

Palgrave Studies in Agricultural Economics
and Food Policy

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Agricultural and food policy lies at the heart of many pressing societal issues today and economic analysis occupies a privileged place in contemporary policy debates. The global food price crises of 2008 and 2010 underscored the mounting challenge of meeting rapidly increasing food demand in the face of increasingly scarce land and water resources. The twin scourges of poverty and hunger quickly resurfaced as high-level policy concerns, partly because of food price riots and mounting insurgencies fomented by contestation over rural resources. Meanwhile, agriculture's heavy footprint on natural resources motivates heated environmental debates about climate change, water and land use, biodiversity conservation and chemical pollution. Agricultural technological change, especially associated with the introduction of genetically modified organisms, also introduces unprecedented questions surrounding intellectual property rights and consumer preferences regarding credence (i.e., unobservable by consumers) characteristics. Similar new agricultural commodity consumer behavior issues have emerged around issues such as local foods, organic agriculture and fair trade, even motivating broader social movements. Public health issues related to obesity, food safety, and zoonotic diseases such as avian or swine flu also have roots deep in agricultural and food policy. And agriculture has become inextricably linked to energy policy through biofuels production. Meanwhile, the agricultural and food economy is changing rapidly throughout the world, marked by continued consolidation at both farm production and retail distribution levels, elongating value chains, expanding international trade, and growing reliance on immigrant labor and information and communications technologies. In summary, a vast range of topics of widespread popular and scholarly interest revolve around agricultural and food policy and economics. The extensive list of prospective authors, titles and topics offers a partial, illustrative listing. Thus a series of topical volumes, featuring cutting-edge economic analysis by leading scholars has considerable prospect for both attracting attention and garnering sales. This series will feature leading global experts writing accessible summaries of the best current economics and related research on topics of widespread interest to both scholarly and lay audiences.

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Sustainable Agricultural Development

An Economic Perspective

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Foreword

Modern worries about environmental degradation focus appropriately on anthropogenic causes, that is, on the human behaviors that despoil air, climate, land, and water and imperil nonhuman species. Agriculture is among the human activities that most intimately links our behaviors to natural systems, with bidirectional feedback since the state of natural systems heavily influences agricultural productivity just as agricultural practices regulate the ecosystems in which they take place. Ever since humankind began domesticating plants and animals for agricultural production several millennia ago, our species has been actively changing natural ecosystems, altering them to suit our consumptive and aesthetic purposes. But climate, water quality, biodiversity loss, deforestation, and other environmental crises have emerged due to our imperfect understanding of the complex feedback intrinsic to agroecosystems, spillover effects that make it easy for decision-makers to ignore the full range of consequences of our actions, and present biased preferences. So today we face multiple environmental crises, each directly linked to agriculture.

The world has confronted agriculture-related crises before; we can learn from past experience. For example, roughly fifty years ago, Malthusian concerns about rapid human population growth, a global food price spike, and recurring famines in the late 1960s and early 1970s led to a world food crisis. This episode rapidly concentrated policymakers' and researchers' attention on global hunger. Major investments

followed, focusing on rapidly expanding the supply of staple cereals, roots, and tubers that comprise the base diets of the poor worldwide, and launching and expanding social protection policies with food assistance programs as a centerpiece. The resulting Green Revolution, global early warning systems, and dramatic expansion of cash and in-kind transfer programs successfully drove down real food prices and virtually eliminated famines for several decades. The core objective of averting mass hunger was accomplished. For two generations now, the world has been providing adequate calories for roughly ninety million additional people year after year, a remarkable accomplishment.

But success in addressing the world food crisis of the 1970s by targeting global hunger came with a heavy environmental price, on which world leaders are now appropriately concentrating, manifest in the sustainable development goals and related declarations. Moreover, environmental degradation now threatens the agricultural productivity and nutritional gains of recent decades. Extreme climate events and soil and water degradation have contributed to modest upticks in the number of undernourished people globally the past three years. It is (past) time to shift objectives: to safeguard the planet while maintaining agricultural productivity growth on which economic development fundamentally depends; hence, the importance of sustainable agriculture, and of this book.

In this impressive volume, John Antle and Srabashi Ray lucidly explain the intricate interrelationships between agriculture and the environment, the path followed over the past half century as the world focused almost single-mindedly on growing global per capita calorie supplies, the environmental impacts of modern agricultural practices, and the current state of the debate on sustainable agriculture. Most importantly, they carefully lay out the tradeoffs intrinsic to the choices faced by farmers, agribusinesses, government policymakers, and individual consumers. They also flag where synergies might arise, where economic and environmental advance might be mutually reinforcing through agricultural development.

Ultimately, Antle and Ray offer a hopeful analysis. We have faced and overcome agriculture-related crises before and can do so again. But this is not an easy task. It will take political will, but it will equally require outstanding science. Some technological and institutional changes can foster total factor productivity growth that enables simultaneous improvements

in agricultural, economic, environmental, and social indicators. But more generally, we face tradeoffs that must be assessed carefully and honestly. This requires marshaling evidence and insights from multiple disciplines, a task for which few, if any, scientists are better equipped than John Antle. Careful analysis and accurate data are essential to evaluate these tradeoffs, to find the feasible sustainable agricultural development paths, and avoid the dangers of either continued environmental degradation or increased unnecessary undernutrition. For a generation, Professor Antle has been advancing the research frontier in developing our analytical tool kit for tradeoffs analysis. His work with Ray and other coauthors uniquely equips these authors to guide the reader through the myriad issues that link ever-changing agricultural practices to economic and environmental outcomes of global importance. Indeed, they are the ideal intellectual guides for those of us interested in this topic.

The powerful insights Antle and Ray offer in this volume are too numerous to summarize in this brief foreword. In refreshingly clear prose, this outstanding volume lays out the central issues in accessible terms and compactly summarizes a deep and complex literature with remarkable precision and rigor. Serious students of sustainable agriculture need to read this volume.

It is a great pleasure to include John Antle and Srabashi Ray's excellent volume in the Palgrave Studies in Agricultural Economics and Food Policy series. I learned a good deal by reading it and expect many others will as well. This book should prove an essential reference to anyone striving to understand the origins and evolution of agricultural and food policy in modern society.

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Christopher B. Barrett

Preface

Sustainability is now widely accepted as a guiding concept and goal for our economies and societies, and for agriculture and the food system. But it is also widely accepted that modern societies, as well as agriculture and the food system, are now on largely unsustainable trajectories. We have entered the Anthropocene, the era in which humans are the dominant force affecting the state of Earth systems on which life depends. One of the grand challenges facing humanity is to put itself on a sustainable trajectory.

We conclude this book by saying that there is reason for cautious optimism that we can meet this challenge in the coming decades. Fifty years ago, many people justifiably doubted the ability of the world to feed itself, and ‘limits to growth’ were predicted as humans exhausted natural resources such as oil. Despite a rapidly growing world population, those dire prospects were avoided through applications of science and technology as well as institutional and policy innovations. Humans created a remarkable global food system that allows more people than ever before to have more than adequate diets and attain the longest life expectancy in history. Much of this progress was possible because humans developed ways to discover and use more fossil fuels than once was thought possible.

But these very successes in agricultural development, and in fossil-fueled economic development, have created huge challenges in environmental and social dimensions that were largely unanticipated until

recently. Just as the abundance of fossil fuels turns out to be the largest obstacle to a stable and livable climate, the indiscriminate pursuit of cheap calories has led agriculture and the food system down an unsustainable pathway.

The good news is that we now have many tools that can be used to design and build more sustainable agricultural systems, and we introduce the reader to some of them in this book. Using these tools, researchers, together with stakeholders, are making progress to identify the changes in household and producer behavior that could limit climate change to 1.5 °C, and they are moving agriculture and the food system in more sustainable directions. First and foremost, we know that to limit climate change, the global energy system must move rapidly away from reliance on fossil fuels. But also, agriculture and the food system must change—for example, recent studies show that substantially reducing meat consumption could have a large impact on greenhouse gas emissions and have other environmental and health benefits. At the same time, meat production, consumption, and trade are growing rapidly, particularly in the regions of the world undergoing the transition from low- to middle-income status. And, many people argue that increasing meat consumption can play a valuable role in improving the nutrition in the poor regions of the world. What is lacking in the debate over sustainable development, in our view, is to go beyond the identification of goals and the design of possible sustainable development pathways, to implement feasible actions—technologies and policies—that will move today’s agricultural systems in more sustainable directions.

In this book, we provide an explanation—from the perspective of economics—for this gap between goals and the state of the world. A central theme of this book is that agricultural systems are complex, diverse, and heterogeneous. These characteristics mean that there are various synergies and tradeoffs as we attempt to improve the performance of agricultural systems. And for the most part, attempts to change them focus on particular aspects of their performance. Yet, as we show in this book, there are multiple important factors in each of the three dimensions of sustainability—economic, environmental, and social. This means that there are rarely simple, one-size-fits-all solutions, and there will inevitably be winners and losers as the systems change. The example of the recent expansion

of deforestation in the Amazon driven by economic and policy changes in China and the United States is but one example of this complexity. Addressing such challenges requires an understanding of the systems, as well as an effective participatory process to envision and design feasible pathways. It also requires implementation strategies that mobilize consumers, food producers, and all of civil society to work toward solutions.

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We'd like to thank Chris Barrett for the opportunity to contribute to this book series, and Sophia Siegler for keeping us on a sustainable pathway toward a successful book. Over the years, John Antle has benefitted from many productive collaborations around the topic of this book. Srabashi Ray is grateful to peers, mentors, friends, and family for their support and encouragement in her professional endeavors. Thanks to all.

Praise for *Sustainable Agricultural Development*

“This important book clearly lays out the complex challenges facing agricultural development at local-to-global scales. Despite the great success of the current food system, it faces two major issues: climate change and malnutrition. Through their economic lens, the authors explicate the participatory processes and analytical tools needed to find solutions to these challenges. They offer pathways to sustainable agricultural development for both developing and high-income countries, focusing on methods by which to create them. The Agricultural Model Intercomparison and Improvement Project (AgMIP) welcomes this insightful book, and will utilize its methods in major assessments of climate change and the global food system.”

—Cynthia Rosenzweig, *Senior Research Scientist, NASA Goddard Institute for Space Studies and the Earth Institute*

“Antle and Ray provide a comprehensive assessment of the synergies and trade-offs in achieving sustainable development with a much needed focus on food and agricultural systems. This book provides timely input to the current debates and controversies around the state and future of global food systems. The authors’ cautious optimism that we will eventually get it right and will embark on a path of sustainable development at the local and global scales is appealing. A must read for all of us interested in a future world that can sustainably feed nine billion people.”

—Prabhu Pingali, *Professor of Applied Economics, Cornell University*

“Finding pathways to sustainable development is the challenge of our time. Antle and Ray provide a readable, non-technical account of the central role that agriculture must play in meeting that challenge. Using examples from developing and industrialized regions, they explain the concepts and analytics that are used by scientists and economists to design more sustainable agricultural development pathways. Essential reading for anyone who wants to understand agriculture’s role in sustainable development.”

—Pramod Aggarwal, *South Asia Research Program Director, Research Program on Climate Change, Agriculture and Food Security*

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Abbreviations

AgMIP	Agricultural Model Inter-comparison and Improvement Project
BCA	Benefit-Cost Analysis
BMI	Body Mass Index
CAADP	Comprehensive Africa Agriculture Development Program
CFC	Chlorinated Fluorocarbons
CGIAR	Consultative Group for International Agricultural Research
ERS	Economic Research Service
EU	European Union
FABLE	Food, Agriculture, Biodiversity, Land, and Energy
FAIR	Findable, Accessible, Interoperable, and Reusable
FAO	Food and Agriculture Organization
FIES	Food Insecurity Experience Scale
GAEZ	Global Agro-Ecological Zone
GDP	Gross Domestic Product
GHG	Green House Gas
GMO	Genetically Modified Organism
GNI	Gross National Income
GR	Green Revolution
GYGA	Global Yield Gap Atlas
HDDS	Household Dietary Diversity Score
HFSSM	Household Food Insecurity Access Scale
IBFS	Income-Based Food Security
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics

xx Abbreviations

IFPRI	International Food Policy Research Institute
IGP	Indo-Gangetic Plain
IPCC	Intergovernmental Panel on Climate Change
IPL	International Poverty Line
IPM	Integrated Pest Management
MOSPI	Ministry of Statistics and Programme Implementation
NBS	National Bureau of Statistics
NCP	North China Plain
NECP	Northeast China Plain
OECD	Organisation for Economic Co-operation and Development
PRD	Pearl River Delta
RCP	Representative Concentration Pathway
RCT	Randomized Controlled Trial
RIA	Regional Integrated Assessment
SB	Sichuan Basin
SDG	Sustainable Development Goal
SSP	Shared Socioeconomic Pathway
TOA-MD	Tradeoff Analysis Model for Multi-Dimensional Impact Assessment
UN	United Nations
US	United States
WEAI	Women's Empowerment in Agriculture Index
YP	Yangtze Plain

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