet future needs emerging as key issues. This article examines how thinking on these questions has evolved since 1993 and presents updated projections of the main trends concerning water resources.

TI: Climate Change, Agriculture, and Developing Countries: Does Adaptation Matter?

AU: Mendelsohn,-Robert; Dinar,-Ariel

SO: World-Bank-Research-Observer; 14(2), August 1999, pages 277-93.

AB: Because most developing countries depend heavily on agriculture, the effects of global warming on productive croplands are likely to threaten both the welfare of the population and the economic development of the countries. Tropical regions in the developing world are particularly vulnerable to potential damage from environmental changes because the poor soils that cover large areas of these regions already have made much of the land unusable for agriculture. Although agronomic simulation models predict that higher temperatures will reduce grain yields as the cool wheat-growing areas get warmer, they have not examined the possibility that farmers will adapt by making production decisions that are in their own best interests. A recent set of models examines cross-sectional evidence from India and Brazil and finds that even though the agricultural sector is sensitive to climate, individual farmers do take local climates into account, and their ability to do so will help mitigate the impacts of global warming.

TI: Economic Implications of Climate Change for U.S. Agriculture: Assessing Recent Evidence

AU: Lewandrowski,-Jan; Schimmelpfennig,-David

SO: Land-Economics; 75(1), February 1999, pages 39-57.

AB: Recent studies estimate potential economic impacts of climate change on U.S. agriculture. While results are not directly comparable, several 'big picture' lessons can be drawn. These broader findings are developed and put into a policy context. While the estimated impacts on U.S. agriculture, and the U.S. economy, do not yet justify costly adaptation or mitigation strategies, some regional and environmental impacts could be quite severe. Current policy efforts should focus on reducing climate change uncertainties and increasing farm sector flexibility. From a national perspective, future agreements to limit greenhouse gas emissions could be partially met through adjustments of farm practices.

TI: Social Vulnerability to Climate Change and Extremes in Coastal Vietnam

AU: Adger,-W.-Neil

SO: World-Development; 27(2), February 1999, pages 249-69.

AB: A framework for analyzing social vulnerability is outlined, an aspect largely underemphasized in assessments of the impacts of climate change and climate extremes. Vulnerability is defined in this paper as the exposure of individuals or collective groups to livelihood stress as a result of the impacts of such environmental change. It is constituted by individual and collective aspects which can be disaggregated, but are linked through the political economy of markets and institutions. Research in coastal northern Vietnam shows that baseline social vulnerability is enhanced by some institutional and economic factors associated with Vietnam's economic transition from central planning, namely the breakdown of collective action on protection from extreme events and an increasingly skewed income. Offsetting these trends are other institutional changes associated with the dynamic nature of the economic restructuring and evolution of the market transition in Vietnam, which decrease vulnerability.

TI: Valuing the Impact of Large-Scale Ecological Change in a Market: The Effect of Climate Change on U.S. Timber

AU: Sohngen,-Brent; Mendelsohn,-Robert

SO: American-Economic-Review; 88(4), September 1998, pages 686-710.

AB: This paper establishes a methodology for valuing the impact of large-scale ecological changes in a market. Given the large capital stocks inherent in most ecological systems, the dynamic nature of most ecological change, and the dynamic response of markets, it is critical to build dynamic models to capture the resulting effects. This paper demonstrates how to construct such a model using the impacts of climate change on U.S. timber markets as an example. Across a wide range of scenarios and models, warming is predicted to expand timber supplies and thus benefit U.S. timber markets.

TI: Economic and Welfare Impacts of Climate Change on Developing Countries

AU: Winters,-Paul et-al.

SO: Environmental-and-Resource-Economics; 12(1), July 1998, pages 1-24.

