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Irrigated Agriculture and the Environment, edited by James S. Shortle & Ronald C. Griffin

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minerals use. Pigouvian taxes are briefly considered as a means to force producers toward socially optimal production, but of more interest is the evidence provided of improved environmental performance by minerals producers in Chile and Canada. Technology clearly has improved the environmental performance of some firms and the gap between best practice technology and artisanal production is highlighted.

Internalising the environmental and other social costs of minerals production is a textbook recommendation, but Tilton cautions that it will be a long struggle to achieve such an objective. Thirty-plus years of intense effort have resulted in major improvements in the accuracy of non-market valuation techniques that are used to assess how large are environmental and social costs, but persuading politicians to act on the knowledge generated about the magnitude of external costs may be a major challenge.

Major industrial countries, particularly the United States, are often berated for their profligate use of mineral commodities on grounds of inequity and injustice. Tilton argues that these criticisms are misguided. The high income countries are high consumers of these products, but they are also high investors in research and development, and arguably are in a much stronger position to develop new technologies that can offset decreasing minerals availability for all countries. This last argument nicely illustrates a main feature of this excellent, carefully written book. Deductive logic and basic resource economics are used to review the evidence, analyse issues, and draw sometimes surprising conclusions.

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Irrigated Agriculture and the Environment. Edited by James S. Shortle & Ronald C. Griffin. Northampton, MA: Edward Elgar Publishing, Inc., 2001. 272 pages. \$110 hardback.

Irrigated agriculture (versus rain-fed agriculture) is one of the great achievements in bettering the health and well being of a large portion of the world's population. In the twentieth century, as population expanded and irrigation engineering became more refined, the total irrigated acreage expanded by a factor of about seven to a total land area of over one million square miles. The benefits of this achievement do not come without costs, however. Some of these costs are directly related to the environmental impacts on soils, water, and aquatic species. How can one account for these costs or utilize them in decision making? The editors of this book bring together previously published journal articles to help answer this question.

Edward Elgar Publishing, based in the United Kingdom, has created "The Management of Water Resources" series of which this book is the first of five. The other titles are *Water Resources and Climate Change*, *Water Resources and Economic Development*, *The Economics of Industrial Water Use*, and *Conflict Prevention and Resolution in Water Systems*.

The editors of *Irrigated Agriculture and the Environment* are from Pennsylvania State University and Texas A&M University, respectively, and work in the area of resource/environmental economics. They have pulled together 18 journal articles dating from 1982 through 1999, with most of the articles from the 1990s. The source journals are the *American Journal of Agricultural Economics*, *Environmental Resource Economics*, *Journal of Agricultural and Resource Economics*, *Journal of Environmental Economics and Management*, *Natural Resources Journal*, and *Water Resources Research*. In the introductory chapter titled "Economic Perspectives on Irrigated Agriculture and the Environment," the editors state, "In this volume we present a sampling of economic research concerning irrigated agriculture's interfaces with the environment." This first chapter is a must read as it sets the tone and texture for the organization of the book.

The articles are organized into three parts. Part I, Pollution Control Instruments for Irrigated Agriculture, brings together the largest grouping of articles, eight, to speak to two questions. The first question is what are the appropriate bases for defining and measuring environmental compliance. Common measures have been inputs (applied water, fertilizers, and pesticides), outflows (concentrations in surface and subsurface return flows), or changes in concentrations in the receiving water. In addition to the concentration, we must now consider the TMDL, or Total Maximum Daily Load, of a pollutant to a water body. The second question is how to induce changes at the farm level that lead to improved water quality. Regulations, of course, are one way to induce change, but there may be economic incentives that work as well. The editors are careful to delineate the difference between point source pollution sources, which are easier to recognize, measure, and control, and non-point source pollution (such as agricultural activities), which is more difficult to track either from the source or back to the source. The editors chose to open part I with "Agricultural Runoff as a Nonpoint Externality: A Theoretical Development" by Ronald C. Griffin and Daniel W. Bromley from the *American Journal of Agricultural Economics* (1982), which the editors cite as a particularly influential article. This first article quickly points out a consistency in the entire collection, mathematical modeling is important in framing the paradigm, quantifying the components, and estimating the effects of tradeoffs. The articles not only highlight the use of single focus models, but also of interdisciplinary, integrated models. Although not necessary for every

article, it is clear that the reader will gain much more from the entire collection if he/she has a good understanding of mathematics and economic modeling.

Part II, Salinity and Water Allocation, presents four articles that speak to an immensely important problem in the arid and semi-arid Southwest, how to use water to keep soils from becoming too salty for plant growth without contaminating surface and ground water with return flows. The papers take on a variety of scales of the problem from the individual farmer up to the entire Colorado River basin. The editors use the word "problemshed" to describe the Colorado River, a word that is very appropriate for our own Rio Grande.

Part III, Water Reallocation and the Environment, contains the remaining six articles. It is in this part that instream flow benefits, including enhanced habitat for endangered species, are considered. The editors have chosen to include "Water Allocation in the American West: Endangered Fish Versus Irrigated Agriculture" by M.R. Moore, A. Mulville, and M. Weinberg, which appeared in the Spring 1996 volume of this very publication, the *Natural Resources Journal*. The last article in this part, and in the book, "Limiting Pumping from the Edwards Aquifer: An Economic Investigation of Proposals, Water Markets, and Spring Flow Guarantees" by B.A. McCarl, C.R. Dillon, K.O. Keplinger and R. Lynn, is of note because it recognizes the interconnect between ground water and surface water. The authors account for groundwater pumping in the economic model that was developed. This type of tradeoff between pumping and surface water flow is a very important aspect of water management in alluvial valleys of the west.

The editors note that the articles they have chosen to include in this volume were selected to provide both theoretical and empirical guidance for the different topic areas as grouped into the three parts. They also state that what was included, or not included, in the volume was their responsibility. Anytime one makes a "best of" list, someone else will point out the failings of those included or the virtues of those that were not. I believe that the editors have pulled together an interesting group of articles that will appeal to resource economists and water managers who are interested in the impact of agriculture on water resources. I do caution again that one should have a good understanding of economic modeling and mathematics to understand many of the articles.

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Life Support: The Environment and Human Health. Edited by Michael McCally. Cambridge, MA: MIT Press, 2002. Pp. 312. \$19.55 paper.