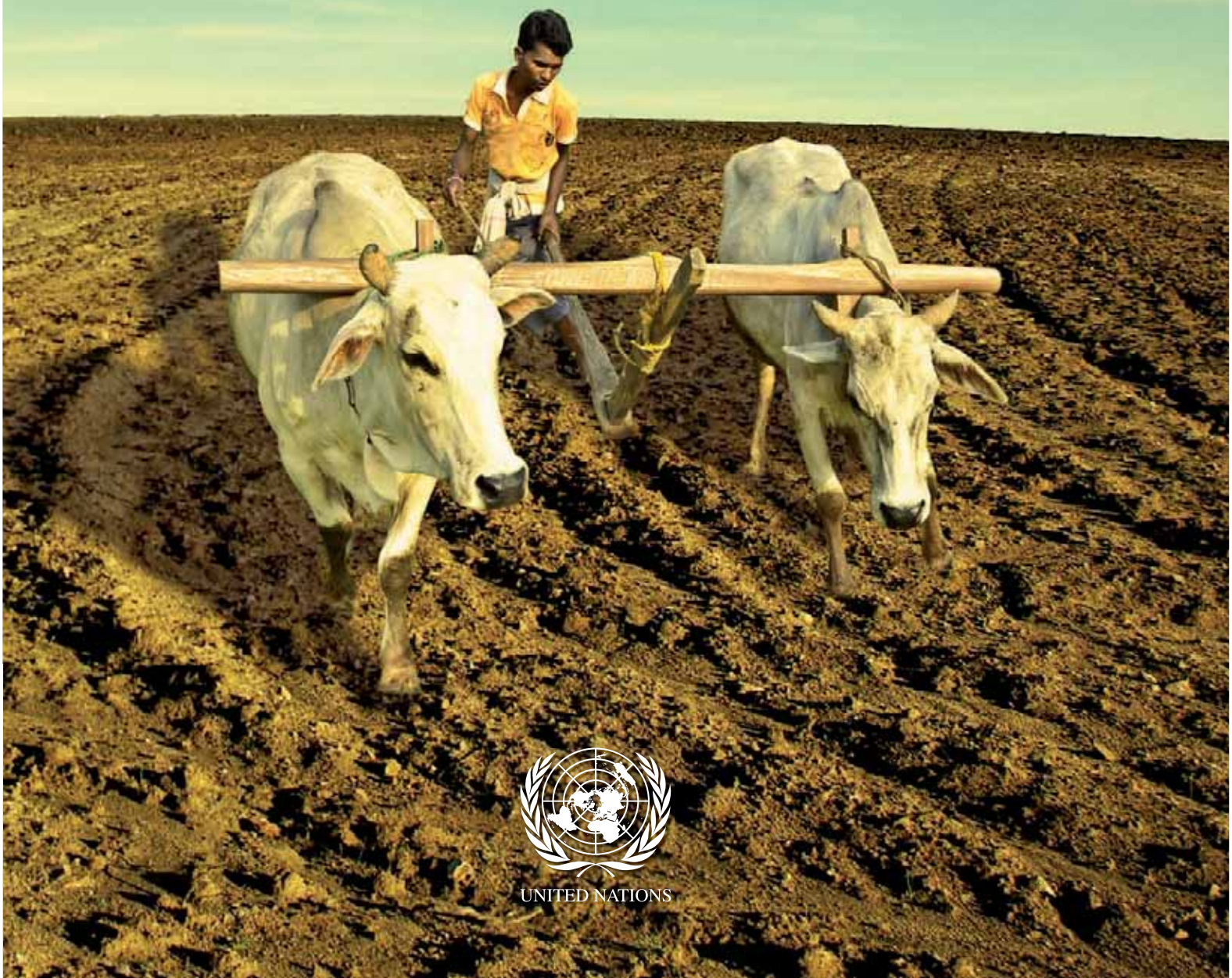
UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