AB: The impact of global climate change on developing countries is analyzed using CGE-multimarket models for three archetype economies representing the poor cereal importing nations of Africa, Asia, and Latin America. The objective is to compare the effects of climate change on the macroeconomic performance, sectoral resource allocation, and household welfare across continents. Simulations help identify those underlying structural features of economies which are the primary determinants of differential impacts; these are suggestive of policy instruments to countervail undesirable effects. Results show that all these countries will potentially suffer income and production losses. However, Africa, with its low substitution possibilities between imported and domestic foods, fares worst in terms of income losses and the drop in consumption of low income households. Countervailing policies to mitigate negative effects should focus on integration in the international market and the production of food crops in Africa, and on the production of export crops in Latin America and Asia.

TI: The Impact of Climate Change on US Agriculture: A Response to Mendelsohn et al. (1994).

AU: Kaufmann,-Robert-K.

SO: Ecological-Economics; 26(2), August 1998, pages 113-19.

TI: Health and Amenity Effects of Global Warming

AU: Moore,-Thomas-Gale

SO: Economic-Inquiry; 36(3), July 1998, pages 471-88.

AB: This study shows that climate change would probably reduce mortality in the United States by about 40,000 per year, assuming a 4.5 degree warmer climate--the IPCC best estimate of temperature change with a doubling of carbon dioxide. Benefits would extend to lower medical costs nationwide. Measuring willingness to pay by wage rates shows that people prefer warm climates and would be willing to give up between \$30 billion and \$100 billion annually for a 4.5 degree increase in temperatures.

TI: Extensions and Alternatives to Climate Change Impact Valuation: On the Critique of IPCC Working Group III's Impact Estimates

AU: Fankhauser,-Samuel; Tol,-Richard-S.-J.; Pearce,-David-W.

SO: Environment-and-Development-Economics; 3(1), February 1998, pages 59-81.

AB: The paper discusses valuation issues in the context of climate change impact estimation. Issues addressed are aggregation of damage costs over diverse regions (particularly equity-weighting), differentiation of per-unit values, willingness to pay versus willingness to accept compensation as a basis for valuation, and accountability for impacts. Numerical illustrations show that the damage cost estimates are quite sensitive to the assumptions made on these issues.

TI: The Aggregation of Climate Change Damages: A Welfare Theoretic Approach

AU: Fankhauser,-Samuel; Tol,-Richard-S.-J.; Pearce,-David-W.

SO: Environmental-and-Resource-Economics; 10(3), October 1997, pages 249-66.

TI: The Damage Costs of Climate Change towards a Dynamic Representation

AU: Tol,-Richard-S.-J.

SO: Ecological-Economics; 19(1), October 1996, pages 67-90.

AB: Economic assessments of climate change impacts are commonly presented as the effect of a climate change associated with a doubling of the atmospheric concentration of carbon dioxide on the current economy. This paper is an attempt to express impact as a function of both climate change and socio-economic change. With regard to climate change, issues discussed are level versus rate of change, speed of adaptation, speed of restoration and value adjustment, and symmetry. With regard to socio-economic change, agriculture, migration and the valuation of intangible losses are addressed. Uncertainty and higher order impacts are treated briefly. It is qualitatively argued and quantitatively illustrated that these issues matter a great deal for the damage profile over the next century. A damage model, based on my best guesses, is presented in the Appendix.

TI: Pollution Transport in the Southwest Pacific: Possible Impacts on New Zealand Air Quality

AU: Bridgman,-Howard-A.

SO: New-Zealand-Geographer; 51(2), October 1995, pages 13-15.

AB: The impacts of long range transport of pollutants from anthropogenic and natural sources play a major role in atmospheric chemistry and may have an impact on global

climate change. Although atmospheric transport in the Northern Hemisphere is recognised as an essential feature on a global scale, long range transport in the Southern Hemisphere may have important regional implications.

TI: Assessing the Economic Costs of Sea Level Rise

AU: Turner,-R.-K.; Adger,-N.; Doktor,-P.

SO: Environment-and-Planning-A; 27(11), November 1995, pages 1777-96.

