

Strzepek, Kenneth M., and David N. Yates. 2000. "Responses and Thresholds of the Egyptian Economy to Climate Change Impacts on the Water Resources of the Nile River," *Climatic Change*, Vol. 46, No. 3, August, pp. 339-356.

ABSTRACT: Are there "thresholds" in greenhouse gas (GHG) concentrations above which associated climate change impacts become economically, socially or environmentally unacceptable? If thresholds exist, then emissions might be limited in such a way that GHG concentrations are not exceeded. Environmental, social, and economic systems should be examined in order to determine these threshold levels.

This paper addressed the potential impacts of climate change on the water resources of the Nile River and associated impacts on the Egyptian economy through the use of a recursively dynamic general equilibrium model. The model was used to examine both economy-wide and sectoral impacts, and impacts on social and national policy indicators under various economic growth and climate change scenarios. Macro-economic indicators such as Gross Domestic Product (GDP) showed that strict economic thresholds, characterized by discontinuities in the response function, did not occur. This was because autonomous economic adjustments generated a smooth socioeconomic transition over the 70-year simulation period. The economy underwent a gradual structural transformation, as capital and resources were moved from cropped agricultural to both the livestock and the non-agricultural sectors. Under "wet" climate scenarios, surplus water beyond 75 billion cubic meters (BCM) remained unused, as the marginal value of water dropped to zero and other resource constraints limited agricultural growth. For drier scenarios (below 75 BCM), water was a constraint to agricultural production into the 21st century, as resources were diverted to less water demanding crops and the livestock and non-agricultural sectors. The reduced water scenarios showed agriculture declining in its total share of GDP, burdening the agricultural wage earner. Egypt increased its dependence on imports to meet food demand, dramatically decreasing grain self-sufficiency, while increasing protein self-sufficiency. If national policy requires a certain level of food self-sufficiency, then these metrics could be used in defining policy-based thresholds.

Raey, M. El, Kh. Dewidar, and M. El Hattab. 1999. "Adaptation to the impacts of sea level rise in Egypt," *Climate Research*, Vol. 12, pp. 117-128.

ABSTRACT: Assessment of the vulnerability of and expected socioeconomic losses over the Nile Delta coast due to the impact of sea level rise (SLR) was carried out in detail. Impacts of SLR on the Governorates of Alexandria and Port Said, in particular, were evaluated quantitatively. Options and costs of adaptation were analyzed and presented. Multi-criteria and decision matrix approaches based on questionnaire surveys were carried out to identify priorities in the 2 case studies. Results indicate that there are very limited possibilities of changing jobs for vulnerable stakeholders; cost is the main barrier of implementation; the majority of stakeholders recommend protection actions; and beach nourishment with limited hard structures (groins and breakwaters) is the best immediate option for adaptation, while the ICZM approach is the best available strategic option.

Yates, David N., and Kenneth M. Strzepek. 1998. "An Assessment of Integrated Climate Change Impacts on the Agricultural Economy of Egypt," *Climatic Change*, Vol. 38, No. 3, March, pp. 261-287.

ABSTRACT: This study used a quadratic programming sector model to assess the integrated impacts of climate change on the agricultural economy of Egypt. Results from a dynamic global food trade model were used to update the Egyptian sector model and included socio-economic trends and world market prices of agricultural goods. In addition, the impacts of climate change from three bio-physical sectors - water resources, crop yields, and land resources - were used as inputs to the economic model.

The climate change scenarios generally had minor impacts on aggregated economic welfare (sum of Consumer and Producer Surplus or CPS), with the largest reduction of approximately 6 percent. In some climate change scenarios, CPS slightly improved or remained unchanged. These scenarios generally benefited consumers more than producers, as world market conditions reduced the revenue generating capacity of Egyptian agricultural exporters but decreased the costs of imports. Despite increased water availability and only moderate yield declines, several climate change scenarios showed producers being negatively affected by climate change. The analysis supported the hypothesis that smaller food importing countries are at a greater risk to climate change, and impacts could have as much to do with changes in world markets as with changes in local and regional biophysical systems and shifts in the national agricultural economy.

El-Shaer, H.M., C. Rosenzweig, A. Iglesias, M.H. Eid, and D. Hillel. 1997. "Impact of climate change on possible scenarios for Egyptian agriculture in the future," *Mitigation and Adaptation Strategies for Global Change*, Vol. 1, pp. 233-250.

ABSTRACT: If no timely measures are taken to adapt Egyptian agriculture to possible climate warming, the effects may be negative and serious. Egypt appears to be particularly vulnerable to climate change because of its dependence on the Nile River as the primary water source, its large traditional agricultural base, and its long coastline, already undergoing both intensifying development and erosion. A simulation study characterized potential yield and water use efficiency decreases on two reference crops in the main agricultural regions with possible future climatic variation, even when the beneficial effects of increase CO₂ were taken into account. On-farm adaptation techniques which imply no additional cost to the agricultural system did not compensate for the yield losses with the warmer climate or improve the crop water-use efficiency. Economic adjustments such as the improvement of the overall water-use efficiency of the agricultural system, soil drainage and conservation, land management, and crop alternatives are essential. If appropriate measures are taken, negative effects of climate change in agricultural production and other major resource sectors (water and land) may be lessened.

Onyeji, S Chib, and Günther Fischer. 1994. "An economic analysis of potential impacts of climate change in Egypt," *Global Environmental Change*, Vol. 4, No. 4, December, pp. 281-299.

ABSTRACT: Projections of climate impacts on crop yields simulated for different General Circulation Model (GCM) scenarios are used, in a recursively dynamic general equilibrium framework, to account for potential economy-wide impacts of climate change in Egypt. Comparing these impact projections to those obtained under a reference, business-as-usual, scenario assuming some moderate changes in the political, economic or technological spheres, indicates that global warming has potentially negative effects. The analysis is based on a global assessment of potential climate change-induced variations in world commodity production and trade. The Egyptian agricultural sector, and the non-agricultural sector to a lesser extent, are projected to be increasingly less self-sufficient. Specific potential adverse impacts are identified. The simulation results show that high-cost adaptation measures involving major changes in the agricultural system and practices may mitigate these adverse impacts. Stimulating economic development of the rural areas and creating appropriate conditions for effective diffusion and development of technologies -- particularly for the agricultural sector -- would seem a desirable strategy. Perhaps, more importantly, the simulation results show that the assumption of exogenously determined technological progress may be inappropriate, in which case the potential adverse impacts of a future warming of the global climate are likely to be fewer than is indicated in this study -- if prevailing constraints on productivity growth in the major food and feed grains are 'released' by endogenous advances in technology.