TRADE AND ENVIRONMENT REVIEW 2013

WAKE UP BEFORE IT IS TOO LATE

MAKE AGRICULTURE TRULY SUSTAINABLE NOW FOR FOOD SECURITY IN A CHANGING CLIMATE



UNITED NATIONS

KEY MESSAGES

- **The 2008 food crisis was an important catalyst for realizing the need for a fundamental transformation and questioning some of the assumptions that had driven food, agricultural and trade policy in recent decades.** However, actual results achieved since 2008 suggest that a paradigm shift has started, but is largely incomplete. Priority remains heavily focused on increasing industrial agricultural production, mostly under the slogan "growing more food at less cost to the environment". The perception that there is a supply-side productivity problem is however questionable. Hunger and malnutrition are mainly related to lack of purchasing power and/or inability of rural poor to be self-sufficient. Meeting the food security challenges is thus primarily about empowerment of the poor and their food sovereignty. Furthermore, the current demand trends for biofuels, concentrate animal feed, excessively meat-based diets and post-harvest food waste are regarded as given, rather than challenging their rational.
- **The fundamental transformation of agriculture may well turn out to be one of the biggest challenges, including for international security, of the 21st century.** Much slower agricultural productivity growth in the future, a quickly rising population in the most resource-constrained and climate-change-exposed regions (in particular in sub-Saharan Africa and South Asia) and a burgeoning environmental crises of agriculture are the seeds for mounting pressures on food security and the related access to land and water. This is bound to increase the frequency and severity of riots, caused by food-price hikes, with concomitant political instability, and international tension, linked to resource conflicts and migratory movements of staving populations.
- **The world needs a paradigm shift in agricultural development: from a "green revolution" to an "ecological intensification" approach.** This implies a rapid and significant shift from conventional, monoculture-based and high-external-input-dependent industrial production towards mosaics of sustainable, regenerative production systems that also considerably improve the productivity of small-scale farmers. We need to see a move from a linear to a holistic approach in agricultural management, which recognizes that a farmer is not only a producer of agricultural goods, but also a manager of an agro-ecological system that provides quite a number of public goods and services (e.g. water, soil, landscape, energy, biodiversity, and recreation).
- **The required transformation is much more profound than simply tweaking the existing industrial agricultural system.** Rather, what is called for is a better understanding of the multi-functionality of agriculture, its pivotal importance for pro-poor rural development and the significant role it can play in dealing with resource scarcities and in mitigating and adapting to climate change. However, the sheer scale at which modified production methods would have to be adopted, the significant governance issues, the power asymmetries' problems in food input and output markets as well as the current trade rules for agriculture pose considerable challenges.
- **Elements and key achievements of the required transformation of agriculture, elaborated upon by the authors of this Review, include:**
  - Increasing soil carbon content and better integration between crop and livestock production, and increased incorporation (not segregation) of trees (agroforestry) and wild vegetation.
  - Reduction of direct and indirect (i.e. through the feed chain) greenhouse-gas emissions of livestock production.
  - Reduction of indirect (i.e. changes in land-use-induced) GHG emissions through sustainable peatland, forest and grassland management.
  - Optimization of organic and inorganic fertilizer use, including through closed nutrient cycles in agriculture.
  - Reduction of waste throughout the food chains.
  - Changing dietary patterns towards climate-friendly food consumption.
  - Reform of the international trade regime for food and agricultural products.
- **In pursuing a fundamental transformation of agriculture, one should take into account systemic considerations** in particular (i) the need for a holistic understanding of the challenges involved due to inter-linkages between sometimes competing objectives; (ii) the merits and demerits of single climate-friendly practices versus those of systemic changes (such as agro-ecology, agro-forestry, organic agriculture); and (iii) the need for a two-track approach that drastically reduces the environmental impact of conventional agriculture, on the one hand, and broadens the scope for agro-ecological production methods, on the other.

Note

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UNCTAD/DITC/TED/2012/3
UNITED NATIONS PUBLICATION

ISSN 1810-5432

Foreword

Not long after the 2008-2009 food price crisis, high and volatile food prices are back in the international agenda creating renewed concerns for world food security. Once again, discussions are mostly focused on suggesting quick-fixes linked to some specific contributing factors, such as food price speculation or the increasing use of bio-energy. Insufficient attention is being paid to the fact that the increasing energy intensity of agricultural production and the direct and indirect link between agricultural and fuel prices was among the underlying factors that triggered the 2008 crisis and now contributes again to the current round of food price escalation. Furthermore, the recent drought affecting the main US grain production zones, putting upward pressure on international grain prices, is an incident now increasingly frequent and widespread with global warming. As this Review highlights, agriculture is not only chiefly affected by global warming but also one of its driving forces. Quick fixes will not be able to effectively deal with the complex interplay between energy intensity, greenhouse gas emissions, global warming and food security needs. Rather, what is called for is a better understanding of the multi-functionality of agriculture, its pivotal importance for pro-poor rural development and the significant role it can play in dealing with resource scarcities and in mitigating and adapting to climate change.

Despite significant increases in agricultural productivity and the fact that the world currently already produces sufficient calories per head to feed a global population of 12-14 billion, hunger has remained a key challenge. Around one billion people chronically suffer from starvation and another billion are mal-nourished. Some 70 per cent of these people are themselves small farmers or agricultural laborers. Therefore, hunger and mal-nutrition are not phenomena of insufficient physical supply, but results of prevailing poverty, and above all problems of access to food. Enabling these people to become food self-sufficient or earn an appropriate income through agriculture to buy food needs to take center stage in future agricultural transformation. Millennium Development Goal number one is bound to be missed, mainly because agriculture has not received the attention it deserves for achieving food security and as an engine of sustainable economic, social and environmental development in developing countries.

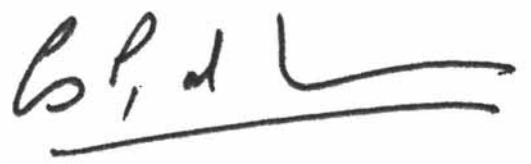
No doubt, the 2008 food-price crisis led to a reversal of the long-term neglect of agriculture as a vital economic sector in developing countries. Also, the declining trend of public funding for agriculture was arrested and some new funding has recently been committed. However, the implementation of these commitments lacks way behind requirements. One does neither see the necessary level of urgency nor the political willingness, from the international community, for drastic changes. Priority remains heavily focused on increasing production (mostly under the slogan “more with less”). The currently pursued approach is still very much biased towards expansion of “somewhat-less-polluting” industrial agriculture, rather than more sustainable and affordable production methods. It is still not recognized that a paradigm shift is required, in particular accentuated by the increasing pressures coming from climate change mitigation and adaptation. As correctly highlighted in the Review, global warming is a threat multiplier - it compounds, supplements or reinforces other threats so that the bio-physical vulnerability of agriculture increases impacting the most vulnerable people in the world.

Slowing agricultural productivity growth in the future, high population growth in the most resource-constrained and climate-change-exposed regions and a burgeoning environmental crises in agriculture are the seeds for mounting pressures on food security and the related access to land and water. This is bound to increase the severity and frequency of riots, originated by food price increases, with concomitant political instability, and international tension, caused by resource conflicts and migratory movements of starving populations. Thus, the fundamental transformation of agriculture may well turn out to be one of the biggest challenges, including for international security, of the 21st century.

In paragraph 108 of the Rio+20 Declaration, adopted in June 2012, Heads of State reaffirm their “commitments regarding the right of everyone to have access to safe, sufficient and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger. (They) acknowledge that food

security and nutrition has become a pressing global challenge and, in this regard, (they) further reaffirm (their) commitment to enhancing food security and access to adequate, safe and nutritious food for present and future generations." It is high time for these commitments to come to reality before the MDGs' deadline of 2015.

In this Trade and Environment Review, more than 50 international experts have contributed their views to a comprehensive analysis of the above-outlined challenges and the most suitable strategic approaches for dealing holistically with the inter-related problems of hunger and poverty, climate change, economic, social and gender inequity, poor health and nutrition, and environmental sustainability. The authors and the UNCTAD secretariat are looking forward to an inspiring dialogue with readers of this Review on one of the most interesting and challenging subjects of present development discourse.



Geneva, March 2013.

Carlos Pérez del Castillo,
Chairman Consortium Board,
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a Food Secure Future (CGIAR).

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Acknowledgements

This Trade and Environment Review was edited and compiled by Ulrich Hoffmann, Senior Trade Policy Advisor, Office of the Director, Division on International Trade in Goods and Services, and Commodities. Frank Grothaus assisted in proof-reading the manuscript. It was prepared for publishing by Rafe Dent, with assistance on graphics by Sophie Combette and Nadege Hadjemian. The manuscript was language edited by Praveen Bhalla.

Acronyms and abbreviations

AAAS	American Association for the Advancement of Science
AATF	African Agricultural Technology Foundation
AbL	Association for sustainable, i.e. more socially and environmentally beneficial agriculture (Arbeitsgemeinschaft bäuerliche Landwirtschaft/ Germany)
ABSP	Agricultural Biotechnology Support Project
ACP	African, Caribbean and Pacific countries
AF	agroforestry
AFTPs	agroforestry tree products
AHBFI	A Harvest Biotech Foundation International
AKST	agricultural knowledge, science and technology
AoA	Agreement on Agriculture (of the WTO)
ARI	African Re-greening Initiative
AROS	Asian Regional Organic Standard
ASALs	arid and semi-arid lands
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASEAN	Association of Southeast Asian Nations
ASPO	Association for the Study of Peak Oil & Gas (United States)
AVRDC	The Word Vegetable Center
BAU	business as usual (scenario)
BfR	Federal Institute for Risk Assessment (Germany)
birr	Ethiopian currency
BIS	Bank for International Settlements
BMELF	German Federal Ministry for Food, Agriculture and Forests (since 2001 known as the Federal Ministry for Food, Agriculture and Consumer Protection)
BRIC	grouping that refers to the countries Brazil, the Russian Federation, India and China
BSE	bovine spongiform encephalopathy (mad cow disease)
BSI	British Standards Institution
Bt	bacillus thuringiensis
BTI	Boyce Thompson Institute
BVL	Federal Office of Consumer and Food Safety (Germany)
C	carbon
C_3	photosynthetic pathway
C_4	carbon fixation (photosynthetic pathway)
CAFTA	Central America-Dominican Republic-United States Free Trade Agreement
CAP	Common Agricultural Policy
CARE	Cooperative for Assistance and Relief
CAWMA	comprehensive assessment of water management in agriculture
CBD	Convention on Biological Diversity
CBOT	Chicago Board of Trade
CC	climate change
CCP	Committee on Commodity Problems (FAO)
CCTEC	Cornell University: College of Agriculture and Life Sciences
CDE	Centre for Development and Environment (University of Bern, Switzerland)
CDM	Clean Development Mechanism
CEO	chief executive officer
CETIM	Centre Europe - Tiers Monde
CFAR	Climate Forecasting for Agricultural Resources (project)
CFS	Committee on World Food Security (FAO)
CFS-HLPE	High Level Panel of Experts on Food Security and Nutrition to the FAO Committee on World Food Security
CGC	Chinese construction company owned by SINOPEC
CGIAR	Consultative Group on International Agricultural Research
CH_4	methane
CIF	cost, insurance and freight
CIFOR	Center for International Forestry Research
CIMMYT	International Maize and Wheat Improvement Center

CIP	International Potato Research Center
CIRAD	Agricultural Research for Development Centre (France)
CIS	Commonwealth of Independent States
CIWF	Compassion in World Farming
CLIRUN II	hydrologic model
CNV	conventional system
CO_2	carbon dioxide
CO_2e/ CO_2-eq	carbon dioxide equivalent
CORAF	Western and Central African Council for Agricultural Research and Development
COROS	Common Objectives and Requirements for Organic Systems
Crad-L	Caparo Renewable Agriculture Developments Ltd.
CRC	Chemical Rubber Company Press
CRF	Cornell Research Foundation
CRI	Copenhagen Resource Institute
CRI	Climate Risk Index
CRP	Conservation Reserve Program
CSD	UN Commission on Sustainable Development
CSE	Cooperative of SEKEM Employees
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSP	Conservation Stewardship Program
CUT	Compost Utilization Trial
DAC	Development Assistance Committee (of the OECD)
DAP	diammonium phosphate
DEFRA	Department for Environment, Food and Rural Affairs (United Kingdom)
DITC	Division on International Trade in Goods and Services, and Commodities (UNCTAD)
DOK trials	biodynamic-bioorganic-conventional (comparison)
EACC	World Bank´s Economics of Adaptation to Climate Change analysis
EAOPS	East African Organic Products Standard
EBDA	Egyptian Biodynamic Association
EC	European Commission
EEA	European Environment Agency
EED	Church Development Service (Germany)
EESRC	Ethiopian Energy Study and Research Center
EFRs	environmental flow requirements
EFSA	European Union Food Safety Authority
EHEC	e.coli bacterium
EJ	exajoule
EMBO	European Molecular Biology Organization
ENA	European Nitrogen Assessment
EREDPC	Ethiopia Rural Energy Development Assessment and Promotion Center
EROI	energy return on energy invested
ESMAP	Energy Sector Management Assistance Programme (UNDP/ World Bank)
ETB	Ethiopian birr
ETC Group	Erosion, Technology and Concentration Group
EU	European Union
Eurostat	European Statistical Office
FAO	Food and Agricultural Organization of the United Nations
FAOSTAT	Statistics Division of the FAO
FARA	Forum for Agricultural Research in Africa
FAT	Swiss Research Institute for Agriculture and Agricultural Engineering
FAWC	Farm Animal Welfare Council
FAZ	Frankfurter Allgemeine Zeitung (a nationwide German newspaper)
FDI	foreign direct investment
FFS	farmer field schools
FiBL	Research Institute for Organic Agriculture (Switzerland)
FISP	Farm Input Subsidy Program
FOB	free on board
FPIF	Foreign Policy in Focus

FPUs	food production units
FSC	food supply chain
FST	farm systems trial
ft.	feet
FTA(s)	free trade agreement(s)
FVO	Food and Veterinary Office (EU)
G 8	group of 8 developed countries
GAP	good agricultural practice
GATT	General Agreement on Tariffs and Trade
GCMs	general circulation models
GCMs	global climate models
GDP	gross domestic product
GE	genetically engineered/ genetic engineering
GEA	Greening the Economy with Agriculture
GEF	Global Environment Facility
GEO	Global Environment Outlook (UNEP publication)
GFRAS	Global Forum for Rural Advisory Services
GHG	greenhouse gas (emissions)
GIGA	German Institute for Global and Area Studies
GIZ	German Agency for International Cooperation
GLP	global land project
GM	genetically modified
GMO	genetically modified organisms
GOMA	Global Organic Market Access project (FAO, IFOAM & UNCTAD)
GRI	Global Reporting Initiative
GRO	golden rice online
Gt	gigaton
GTZ	German Agency for Technical Cooperation (now GIZ, see above)
GWP	global warming potential
ha	hectare(s)
Hg	hectograms
HLPE	High-level Panel of Experts on Food Security and Nutrition (FAO)
HRC	Human Rights Council
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology for Development
IAP	International Association for Partnership in Ecology and Trade
IATP	Institute for Agriculture and Trade Policy
ICGEB	International Center for Genetic Engineering and Biotechnology
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT(s)	information and communication technology (-ies)
ICTSD	International Centre for Trade and Sustainable Development
IEA	International Energy Agency
IECA	International Erosion Control Association
IER	Institut d'Economie Rurale
IFAD	International Fund for Agricultural Development
IfEU	Institute for Energy and Environment (Germany)
IFOAM	International Federation of Organic Agricultural Movements
IFPRI	International Food Policy Research Institute
IGBP	International Geosphere-Biosphere Programme
IIED	International Institute for Environment and Development
IITA	International Institute of Tropical Agriculture
IK	indigenous knowledge
IKS	indigenous knowledge studies/ systems
ILC	International Land Coalition
ILRI	International Livestock Research Institute (Africa-based)
ILUC	indirect land use changes
IMAP	global M&A organization
IMF	International Monetary Fund

INBI	Centre for Integrated Research in Biosafety
INSAH	Institut du Sahel
IP	intellectual property
IPCC	Intergovernmental Panel on Climate Change
IPGRI	International Plant Genetic Resources Institute
IPM	integrated pest management
IPPC	Integrated Pollution and Control (EU directive)
IPRs	intellectual property rights
IRI	International Research Institute for Climate Predictions
IROCB	International Requirements for Conformity Assessment Bodies
IRRI	International Rice Research Institute
ISAAA	International Service for the Acquisition of Agri-Biotech Applications
ISIS	Institute of Science in Society
ISO	International Organization for Standardization
ISOFAR	International Society of Organic Agriculture Research
ITC	International Trade Centre of UNCTAD/ WTO
IWMI	International Water Management Institute
kcal	kilocalorie
KDGCBP	Kenya Dairy Goat and Capacity Building Project
kg(s)	kilogram(s)
km^3	cubic kilometer
kWh	kilowatt hour
LAP	Libya Africa Investment Portfolio
lbs/ac	pounds per acre
LDC/LDCs	least developed country/ -ies
LEAD	Livestock, Environment and Development Initiative
LED	light-emitting diode
LEG	organic legume system
LHS	left hand side
LLC	limited liability company
LTAR	long-term agroecological research
LUCCG	Land Use Climate Change Report (to the Welsh Assembly Government)
M&I	municipal and industrial
MAR	mean annual runoff
MDG(s)	Millennium Development Goal(s)
MEA	Millennium Ecosystem Assessment
MENA	Middle East and North Africa (region)
MJ	megajoules
mm	millimeter
Mt	megatons
N	nitrogen (in soil)
N(r)	reactive nitrogen
N_2	nitrogen (molecule of two atoms)
N^2O	nitrous oxide
NAFTA	North American Free Trade Agreement
NAIP	National Agricultural Innovation Programme (of the Indian Council of Agricultural Research)
NAS	National Academy of Sciences (US)
NASA	National Aeronautics and Space Administration
NBPE	National Biogas Programme Ethiopia
NCAR	National Center for Atmospheric Research (United States)
NCCR	Swiss National Centre of Competence in Research
NFA	National Food Administration (of Sweden)
NGO	non-governmental organization
NH_3	ammonium
NNPC	Nigerian National Petroleum Corporation
NO	nitric oxide
NPP	(global, terrestrial) net primary production
NPV	net present value

NUE	nitrogen use efficiency
ODA	official development assistance
ODI	Overseas Development Institute
OEA	Environmental Assessment of Ogoniland
OECD	Organization for Economic Co-operation and Development
OECD-DAC	OECD Development Assistance Committee
OGSs	organic guarantee systems
OI	Oakland Institute
OTC	over-the-counter (transactions)
OTDS	overall trade-distorting support
PANNA	Pesticide Action Network North America
PAS	Public Available Specification
PBS	Program for Biodiversity
PCF	Product Carbon Footprint
PEP	phosphoenol pyruvate
PGA	phosphoglycerate
PGS	participatory guarantee system
PICTIPAPA	International Potato Late Blight Testing Program
ppm	parts per million
PRAI	Principles for Responsible Agricultural Investment
PSDA	Private Sector Development in Agriculture
PV	photovoltaic
PwC	Pricewaterhouse Coopers
R&D	research and development
RASFF	Rapid Alert System of Food and Feed (EU)
REDD	reduction of emissions from deforestation and forest degradation
REN21	Renewable Energy Policy Network for the 21st Century
RHS	right hand side
RNE	German Council for Sustainable Development
RS	Royal Society
RSB	Roundtable on Sustainable Biofuels
RuBP	ribulose bisphosphate
RVACSC	Regional Value-added Citizen Shareholder Corporation
S/SE	South/ South East
SAN	Sustainable Agriculture Network
SANCO	Directorate General for Health and Consumer Affairs (European Commission)
SAR	Special Administrative Region
SARD	sustainable agriculture and rural development
SCAR	Standing Committee on Agricultural Research (of the European Commission)
SCNT	Somatic Cell Nuclear Transfer (cloning)
SCOPE	Scientific Committee on Problems of the Environment
SCORE	Sustainable Consumption Research Exchange
SDF	SEKEM Development Foundation
SDT	special and differential treatment
SEKEM	ancient Egyptian for “vitality from the sun”
SNNPR	Southern Nations Nationalities and Peoples Region
SNV	Netherlands Development Organization
SOC	soil organic carbon
SOFA	The State of Food and Agriculture (FAO publication)
SOM	soil organic matter
SP	special products
SRES	Special Report on Emissions Scenarios (IPCC)
SSA	sub-Saharan Africa
SSG	special agricultural safeguard
SSM	special safeguard mechanisms
SVC	Scientific Veterinary Committee (EU)
t CO_2-eq	tons of carbon dioxide equivalent
TED	Trade, Environment, Climate Change and Development (Branch of UNCTAD)

TER	Trade and Environment Review
toes	tons of oil equivalents
tonnes C ha-1	tonnes of carbon per hectare
UE	Union européenne
UEMOA	Western African Economic and Monetary Union
UK	United Kingdom
UN	United Nations
UN DESA	UN Department of Economic and Social Affairs
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNGC	United Nations Global Compact
UNISIST	United Nations International Scientific Information System
UN-NADAF	United Nations New Agenda for the Development of Africa
UNRISD	United Nations Research Institute for Social Development
UNSO	United Nations Statistical Office
US CRS	United States Congressional Research Services
US/ USA	United States of America
USAID	U.S. Agency for International Development
USDA	United States Department of Agriculture
USFDA	United States Food and Drug Administration
UW	University of Wisconsin
VAM	vesicular arbuscular mycorrhizae (fungi)
VEETC	Volumetric Ethanol Excise Tax Credit (US)
VZBV	Federation of German Consumer Organisations (Verbraucherzentrale Bundesverband)
WARDA	West Africa Rice Development Association
WB	World Bank
WFP	UN World Food Programme
WHO	World Health Organization
WMO	World Meteorological Organization
WOCAT	World Overview of Conservation Approaches and Technologies
WRAP	Waste and Resources Action Programme
WRI	World Resources Institute
WSC	World Shipping Council
WTI	West Texas Intermediate (oil price)
WTO	World Trade Organization
WUE	water use efficiency
yr	year

Explanatory notes

Classification by country or commodity group

The classification of countries in this *Review* has been adopted solely for the purposes of statistical or analytical convenience and does not necessarily imply any judgement concerning the stage of development of a particular country or area.

The major country groupings used in this *Review* follow the classification by the United Nations Statistical Office (UNSO). They are distinguished as:

- Developed or industrial(ized) countries: the countries members of the OECD (other than Mexico, the Republic of Korea and Turkey) plus the new EU member countries and Israel.
- Transition economies refers to South-East Europe and the Commonwealth of Independent States (CIS).
- Developing countries: all countries, territories or areas not specified above.

The terms "country" / "economy" refer, as appropriate, also to territories or areas.
References to "Latin America" in the text or tables include the Caribbean countries unless otherwise indicated.
References to "sub-Saharan Africa" in the text or tables do not include South Africa unless otherwise indicated.

For statistical purposes, regional groupings and classifications by commodity group used in this *Review* follow generally those employed in the UNCTAD Handbook of Statistics (United Nations publication, sales no. E/F.08.II.D.18) unless otherwise stated. The data for China do not include those for Hong Kong Special Administrative Region (Hong Kong SAR), Macao Special Administrative Region (Macao SAR) and Taiwan Province of China.

Other notes

The term "dollar" ($) refers to United States dollars, unless otherwise stated.

The term "billion" signifies 1,000 million.

The term "tons" refers to metric tons.

Annual rates of growth and change refer to compound rates.

Exports are valued FOB and imports CIF, unless otherwise specified.

Use of a dash (–) between dates representing years, e.g. 1988–1990, signifies the full period involved, including the initial and final years.

An oblique stroke (/) between two years, e.g. 2000/01, signifies a fiscal or crop year.

A dot (.) indicates that the item is not applicable.

Two dots (..) indicate that the data are not available, or are not separately reported.

A dash (-) or a zero (0) indicates that the amount is nil or negligible.

Decimals and percentages do not necessarily add up to totals because of rounding.