AB: Sea level rise is one of the potential consequences of human induced global climate change, and coastal zones, together with their inhabitants, may be becoming more susceptible and vulnerable to such external shocks and related damage impacts. Global, regional, and national scale studies have been undertaken in an attempt to assess the future threat posed by sea level rise. To date none of these studies have fully encompassed the relationship between the physical change impacts and the socioeconomic implications. The authors utilize both a "GDP-at-risk" and an economic cost-benefit approach, in combination with biophysical analysis, to model the impacts of sea level rise along the East Anglian coastline of Eastern England. The economic results indicate that for most sea-level-rise predictions the protect strategy is economically justifiable on a region-wide basis. At a more localized scale a combination of response options, including "do nothing and retreat," may be optimal.

TI: Climatic Change and Canada's Boreal Forest: Socio-economic Issues and Implications for Land Use

AU: van-Kooten,-G.-Cornelis

SO: Canadian-Journal-of-Agricultural-Economics; 43(1), March 1995, pages 133-48.

AB: This paper reviews the effect of climate change and policies to sequester carbon on forest land use. Efficient mitigation strategies often require the conversion of agricultural land to forestry in order to sequester carbon, but such strategies could be wrong for Canada's boreal forest region if global warming is inevitable. It is argued that, from both an economic and a social perspective, conversion of the southern boreal forest to grassland or agriculture might be a better policy.

TI: Effects of Global Warming on Energy Use for Space Heating and Cooling in the United States

AU: Rosenthal,-Donald-H.; Gruenspecht,-Howard-K.; Moran,-Emily-A.

SO: Energy-Journal; 16(2), 1995, pages 77-96.

AB: This study uses a three-step approach to estimate the impact of global warming on U.S. energy expenditures for space heating and cooling in residential and commercial buildings. First, average results from six different global circulation models are used to estimate the change in heating and cooling degree days in five U.S. climate zones associated with a 1 [degree] centigrade (C) global warming. Second, the change in degree days is mapped into a corresponding change in U.S. energy use for space conditioning, taking account of differences in population and baseline space conditioning intensity levels across regions, under the assumption that desired indoor temperature is unaffected by climate change. Finally, we estimate the associated change in energy expenditures. We find that global warming of 1[degree]C would reduce projected U.S. energy expenditures in 2010 by \$5.5 billion (1991 dollars). This contrasts with earlier studies

which have suggested modest global warming would increase U.S. on space conditioning energy.

TI: Climate Change and Agricultural Production: An Extensive Averaged Spatial-Ecologic Approach

AU: Alden,-D.-M.

SO: Environment-and-Planning-A; 26(1), January 1994, pages 121-36.

AB: In this paper, the "extensive averaged spatial-ecologic" approach for assessing the direct impacts of climate change on international agricultural production is developed. The approach allows the temporal impacts of climate change to be determined, measured in terms of the of the degree of adaptation of the agricultural sector to climate change. Use is made of a world agricultural commodity markets model, constructed with the static World Policy Simulation modeling framework, to determine the combined direct and indirect temporal impacts of an "enhanced greenhouse effect" climate scenario.

TI: Climate Change: Trade and Welfare Effects

AU: Hanslow,-Kevin et-al.

SO: Australian-Commodities-Forecasts-and-Issues; 1(3), September 1994, pages 344-54.

AB: If countries in the OECD, the former Soviet Union and Eastern and Central Europe were to reduce CO [subscript 2] emissions by 20 percent, developing countries would also be adversely affected. An equal percentage reduction in emissions across the first group of countries only is likely to be much more costly to all countries. The welfare of all countries could be improved if the first group of countries operated a tradable quota scheme and engaged in joint implementation projects with the second group.

TI: Estimating Corn Yield Response Models to Predict Impacts of Climate Change

AU: Dixon,-Bruce-L. et-al.

SO: Journal-of-Agricultural-and-Resource-Economics; 19(1), July 1994, pages 58-68.

