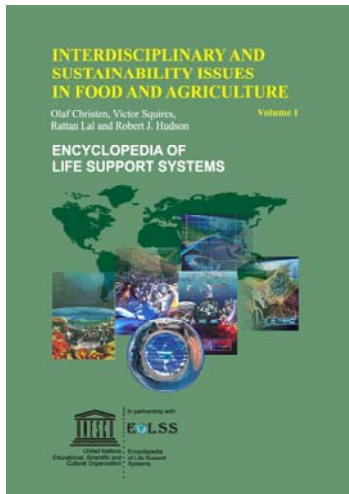


CONTENTS

INTERDISCIPLINARY AND SUSTAINABILITY ISSUES IN FOOD AND AGRICULTURE



Interdisciplinary and Sustainability Issues in Food and Agriculture Volume 1

e-ISBN: 978-1-84826-335-2

ISBN : 978-1-84826-785-5

No. of Pages: 404

Interdisciplinary and Sustainability Issues in Food and Agriculture Volume 2

e-ISBN: 978-1-84826-336-9

ISBN : 978-1-84826-786-2

No. of Pages: 478

Interdisciplinary and Sustainability Issues in Food and Agriculture Volume 3

e-ISBN: 978-1-84826-337-6

ISBN : 978-1-84826-787-9

No. of Pages: 460

For more information of e-book and Print Volume(s) order, [please click here](#)
Or contact : eolssunesco@gmail.com

CONTENTS

VOLUME I

Development Issues in Food and Agriculture **1**

Olaf Christen, *Institute of Agronomy and Crop Science, University of Halle-Wittenberg, Germany*

1. Introduction
2. Human Development and Food and Agriculture
3. Sociocultural Development and Food and Agriculture
4. Economic Development and Food and Agriculture
5. Technological Development and Food and Agriculture

Environment and Food and Agricultural Systems **11**

Wolfgang Heyer, *Institute of Agronomy and Crop Science, University of Halle-Wittenberg, Germany*

1. General Background for Agro-Ecology
 - 1.1. The Field of Ecology
 - 1.2. Specifics of Agro-Ecology
 - 1.2.1. Functional Aspect
 - 1.2.2. Energy Status
 - 1.2.3. Nutrient and Matter Flows
 - 1.2.4. Matter Flows and Biodiversity
 - 1.2.5. Agro-Ecology and Sustainability
2. Environmental Resources of Food Supply
3. Environmental Constrains on Food Production
4. Loss of Biological Diversity and its Potential Impact on Food Production
 - 4.1. General causes of Biodiversity Losses
 - 4.2. Impact on Food Production
5. Water for Agriculture and Food Production
6. Energy use in Food and Agriculture

Sustainability of Agriculture **31**

A. Frangenberg, *Institute of Agriculture and Environment, Bonn, Germany*

1. Concept of Sustainable Agriculture
 - 1.1 Challenges Lying Ahead
 - 1.2 Agenda 21
 - 1.3 The Forward Looking Concept
 - 1.4 A Matter of Scale
2. The Economics of Low-input Farming Systems
3. Sustainability and Conservation of Natural Resources
 - 3.1 Natural Resources form the Basis
 - 3.2 Complexity of Agricultural Ecosystems
 - 3.3 Soil and Water Protection
4. Energy Conservation
 - 4.1 Different Approaches – Different Results
 - 4.2 A Holistic Approach is Needed
5. Fertilizer Use, Efficiency, and Its Environmental Impact
 - 5.1 The Problem of Nutrient Deficiencies
 - 5.2 Organic versus Mineral Fertilizers
 - 5.3 Energy Production and Recycling
6. Water Conservation
7. Tillage and No-till Systems for Soil and Water Conservation

- 7.1 Row-crops Pose Major Risks
- 7.2 Leaving the Soil Covered and Undisturbed
- 7.3 Changes in Tillage Require Changes in the Entire Cropping System
- 8. Natural Resource Conservation

Waste Management Issues, Including Recovery, and Sustainable Food and Agriculture 53
 Olaf Christen, *Institute of Agronomy and Crop Science, University of Halle-Wittenberg, Germany*

- 1. Introduction
- 2. Farm Operation Waste
- 3. Feedlot Waste
- 4. Food Processing Waste
 - 4.1. Fruit Processing Waste
 - 4.2. Vegetable Processing Waste
 - 4.3. Animal By-products
 - 4.4. By-products of the Processing of Oil Crops
- 5. Pulp and Paper Waste
- 6. Land Application of Waste Water and Health

Sustainable Development of Agriculture, Fisheries, and Forestry 68
 Olaf Christen and Wolfgang Heyer, *Institute of Agronomy and Crop Science, University of Halle-Wittenberg, Germany*

- 1. Introduction
- 2. Major Issues in Sustainable Development of Agricultural Production
 - 2.1. Yield increases
 - 2.2. Variability of yields
 - 2.3. Short arable rotations
 - 2.4. Limited resources
- 3. Control Systems for Pests, Weeds and Diseases
 - 3.1. Development and steps towards Pest control systems
 - 3.2. Scientific background of disease and pest control systems
 - 3.2.1. Host factors
 - 3.2.2. Pathogen / Pest factors
 - 3.2.3. Environmental factors
 - 3.2.4. Human interferences
 - 3.3. Basics of Decision making and risk assessment
 - 3.3.1. Surveillance
 - 3.3.2. Forecast
 - 3.3.3. Pest - Crop loss – relationship
 - 3.3.4. Damage threshold
 - 3.4. Organization and operation of pest control systems
 - 3.4.1. Principal organization schemes
 - 3.4.2. Examples of successful disease control systems
- 4. Practices for Improvement of Soil Fertility
- 5. Environment Protection and Sustainable Development of Agriculture
- 6. Food safety and Sustainable Agricultural Development
- 7. Effects of Agriculture on Biodiversity

Ethical Issues in Agriculture 97
 Herwig Grimm, *Interdisciplinary Institute of Technology, Theology and Natural Science, Munich, Germany*

- 1. Introduction
- 2. Agriculture – ethical approaches

3. Agriculture and sustainable agriculture
4. Animal Well-far and livestock husbandry
5. Intellectual property – patenting and ethics
6. Ethical issues in agricultural research

Safety in Food and Agriculture

110

Wolfgang Heyer, *Institute of Agronomy and Crop Science, University of Halle-Wittenberg, Germany*

1. Introduction
2. Safe handling of organisms and biologically derived material
3. Safe handling of Pesticides
4. Awareness of biosafety protocols, regulation and legislation
5. Occupational health and safety
6. Safety from biological wastes

Food and Agricultural System Development Information and Knowledge

127

Jan Holm Ingemann, *Department of Economics, Politics and Public Administration, Aalborg University, Denmark*

1. Introduction
 - 1.1 Agriculture as Complex Systems
 - 1.2 Stating the Problem
 - 1.3 The Bottom Line: Two Crucial Questions
2. Contrasts in Agricultural Food Production and Consumption—Past and Present
3. Development of Agricultural Technology in Industrial Nations
 - 3.1 The Peasant System of the Past
 - 3.2 Industrialization of Farming
 - 3.2.1 Spillover from Industrial Farming
 - 3.2.2 Caught in a Social Trap
 - 3.3 Organic Food
 - 3.3.1 Definition of Organic Agriculture
 - 3.3.2 Demand Side Satiety, Abundance, and Ethics
 - 3.3.3 Supply Side Grass-Root Pioneers and Idealists
4. Developing Nations and their Double Bindings
 - 4.1 Food Provision Systems
 - 4.2 Poverty and Economic Performance
 - 4.3 Population Growth versus Aggregate Production of Food
5. Lookout

Promoting Sustainable Agriculture and Rural Development

151

I.R. Bowler, *Department of Geography, University of Leicester, UK*

1. Introduction
2. The Meaning of Sustainable Agriculture and Rural Development in Europe
 - 2.1. Rural Regions in Europe
 - 2.2. Sustainable Agriculture and Rural Development
3. Constraints on Sustainable Development in Rural Regions
 - 3.1. The Restructuring of Agriculture
 - 3.2. Rural Socioeconomic Processes of Change
4. Indicators of Sustainable Agriculture and Rural Development
5. Promoting Sustainable Agriculture and Rural Development
 - 5.1. Promoting Sustainable Agriculture
 - 5.2. Promoting Sustainable Rural Development
6. The Effects of Policies Promoting Sustainable Agriculture and Rural Development
 - 6.1. Agricultural Effects

- 6.2. Rural Development Effects
- 7. Conclusion

The Role of Food, Agriculture, Forestry, and Fisheries In Human Nutrition 177
 Victor Squires, *Adelaide University, Adelaide, Australia*

- 1. Introduction
 - 1.1. A History of Feast and Famine
 - 1.2. Domestication: The Chosen Few
 - 1.3. Fish as Food
- 2. Humans Have Modified the Global Environment
 - 2.1. Land-Use Change, Food Production, and Human Welfare
 - 2.2. Biodiversity Implications of Land-Use Change
- 3. Population Growth and Food Production
 - 3.1. Agriculture, Food Production, and the Environment
 - 3.2. A Diminishing Resource Base
 - 3.3. Can Agriculture Meet the Challenge?
 - 3.3.1. Energetics of Food Production and Consumption
- 4. Food Security: A Major Goal
- 5. Food, Nutrition, and Health
- 6. Global Stability: Problems and Prospects
 - 6.1. Drivers of Change
 - 6.1.1. Population Growth
 - 6.1.2. Economic Growth
 - 6.1.3. Technological Innovation
 - 6.1.4. Social Factors Affecting the Future
 - 6.1.5. Urbanization
 - 6.1.6. Equity Patterns
- 7. The Search for Sustainability
- 8. Conclusions

Food and Agriculture and the Use of Natural Resources 206
 Victor R. Squires, *Adelaide University, Australia*

- 1. Introduction
- 2. A Brief History of Food—Gathering, Production, and Storage
- 3. The Impact of Technology on Agriculture and Food Production
 - 3.1. The Green Revolution
- 4. Protecting the Resource Base: Economic and Ecological Imperatives
- 5. Constraining Factors in Food Production
- 6. Challenges for the Twenty-first Century

Forests and Grasslands as Cradles for Agriculture 220
 E. Gunilla A. Olsson, *Department of Biology, Norwegian University of Science and Technology, Trondheim, Norway*

- 1. Humans as Parts of Forest and Grassland Ecosystems
 - 1.1. Human Subsistence in Forests and Grasslands Based on Gathering and Hunting
 - 1.2. Transition of Natural Communities into Seminatural Communities
- 2. The Development of Agroecosystems—Agroforestry was the Origin
 - 2.1. The Transition from Food Collection to Food Production
 - 2.2. Agroforestry—What Does it Mean and How Does it Work?
 - 2.3. Nutrient Cycling in Natural, Agricultural, and Agroforestry Ecosystems
- 3. Agroforestry Today
 - 3.1. Agroforestry Systems in Temperate Forests and Grasslands

- 3.2. Tropical Grasslands and Forests
4. Sustainable Agroecosystems for the Future
 - 4.1. Prerequisites for Sustainable Agriculture
 - 4.2. Examples of Sustainable Agriculture—Combination of Agroforestry and Conventional Agroecosystems
 - 4.3. Agroforestry Must Be Considered within its Cultural and Socioeconomic Context
5. Conclusions

Impact of Global Change on Agriculture

239

A.M. Mannion, *Department of Geography, University of Reading, UK*

1. Agriculture and Environment
 - 1.1. Agriculture and its Role in the Global Carbon Cycle
2. Agriculture and Global Change: A Reciprocal Relationship
 - 2.1. The Past: The Inception of Agriculture and Its Spread
 - 2.2. Present: Snapshot of Current World Agriculture
 - 2.3. The Future
 - 2.3.1. The Impact of Agriculture on Global Change
 - 2.3.2. The Overall Impact of Agriculture on the Biosphere and Atmosphere
 - 2.3.3. The Impact of Global Change on Agriculture
3. Conclusion and Prospects

Socioeconomic Policies and Food Security

271

Kostas G. Stamoulis, *Agriculture and Economic Development Analysis Division (ESA), FAO, Rome, Italy*

Alberto Zezza, *Agriculture and Economic Development Analysis Division (ESA), FAO, Rome, Italy*

1. Introduction
2. Food Security and Policy in a Changing World
 - 2.1. The Changing View of Development
3. Macroeconomic Reforms, Structural Adjustment, and Food Security
4. Economic Growth and Food Security: Tradeoffs and Complementarities
 - 4.1. Economic Growth and Poverty Reduction
 - 4.2. How Food Security Affects Economic Growth
5. Agriculture and Food Security: Implications for Short-term Policies and Long-term Strategies
 - 5.1. Policies to Reverse Agricultural Decline: Impacts on Food Security
 - 5.2. The Role of Prices
 - 5.3. Agricultural and Economy-wide Growth
6. Technological Change, Commercialization of Agriculture, and Food Security
 - 6.1. Risks Associated with New Technologies
7. Specific Interventions to Alleviate Food Insecurity
 - 7.1. Income and Employment Generation Policies and Programs
 - 7.2. Labor-intensive Public Works
8. Food Income Transfers: Targeted Distribution and Food Subsidies
 - 8.1. General
 - 8.2. Food Price Subsidies and Rationing
 - 8.3. Food Stamps
9. Targeting Using Nonincome Criteria
 - 9.1. Targeted Feeding Programs
10. Food Security Policies for the Household or the Individual?
11. Food Security Interventions: The Role of Food Aid
 - 11.1. Problems and Prospects
12. Policies for Stabilization of Food Supplies and Prices
 - 12.1. Stabilizing Domestic Food Production
 - 12.1.1. Other Policies that Affect International Trade
 - 12.1.2. Using Large Buffer Stocks

Human Nutrition: An Overview**299**

Barbara A. Underwood, *President, International Union of Nutritional Sciences, and Scholar-in-Residence, Food and Nutrition Board, Institute of Medicine, National Academies Washington, D.C. USA*

Osman Galal, *Secretary General, International Union of Nutritional Sciences, and Professor, Community Health Sciences UCLA School of Public Health, Los Angeles, California USA*

1. Background
 - 1.1. Nutrition during the past
 - 1.2. Nutrition and today's society
2. Biochemistry of Nutrients in Foods
 - 2.1. Classification of essential nutrients
 - 2.2. Macronutrients
 - 2.2.1. Proteins
 - 2.2.2. Carbohydrates
 - 2.2.3. Lipids
 - 2.3. Micronutrients
 - 2.3.1. Vitamin A
 - 2.3.2. Vitamin D (calciferol)
 - 2.3.3. Vitamin E (tocopherol)
 - 2.3.4. Vitamin K (phyloquinone)
 - 2.3.5. Ascorbic acid (vitamin C)
 - 2.3.6. B-vitamin family
 - 2.3.7. Minerals
3. Significance of Nutrition to Life-cycle Events
 - 3.1. Growth and development
 - 3.2. Morbidity and mortality
 - 3.3. Reproductive performance
 - 3.4. Cognitive competence
 - 3.5. Work productivity
 - 3.6. Healthy aging: nutrition through the life cycle
4. Impact of Malnutrition on Society
 - 4.1. Distribution of food and nutrition insecurity
 - 4.2. Consequences for national and global development
 - 4.3. Specific nutrient deficiencies
 - 4.4. Chronic diseases
 - 4.4.1. Cancer
 - 4.4.2. Hypertension
 - 4.4.3. Cardiovascular disease
 - 4.4.4. Diabetes
 - 4.4.5. Osteoporosis and osteomalacia
 - 4.4.6. Obesity : Epidemiology of over-nutrition morbidity
5. Food Supply, Diversity and Dietary Patterns
 - 5.1. Food supply
 - 5.2. Crop diversity and eating patterns
6. Specific Interventions to Improve Nutrition
 - 6.1. Policies
 - 6.2. Dietary diversification and modification
 - 6.3. Food fortification
 - 6.4. Nutrient supplements
 - 6.5. Public health measures
 - 6.6. Alternative remedies
7. Nutrition in Future Societies

Index**333****About EOLSS****341**

VOLUME II

Cultivated Plants, Primarily as Food Sources

2

György Füleky, *Szent István University, Gödöllő, Hungary*

1. Introduction
 - 1.1. Cultivation
 - 1.2. Which Crops Feed the World?
 - 1.3. Protein Problem
2. History of Crop Production
 - 2.1. Gathering People
 - 2.2. What Do Gatherers Eat?
 - 2.2.1. Grass Seeds (Potential Cereals)
 - 2.2.2. Legumes
 - 2.2.3. Root and Tuber Plants
 - 2.2.4. Oil Plants
 - 2.2.5. Fruits and Nuts
 - 2.2.6. Vegetables and Spices
 - 2.3. Types of Agriculture
 - 2.4. Diffusion of Crops
3. Land Used for Agriculture
 - 3.1. Land Use Categories
 - 3.2. Agricultural Land Use
 - 3.3. Reserve of Productive Agricultural Land
4. Cropping Systems
 - 4.1. Cropping Systems
 - 4.1.1. Shifting Cultivation
 - 4.1.2. Wet-Rice Cultivation
 - 4.1.3. Agroforestry
 - 4.1.4. Grasslands
 - 4.1.5. Mixed Farming
 - 4.1.6. Plantation Crops
 - 4.1.7. Large-Scale Grain Production
 - 4.2. Integrated Agriculture
 - 4.3. Modern Agricultural Revolution
 - 4.4. Major Agricultural Systems
5. Future Trends
 - 5.1. Traditional Plants in Future
 - 5.1.1. Cereals and Pseudocereals
 - 5.1.2. Legumes
 - 5.1.3. Edible and Industrial Oils
 - 5.1.4. Non-Wood Fiber
 - 5.1.5. Industrial Crops
 - 5.1.6. Energy Crops
 - 5.1.7. Fruits and Nuts
 - 5.1.8. Vegetables
 - 5.1.9. Aromatics, Culinary Herbs, and Medicinals
 - 5.1.10. Ornementals
 - 5.2. Human Health and Plant Food Nutrition
 - 5.2.1. Plant Food Composition
 - 5.2.2. Protein-Energy Malnutrition
 - 5.2.3. Nutrition Security
 - 5.3. Plant Products of Biotechnology
 - 5.3.1. Conventionally Bred Crops Versus Genetically Modified (GM) Crop
 - 5.3.2. Possible Future Developments
 - 5.3.3. Potential Risks

Forest Land Resources

46

Juan Picos, *Environment and Natural Resources Engineering Department, Vigo University, Spain*
 Enrique Valero Gutiérrez del Olmo, *Environment and Natural Resources Engineering Department, Vigo University, Spain*

1. Introduction
2. Forest Resources
3. Forest Products
 - 3.1. Wood and Energy from Forests
 - 3.1.1. Wood
 - 3.1.2. Energy
 - 3.2. Non-Wood Forest Products
 - 3.2.1. The Example of Medicinal Plants
 - 3.2.2. Other Examples of the Importance of Non-Wood Forest Products
4. Social and Environmental Services of Forests
 - 4.1. Forests as Shelter and Abode
 - 4.2. Forests as a Source of Employment
 - 4.3. Forests as a Source of Recreation and Improvement of Urban Living Conditions
 - 4.4. Cultural Heritage in Forests
 - 4.5. Spiritual Values of Forests
 - 4.6. Forests and Global Climate Change
 - 4.7. Forest and Conservation of Soil and Water Resources
 - 4.8. Forests as Genetic and Biodiversity Reserves
5. Conservation Equals Assessment Plus Planning Plus Management

Food, Forage and Medicinal Resources of Forests

68

Nancy J. Turner, *School of Environmental Studies, University of Victoria, Canada*
 Sarah E. Turner, *Department of Anthropology, University of Victoria, Canada*

1. Introduction
2. Forest Food
3. Forage
4. Forest Medicines
5. Agroforestry, Swidden and Other Forms of Forest Management
6. Economic Use and Potential
7. Conclusions

Fisheries and Aquaculture : Towards Sustainable Aquatic Living Resources Management 119

P. Safran, *Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Paris, France (Present address: Asian Development Bank (ADB), Manila, Philippines)*

1. Introduction
2. The Role of Fisheries
 - 2.1. An Important Agricultural Resource
 - 2.2. A Source of Foreign Exchange Earnings
 - 2.3. A Source of Protein
 - 2.4. A Source of Income
 - 2.5. A Source of Employment
 - 2.6. A Valuable Ecological Resource
 - 2.7. Towards Sustainable Fisheries Development
3. An Outline of Fisheries
 - 3.1. Artisanal Fisheries
 - 3.2. Industrial Fisheries
 - 3.3. Aquaculture
 - 3.4. Marine Fisheries
4. Fisheries Economic Outlook

- 4.1. Fish Production
- 4.2. Fish Trade
5. Fisheries Issues
 - 5.1. Coastal Resource Management
 - 5.1.1. The Law of the Sea
 - 5.1.2. Integrated Coastal Fisheries Management
 - 5.2. Economic Issues
 - 5.2.1. Overfishing
 - 5.2.2. Overcapacity
 - 5.2.3. Postharvest Losses
 - 5.2.4. Bycatch and Discards
 - 5.2.5. Subsidies
 - 5.3. Environmental Issues
 - 5.3.1. Ecosystems Degradation
 - 5.3.2. Destructive Fishing Practices
 - 5.3.3. Negative Impacts of Aquaculture
 - 5.3.4. Water Pollution
 - 5.4. Policy and Institutional Issues
6. Perspectives
 - 6.1. Fish Supply Outlook
 - 6.2. Towards Responsible Fisheries Management
7. Conclusion

Harvesting the Seas

147

Jean-Paul Troadec, *Menez Perroz, Plouguerneau, France*

1. Introduction
2. Historical Development
 - 2.1. Overview
 - 2.2. Intensification, Diversification and Geographical Expansion
 - 2.3. Development Factors
3. Fishery Systems
 - 3.1. Structure of Fisheries
 - 3.2. Resource Units
 - 3.2.1. Nature and Composition
 - 3.2.2. Distribution and Migration Patterns
 - 3.2.3. Variability
 - 3.3. Fishing or Production Systems
 - 3.4. Exploitation Systems
 - 3.5. Regulatory Systems
 - 3.5.1. Exclusivity Systems
 - 3.5.2. Mechanisms
 - 3.5.3. Structures
4. State of World Fisheries
 - 4.1. Resources
 - 4.1.1. Global Extension of Overfishing
 - 4.1.2. Discards
 - 4.1.3. World Fishery Potential
 - 4.2. Effects of Fishing on the Environment and Biodiversity
5. The Dynamics of Overfishing
 - 5.1. Cause, Nature and Effects
 - 5.2. Weaknesses of Conventional Methods of Access Regulation
 - 5.2.1. Conflicts
 - 5.2.2. Fishery Policies
 - 5.2.3. Crises
6. Conclusions

World Yields of Marine Organisms **176**

C. Aliaume, *Laboratoire Hydrobiologie Marine et Continentale, Universit de Montpellier, France*

S. M. Garcia, *FAO, Fisheries Department, Italy*

R. J. R. Grainger, *FAO, Fisheries Department, Italy*

T. Do Chi, *Laboratoire Hydrobiologie Marine et Continentale, Universit de Montpellier, France*

1. Introduction
2. World Fishery Production over the last Half of Century with Recent Trends
3. Profile of Catches by FAO Fishing Area
 - 3.1. Northwest Atlantic (Area 21)
 - 3.2. Northeast Atlantic (Area 27)
 - 3.3. Western Central Atlantic (Area 31)
 - 3.4. Eastern Central Atlantic (Area 34)
 - 3.5. Mediterranean and Black Sea (Area 37)
 - 3.6. Southwest Atlantic (Area 41)
 - 3.7. Southeast Atlantic (Area 47)
 - 3.8. Western Indian Ocean (Area 51)
 - 3.9. Eastern Indian Ocean (Area 57)
 - 3.10. Northwest Pacific (Area 61)
 - 3.11. Northeast Pacific (Area 67)
 - 3.12. Western Central Pacific (Area 71)
 - 3.13. Eastern Central Pacific (Area 77)
 - 3.14. Southwest Pacific (Area 81)
 - 3.15. Southeast Pacific (Area 87)
4. Conclusion

Economics of Fisheries and Aquaculture **203**

Ragnar Arnason, *Department of Economics, University of Iceland, and European Commission Joint Research Centre (Agriculture and Fisheries Unit)*

1. Introduction
2. Fisheries and fish farming in a historical context
3. Fisheries and fish farming in modern times
4. Global fisheries inefficiency: The common property problem
5. Future fish supply: The expansion of fish farming
6. Some important issues in the world's fisheries

Fisheries Management: Basic Principles **223**

Ragnar Arnason, *Department of Economics, University of Iceland, and European Commission Joint Research Centre (Agriculture and Fisheries Unit), Iceland*

1. Introduction
2. The Fisheries Problem
3. The Fisheries Management Regime
4. Fisheries Management Systems
 - 4.1. Biological fisheries management
 - 4.2. Direct economic restrictions
 - 4.3. Indirect economic fisheries management
 - 4.3.1. Taxation
 - 4.3.2. Property rights
 - 4.3.2.1. Fishing licences
 - 4.3.2.2. sole ownership
 - 4.3.2.3. Territorial use rights
 - 4.3.2.4. Individual quotas
 - 4.3.2.5. community fishing rights
 - 4.4. The most effective fisheries management system

5. Monitoring, Control and Surveillance
6. The Fisheries Judicial System
7. Fisheries Management: Future Developments
 - 7.1. Expanded use of ITQs
 - 7.2. Improvement of existing ITQ systems
 - 7.3. Community fishing rights

Food Quality and Assurance

244

Jiri Davidek, *Institute of Chemical Technology, Prague, Czech Republic*

1. Introduction
2. Analytical Methods Used for Quality Determination
 - 2.1. Chemical and Physical-Chemical Methods
 - 2.2. Microbiological Methods
 - 2.3. Biological Methods
 - 2.4. Biochemical Methods
 - 2.5. Methods of Sensory Analysis
3. Analytical Methods for the Determination of Basic Food Components
 - 3.1. Proteins
 - 3.2. Saccharides
 - 3.3. Lipids
 - 3.4. Vitamins
 - 3.5. Water
 - 3.6. Minerals and Trace Elements
 - 3.7. Sensory Active Compounds
 - 3.8. Antinutritives and Natural Toxic Compounds
 - 3.9. Food Additives
 - 3.10. Food Contaminants
4. Food Quality Control
5. Trends in Quality Control and Assurance

History of Land Improvement

271

I. V. Minaev, *Belarussian Research Institute of Land Reclamation and Meadow Management, Minsk, Belarus*

B. S. Maslov, *Russian Academy of Agricultural Sciences, Moscow, Russia*

1. Introduction
2. Land Amelioration in the Ancient World (Egypt, Mesopotamia, China, India, etc.)
3. Land Amelioration in Medieval Times
4. The Modern Period of Land Amelioration
5. Contribution of Land Amelioration to the Development of Agriculture and Food Supply
6. Scientific and Technical Progress in Land Amelioration
7. Land Amelioration and Economic Security
8. Land Amelioration in the Systems of Sustainable Development

Sustainability of Agricultural Production Under Irrigation

294

Cesáreo Landeros-Sánchez, *Graduate College in Agricultural Science, Mexico*

José H. Rodolfo Mendoza-Hernández, *Graduate College in Agricultural Science, Mexico*

David Palma-López, *Graduate College in Agricultural Science, Mexico*

1. Introduction
2. The Current Situation of Agriculture under Irrigation
3. Environmental Changes Caused by Agriculture under Irrigation
 - 3.1. Soil Erosion Processes
4. Irrigation as a Contamination Source

- 4.1. Nitrogen Compounds Contamination
- 4.2. Pesticide Contamination
5. Perspectives of Agriculture under Irrigation
6. How Agriculture under Irrigation Can Become a Sustainable Activity

Soil Improvement

314

Starikov, Kh. N, *Nizhnii Novgorod State Agricultural Academy, Russia*

1. Introduction
2. Kinds and Technologies of Agrotechnical Work
3. Removal of Trees, Shrubs, Stumps, and Buried Timber
4. Removal of Stones
5. Removal of Tussocks, Thick Sod, and Moss Cover
6. Surface Planing
7. Remediation of Disturbed Lands
8. Soil Amendment
9. Initial Soil Tillage
10. Liming and Fertilization
11. Crop Growing
12. Radical Improvement of Meadows and Pastures
13. Prospects for Soil Improvement

Productivity, Efficiency and Resilience of Crop and Livestock Production

333

Gerald Singh, *University of Alberta, Canada*

Robert J. Hudson, *University of Alberta, Canada*

Noble T. Donkor, *Canadian University College, Canada*

1. Introduction
2. Science of Sustainability
 - 2.1. Sustainability Goals
 - 2.2. Definitions of Sustainability
3. Central Problem
 - 3.1. Human Population Dimensions
 - 3.2. Major Patterns of Food Production
 - 3.3. Climate Change and Agricultural Production
4. Food Production
5. Efficiency
6. Resilience
 - 6.1. Concerns
 - 6.2. Potential Achievements
7. Social Needs for Sustainable Crop and Livestock Production
 - 7.1. Other Agents – Consumers
 - 7.2. General Strategies for Sustainable Production
8. Conclusions

Animal Production in the Tropics

357

C. Devendra, *Consultant Tropical Animal Production Specialist, Kuala Lumpur, Malaysia.*

1. Introduction
2. Rationale for accelerating animal production
3. Role and functions of animals
4. Demand for animal foods
5. Diversity and Animal Genetic Resources
 - 5.1. Diversity
 - 5.2. Species description

- 5.2.1. Buffaloes
- 5.2.2. Cattle
- 5.2.3. Goats
- 5.2.4. Sheep
- 5.2.5. Pigs
- 5.2.6. Chickens and Ducks
- 6. Animal production systems
 - 6.1. Types
 - 6.2. Landless systems
 - 6.2.1. Urban and peri-urban industrial landless systems
 - 6.2.2 Rural landless livestock production
 - 6.3. Crop-based systems
 - 6.3.1. Categories
 - 6.3.2. Relevance
 - 6.3.3. Genesis
 - 6.3.4. Diversification and integration
 - 6.3.5 Trends
 - 6.4. Agro-pastoralism
 - 6.5. Rangeland-based systems
- 7. Opportunities for productivity enhancement
 - 7.1. Emphasis on rainfed areas
 - 7.2. Significance of crop-animal interactions
 - 7.3 Production systems integrated with annual and perennial crops
 - 7.4. Strategy for improved feed utilization
 - 7.5. Animal manure, nutrient flows and dynamics
 - 7.6. Integration with aquaculture
 - 7.7. Improved Marketing
 - 7.8. Policy issues
 - 7.9 Interdisciplinary research and investments
- 8. Evolving scenarios and emerging issues in the future
- 9. Conclusions

Regenerative Food Systems **386**

K. A. Dahlberg, *Political Science and Environmental Studies, Western Michigan University, USA*

- 1. Development of the Concept of Regenerative Food Systems
 - 1.1. The Search for Alternatives to Unsustainable Industrial Agriculture
 - 1.2. From Regenerative Agriculture to Regenerative Food Systems.
 - 1.3. Regenerative Approaches and Analysis
- 2. The Socionatural Framework
 - 2.1. Different Processes Observable with Different Time-Frames and Scales
 - 2.1.1. Inconsistencies, Gaps, and Uncertainties in Natural Systems Analyses
 - 2.1.2. Socio-technological Interactions: Context and Adaptability
- 3. Regenerative Societies and Food Systems
 - 3.1. Reintegrating Food and Agricultural Systems into Nature and Society
 - 3.2. Policy and Management Frameworks: Coping with Uncertainties in a Time of Transition
- 4. Regenerating Local and Regional Food Systems
 - 4.1. Building Local and Regional Visions for Sustainable Food Systems
 - 4.2. Identifying Key Contextual Variables, Structures, Trends, Needs, and Goals
 - 4.3. Developing Local and Regional Policies and Management Practices
- 5. Conclusions

Index **405**

About EOLSS **415**

VOLUME III

Management of Agricultural Systems

2

Robert J. Hudson, *University of Alberta, Canada*

1. Introduction
2. World Agrifood System
 - 2.1. Structure and Evolution
 - 2.2. External Factors
3. Technological Adaptation
 - 3.1. Land
 - 3.2. Genetic Resources
 - 3.3. Agronomic Practices
 - 3.3.1. Cultivation and Cropping Systems
 - 3.3.2. Nutrient Management
 - 3.3.3. Water Management
 - 3.3.4. Pest Management
 - 3.4. Energy and Labor Management
 - 3.5. Grated Production
 - 3.6. Storage, Handling, and Distribution
 - 3.7. Information Technology
4. Institutional Adaptation
 - 4.1. Subsistence and Community-based Management
 - 4.2. Small Farms
 - 4.3. Cooperatives
 - 4.4. Supply-chain Management and Corporate Concentration
5. Policy Adaptation
 - 5.1. Agriculture and Food Policy
 - 5.2. Trade Policy
6. Implications for Sustainability
 - 6.1. Environmental Challenges
 - 6.1.1. Chemical Contaminants
 - 6.1.2. Soil Degradation
 - 6.1.3. Water Supplies and Eutrophication
 - 6.1.4. Global Warming
 - 6.1.5. Biodiversity and Bioinvasions
 - 6.2. Meeting Global Food Needs Sustainably
 - 6.2.1. Environmental Policy
 - 6.2.2. Pricing to Reflect Environmental Costs
 - 6.2.3. Reducing Inputs
 - 6.2.4. Adopting New Technologies
 - 6.2.5. Encouraging Local Diversification
 - 6.2.6. Research and Development

An Overview of the Food System

24

Catherine Cantley, *Department of Biological Systems Engineering, Washington State University, & Department of Agricultural and Biological Engineering, Purdue University, USA*

Juming Tang, *Department of Biological Systems Engineering, Washington State University, USA*

Barbara Rasco, *Department of Food Science and Human Nutrition, Washington State University, USA*

Lester A. Wilson, *Department of Food Science and Human Nutrition, Iowa State University, USA*

1. Introduction
 - 1.1. Current Problems Facing the Food System
 - 1.2. The Importance of Food
2. Food System
 - 2.1. Farming
 - 2.2. Food Processing

- 2.3. Food Distribution Network
 - 2.3.1. Traceability
 - 2.3.2. Labeling
- 2.4. Retail
- 2.5. Waste Management
- 3. Topics of Concern in World Agriculture
 - 3.1. Poverty and Food Security
 - 3.2. Foodborne Illness
 - 3.3. Trade Regulations
 - 3.3.1. Monitoring Chemical Residues
 - 3.3.2. Microbiological Concerns and Food Safety
 - 3.4. Environmental Issues
- 4. Conclusions

Social and Policy Issues of Agriculture and Food

62

Luther Tweeten, *Department of Agricultural, Environmental, and Development Economics, Ohio State University, Columbus, Ohio, USA. 43210*

- 1. Introduction
- 2. Stages Underlying Contemporary Social and Policy Issues of Agriculture
 - 2.1. Stages II and III: The Rise and Decline of Agriculture
 - 2.2. Stage IV: Mature Economies
- 3. Food Supply and Demand
 - 3.1. Food Supply-Demand Balance and Real Price
 - 3.2. Agriculture is Not Just for Food and Fiber Production Any More
 - 3.3. Biotechnology
- 4. Market Structure in Food Industries
 - 4.1. Production Agriculture
 - 4.2. Structure in Food Marketing
 - 4.3. Farm Input Supply Sector
- 5. Coping with Excess: The Problem of Obesity
- 6. Coping with Scarcity: Underdevelopment and Food Insecurity
 - 6.1. The Standard Economic Model
 - 6.1.1. Public Administration
 - 6.1.2. Sound Macroeconomic Policies
 - 6.1.3. International Trade and Investment Policy
 - 6.1.4. Infrastructure Investment
 - 6.1.5. Public Services
 - 6.1.6. Environment
 - 6.1.7. Food and Income Safety Net
 - 6.2. Empirical Evidence for the Standard Model

Institutions, Organizations, and Policies Affecting Agriculture: Protecting Family Farms, Species, and Food and Water Safety

89

Luther Tweeten, *Anderson Professor of Agricultural Marketing, Policy, and Trade, The Ohio State University, Columbus, USA*

- 1. Introduction
- 2. Regulating Genetically Enhanced Organisms (GEOs)
- 3. Regulating Chemicals
- 4. Regulating Pathogens
- 5. Protecting Endangered Species
- 6. Saving Family Farms
- 7. Conclusions

Agricultural Practices as Barriers to Sustainability**109**Kulshreshtha, S. N. *,Department of Agricultural Economics, University of Saskatchewan, Saskatoon, SK, Canada, S7N 5A8*

1. Introduction
 - 1.1. Background and History of Sustainable Agriculture
 - 1.2. Objectives of the Paper
2. What is Sustainable Agriculture?
 - 2.1. Notion of Sustainability
 - 2.2. Terminology Related to Sustainable Agriculture
 - 2.3. Definition of Sustainable Agriculture
 - 2.4. Desirable Characteristics / Indicators of Sustainable Agriculture
3. Symptoms of Unsustainable Agriculture
4. Major Threats / Challenges to Agricultural Sustainability
5. Barriers to Adopting Sustainable Agriculture
 - 5.1. Lack of definition of Sustainable Agriculture
 - 5.2. Lack of Answer to Fundamental Questions
 - 5.3. Lack of Knowledge
 - 5.4. Common Misconceptions about Sustainable Agriculture
 - 5.5. Resistance to Change
 - 5.6. Misguided Research Focus
 - 5.7. Training and Extension
 - 5.8. External Influences Inhibiting Adoption of Sustainable Practices
 - 5.8.1. Competitive Environment Facing Agriculture
 - 5.8.2. Lack of Property Rights
 - 5.8.3. Poor Enforceability of Property Rights
 - 5.8.4. Population Growth and Policy Focus on Food Self-sufficiency
 - 5.8.5. Growing Masses of Poverty
 - 5.8.6. Foreign Aid and Other External Pressure
 - 5.9. Policy Measures
 - 5.9.1. Agricultural Policies
 - 5.9.2. Non-Agricultural Policies
6. Attaining Sustainable Agriculture in the Future
 - 6.1. Emphasis on Systems rather than on Smaller Components
 - 6.2. Investment in Research and Development
 - 6.3. Enhancement of New and Appropriate Technologies
 - 6.4. Agroecological Approach
 - 6.5. Market Access and Product Differentiation
 - 6.6. Policy Reform
 - 6.7. Development of New Pricing System
 - 6.8. Strengthening of Education and Training Infrastructure
 - 6.9. Improving Social Acceptability

Community-Centered Food-Based Strategies for Alleviating and Preventing Malnutrition 137Thompson, B., *Senior Nutrition Officer, Food and Nutrition Division, Food and Agriculture Organization, Italy*

1. