

P.K.Rao

Sustainable Development

ECONOMICS
AND POLICY



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Sustainable Development

Economics and Policy

P. K. RAO

Center for Development Research Princeton, NJ

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Preface

A comet may not strike the planet Earth during the next 500,000 years but a doubling of the emissions of greenhouse gases could occur in about 50 years. So what? Anyone who entertains this question may not necessarily be in the class of anti-environmentalists. It is the humble duty of those who may have some answers to enunciate the same. Besides, the issues of sustainable development are not simply those of the environment and society; an integrated set of elements deserves serious consideration in the development of relevant methods and policies. This book is an effort in that direction; it is aimed at educating those who have never heard of the "green life" beyond perhaps green tea or the green color of the monetary instruments in some countries.

Policymakers, researchers, students in graduate and senior undergraduate education will find this book useful for formal and applied analyses relevant in the short run as well as in the longer horizon. Chapters 3 to 5 could pose a few technical or analytical hurdles for those readers who do not enjoy calculus for any reason (or even no reason!). Some of the appendices and boxed material are geared to smooth the consumption of the contents of the book. If some of the review exercises are very demanding, and should not be underestimated; some of these exercises enhance the possibilities of exploring additional avenues of learning for all of us. They also serve as reminders that advancement of knowledge is a strong prerequisite for sustainable development.

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Abbreviations

ADB	Asian Development Bank
AfDB	African Development Bank
ALTY	average long-term yield
BAU	business as usual
BCSD	Business Charter for Sustainable Development
BOD	biochemical oxygen demand
BOP	balance of payments
BSI	British Standards Institute
CARE	Center for American Relief Everywhere
CBA	cost-benefit analysis
CC	carrying capacity
CDM	clean development methods
CE	carbon equivalent
CEMP	Code of Environmental Principles
CEPA	classification of environmental protection activities
CERES	Center for Environmentally Responsible Economics
CFCs	chlorofluorocarbons
CGAP	consultative group to assist the poorest
CSCE	Convention on security cooperation in Europe
CTE	Committee on Trade and Environment
CV	contingent valuation
DALY	disability-adjusted life years
DDT	dichlorodiphenyltrichloroethane
DEC	depreciation of environmental capital
DFE	design for environment
DICE	dynamic intergrated model of climate and the economy
DNA	deoxyribonucleic acid
DNC	depreciation of natural capital
DNS	debt-for-nature swaps
DPC	depreciation of productive capital

DSR	driving-force-state-response
EAI	Enterprise for the Americas Initiative
EBRD	European Bank for Reconstruction and Development
EDE	environmentally defensive expenditures
EDF	Environmental Defense Fund
EDP	environmentally adjusted net domestic product
EKC	environmental Kuznets curve
EMAS	Eco-management and audit scheme
EMS	environmental management system
ESPF	Earth Summit Plus Five
EV	existence value
FAO	Food and Agriculture Organization
FDI	foreign direct investment
FFB	fresh fruit bunches
G3OSs	GCOS, GOOS, and GTOS
GATT	General Agreement on Tariffs and Trade
GCI	Global Carbon Initiative
GCMs	global circulation models
GCOS	Global Climate Observing System
GDP	gross domestic product
GE	greenhouse effect
GEF	Global Environmental Facility
GHG	greenhouse gas
GNP	gross national product
GOOS	Global Ocean Observing System
GPP	gross primary production
GREEN	general equilibrium environmental
GTOS	Global Terrestrial Observing System
GWP	global warming potential
HCFCs	hydrochlorofluorocarbons
HFCs	hydrofluorocarbons
HIPC	heavily indebted poor countries
IBRD	International Bank for Reconstruction and Development
ICBG	International Cooperative Biodiversity Groups
ICJ	International Court of Justice
ICPD	International Conference on Population and Development
ICREA	International Commodity-related Environmental Agreement
ICSU	International Council of Science Unions
IDA	International Development Association
IDRF	IDA Debt Reduction Facility
IEEA	integrated economic and environmental accounting
IFAD	International Fund for Agriculture and Development
IFC	International Finance Corporation
ILO	International Labour Office
IMF	International Monetary Fund
IMO	International Maritime Organization

INCD	International Convention to Combat Desertification
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
IPF	Intergovernmental Panel on Forests
IPR	intellectual property rights
ISEW	index of sustainable economic welfare
ISO	International Standards Organization
IUCN	The World Conservation Union
IUR	inverted U relationship
LCA	life-cycle analysis
LESS	low CO ₂ – emitting energy supply systems
LPG	liquefied petroleum gas
LSMS	living standards measurement survey
MCPF	marginal cost of public funds
MEA	multilateral environmental agreement
MED	marginal environmental damages
MEW	measure of economic welfare
MFMP	Multilateral Fund for the Montreal Protocol
MIGA	Multilateral Investment Guarantee Agency
MSY	maximum sustainable yield
NDP	net domestic product
NEAP	national environment action plan
NGO	non-governmental organization
NIH	National Institutes of Health
NNP	net national product
NPP	net primary productivity
NPV	net present value
NRDC	Natural Resources Defense Council
NSF	National Science Foundation
NSW	net social welfare
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
OLG	overlapping generations
ONUV	other nonuse value
OPEC	Oil Producing and Exporting Countries
OPIC	Overseas Private Investment Corporation
OV	option value
PCR	polymerase chain reaction
PDIV	potential direct instrument value
PFCs	perfluorocarbons
3P	polluter pays principle
PP	precautionary principle
ppb	parts per billion
ppm	parts per million
PPP	purchasing power parity
ppt	parts per trillion

PR	producer rate of interest
PSA	positive social amenities
QA	quality assurance
QUELRO	quantified carbon emission limitation and reduction commitment
R&D	research and development
RNNP	revised net national product
SAL	structural adjustment lending
SAP	structural adjustment program
SCBA	social cost–benefit analysis
SD	sustainable development
SDA	social disamenities
SDR	social discount rate
SEEA	system of integrated environmental and economic accounting
SMS	safe minimum standard
SNA	system of national accounts
S RTP	social rate of time preference
SSD	strong sustainable development
SSNNP	sustainable social net national product
TEP	tradable emission permit
TEV	total economic value
TQM	total quality management
TRIPS	trade-related intellectual property rights
UN	United Nations
UNCBD	UN Convention on Biological Diversity
UNCED	UN Conference on Environment and Development
UNCSD	UN Commission on Sustainable Development
UNCTAD	UN Conference on Trade and Development
UNDP	UN Development Programme
UNDPCSD	UN Department for policy coordination and sustainable development
UNEP	UN Environment Programme
UNESCO	UN Educational Scientific and Cultural Organization
UNFCCC	UN Framework Convention on Climate Change
UNFPA	UN Fund for Population Activities
UNICEF	UN Children’s Fund
UNIDO	UN Industrial Development Organization
UNIFEM	UN Development Fund for Women
USAID	US Agency for International Aid
USEPA	US Environmental Protection Agency
USGS	US Geological Service
UV	ultra violet
UV	use value
UV-B	ultra violet B
VOC	volatile organic compound
WCED	World Commission on Environment and Development
WFP	World Food Programme

WHO	World Health Organization
WMO	World Meteorological Organization
WTO	World Trade Organization
WTP	willingness-to-pay
WWF	World Wide Fund For Nature (formerly known as World Wildlife Fund)

Chemical Symbols

CFCs	chlorofluorocarbons
CH ₄	methane
Cl ₂	molecular chlorine
CO	carbon monoxide
CO ₂	carbon dioxide
H ₂	molecular hydrogen
HCFCs	hydrochlorofluorocarbons
H ₂ O	water
N ₂	molecular (ordinary) nitrogen
N ₂ O	nitrous oxide
NO	nitric oxide
NO ₂	nitrogen dioxide
NO _x	nitrogen oxide
O	oxygen
O ₂	molecular (ordinary) oxygen
O ₃	ozone
OH	hydroxyl radical
SO ₂	sulfur dioxide
SO _x	sulfur oxide

Contents

<i>List of Boxes</i>	ix
<i>List of Figures</i>	x
<i>List of Tables</i>	xi
<i>Preface</i>	xii
<i>List of Abbreviations</i>	xiv
<i>List of Chemical Symbols</i>	xix
Chapter 1 A BRIEF HISTORY	1
● 1.1 Introduction	3
● 1.2 The Earth Summit	10
● 1.3 More Recent Events	15
● 1.4 Effectiveness of Policies	16
● 1.5 Moving Ahead	19
Appendix: Chronology of International Events	23
Major International Environmental Agreements	25
Review Exercises	27
References	27
Chapter 2 RESOURCES AND THE ENVIRONMENT	31
● 2.1 Introduction	33
● 2.2 Source and Sink Problems	34
● 2.3 The Population Problem	38
● 2.4 Natural Resources	41
● 2.5 Environmental Features	49
● 2.6 Conclusions	61
Review Exercises	62
References	63

Chapter 3	SUSTAINABLE DEVELOPMENT: INTERPRETATIONS	67
● 3.1	Introduction	69
● 3.2	Resilience, Nonlinearity, and Irreversibility	71
● 3.3	Biogeophysical and Ecological Aspects	77
● 3.4	Economic Approaches	84
● 3.5	Economic Growth and Sustainability	94
● 3.6	The Precautionary Principle (PP)	100
● 3.7	Conclusions	102
	Appendix: Optimal Sustainable Development Models	103
	Review Exercises	106
	References	107
Chapter 4	VALUING RESOURCES AND THE FUTURE	111
● 4.1	Introduction	113
● 4.2	General Methods of Valuation	114
● 4.3	Economics of Exhaustible Resources	124
● 4.4	Cost–Benefit Analysis (CBA)	129
● 4.5	Endogenous Preferences	133
● 4.6	Choice of Discount Rates	138
● 4.7	Net National Product (NNP)	149
● 4.8	Conclusions	152
	Appendix: NNP and Sustainability	153
	Review Exercises	157
	References	158
Chapter 5	MANAGING THE GLOBAL COMMONS	163
● 5.1	Introduction	165
● 5.2	Global Commons	166
● 5.3	Climate Change	172
● 5.4	Global Warming Potential (GWP)	175
● 5.5	Economics of the Greenhouse Effect (GE)	180
● 5.6	Stabilization of GHGs	186
● 5.7	Economics of Green Taxes	195
● 5.8	Conclusions	199
	Review Exercises	200
	References	200
Chapter 6	ENVIRONMENTAL ACCOUNTING	205
● 6.1	Introduction	207
● 6.2	Environmental Damage and Resource Depletion	208
● 6.3	Green National Accounts	213
● 6.4	Integrated Economic and Environmental Accounting (IEEA)	222
● 6.5	Indicators of SD	224
● 6.6	Conclusions	228

Review Exercises	228
References	230
Chapter 7 POVERTY AND THE ENVIRONMENT	233
● 7.1 Introduction	235
● 7.2 Trends in Poverty	236
● 7.3 Poverty, Prosperity, and the Environment	239
● 7.4 Gender Aspects	246
● 7.5 Poverty Reduction and Sustainability	249
● 7.6 Policy Alternatives and Political Economy	252
● 7.7 Conclusions	255
Review Exercises	256
References	257
Chapter 8 TRADE, DEBT, AND THE ENVIRONMENT	259
● 8.1 Introduction	261
● 8.2 International Trade and the Environment	262
● 8.3 Reflecting Environmental Costs in Trade	272
● 8.4 Debt, Generational Accounting, and Sustainability	279
● 8.5 International Debt and the Environment	282
● 8.6 Conclusions	290
Review Exercises	291
References	292
Chapter 9 GOVERNANCE AND THE PRIVATE SECTOR	295
● 9.1 Introduction	297
● 9.2 Environmental Markets and the Environment Industry	299
● 9.3 Compliance and Beyond	306
● 9.4 Standards and Certification	312
● 9.5 Financial Institutions and the Environment	314
● 9.6 Conclusions	318
Review Exercises	318
References	319
Chapter 10 INTERNATIONAL INSTITUTIONS	321
● 10.1 Introduction	323
● 10.2 International Financial Institutions	324
● 10.3 Structural Adjustment and the Environment	329
● 10.4 International Agreements and Compliance	334
● 10.5 Indigenous People, Knowledge, and Globalization	338
● 10.6 Conclusions	342
Review Exercises	342
References	343

Chapter 11	POLICY FRAMEWORK	345
● 11.1	Introduction	347
● 11.2	Sustainable Economy and Green Policies	348
● 11.3	International Sharing of Responsibilities	353
● 11.4	Multilevel Framework	358
● 11.5	Concluding Observations	366
	Review Exercises	368
	References	369
<i>Web Site Addresses</i>		371
<i>Glossary</i>		378
<i>Index</i>		390

Boxes

1.1	Main Principles of Agenda 21	11–13
2.1	Endemic species and habitat area	47
3.1	Important concepts – biogeophysics and ecology	71–2
3.2	Chesapeake Bay and sustainability	79
3.3	Conflicts in survival and the environment – Bangladesh	80
3.4	Perspectives on sustainability	84
4.1	Estimates of Nature’s services	120
4.2	Borivili National Park – Bombay (Mumbai) case study	124
4.3	Concepts and definitions – resource economics	126–7
4.4	Hyperbolic discount functions	146
5.1	Ozone hole	171
5.2	Global warming potential – formulae	179
5.3	Sequestering carbon in the Amazon	192
6.1	National level environmental accounting	221
7.1	The poor (people) and the rich (forests)	241
8.1	World Trade Organization and the environment	268–9
8.2	Multilateral environmental agreements	270
8.3	Palm oil cost internalization – Malaysia	274
8.4	Primary commodity exporters and debts	279
8.5	Paris Club Naples Terms	286
9.1	Pollution trading example – California	301
9.2	Corporate initiatives	307–8
9.3	Environmental rating companies	316
10.1	Water (resources) and the (World) Bank	326
10.2	International fisheries disputes	336
11.1	The Prisoner’s Dilemma	354
11.2	Sub-sectoral focus: Pesticides	363
11.3	SD: Priorities and effective instruments	365

Figures

2.1	The greenhouse effect enhancement	51
3.1	Relationship between fitness of an organism and chemical concentrations	73
3.2	Interdependencies of resilience and human welfare	75
3.3	Schematic representation of SD	91
3.4	Environmental Kuznets curve	97
4.1	Equilibria and resilience	115
4.2	Ingredients of TEV	121
4.3	Alternative concepts of equilibria	132