AB: Projections of the impacts of climate change on agriculture require flexible and accurate yield response models. Typically, estimated yield response models have used fixed calendar intervals to measure weather variables and omitted observations on solar radiation, an essential determinant of crop yield. A corn yield response model for Illinois crop reporting districts is estimated using field data. Weather variables are timed to crop growth stages to allow use of the model if climate change shifts dates of the crop growing season. Solar radiation is included. Results show this model is superior to conventionally specified models in explaining yield variation in Illinois corn. Coauthors are Steven E. Hollinger, Philip Garcia, and Viswanath Tirupattur.

TI: A Farm-Level Analysis of Economic and Agronomic Impacts of Gradual Climate Warming

AU: Kaiser,-Harry-M. et-al.

SO: American-Journal-of-Agricultural-Economics; 75(2), May 1993, pages 387-98.

AB: The potential economic and agronomic impacts of gradual climate warming are examined at the farm level. Three models of the relevant climatic, agronomic, and economic processes are developed and linked to address climate change impacts and agricultural adaptability. Several climate warming scenarios are analyzed, which vary in

severity. The results indicate that grain farmers in southern Minnesota can effectively adapt to a gradually changing climate (warmer and either wetter or drier) by adopting later maturing cultivars, changing crop mix, and altering the timing of field operations to take advantage of a longer growing season resulting from climate warming. Coauthors are Susan J. Riha, Daniel S. Wilks, David G. Rossiter, and Radha Sampath.

TI: Economic Implications of Global Climate Change for World Agriculture

AU: Tobey,-James; Reilly,-John; Kane,-Sally

SO: Journal-of-Agricultural-and-Resource-Economics; 17(1), July 1992, pages 195-204.

AB: This paper challenges the hypothesis that negative yield effects in key temperate grain producing regions of the world resulting from global climate change would have a serious impact on world food production. Model results demonstrate that even with concurrent productivity losses in the major grain producing regions of the world, global warming will not seriously disrupt world agricultural markets. Country/regional crop yield changes induce interregional adjustments in production and consumption that serve to buffer the severity of climate change impacts on world agriculture and result in relatively modest impacts on world agricultural prices and domestic economies.

TI: Comparing the Effects of Greenhouse Gas Emissions on Global Warming

AU: Eckaus,-Richard-S.

SO: Energy-Journal; 13(1), 1992, pages 25-35.

AB: This paper analyzes the usefulness as a policy tool of a physical index of radiative forcing of a greenhouse gas, the Global Warming Potential (GWP), as proposed by the Intergovernmental Panel on Climate Change. It is shown that the economic opportunity costs of an increment in radiative forcing will vary over time, while the GWP implicitly sets these costs equal. The GWP can, therefore, play no role in policy making.

TI: The Economic Impact of Crop Losses: A Computable General Equilibrium Approach

AU: Sherony,-Keith-R.; Knowles,-Glenn-J.; Boyd,-Roy

SO: Western-Journal-of-Agricultural-Economics; 16(1), July 1991, pages 144-55.

AB: The impact of crop losses on the U.S. economy are analyzed using a Computable General Equilibrium (CGE) Model. In doing so, concerns about widespread crop losses due to a global climate change or environmental event are addressed. The CGE approach allows for analysis of the interactions between supply and demand within agricultural markets as well as between these markets and the rest of the economy. The results suggest that policy responses which allow free market pricing signals to determine production mitigate the effects of an event that approximate the drought of 1988.

TI: The Impacts of Climate Change on Agriculture in Manitoba

AU: Mooney,-Sian; Arthur,-Louise-M.

SO: Canadian-Journal-of-Agricultural-Economics; 38(4), December 1990, pages 685-94.

TI: Climate Change Impacts on Forestry: Economic Issues

AU: Van-Kooten,-G.-C.

SO: Canadian-Journal-of-Agricultural-Economics; 38(4), December 1990, pages 701-10.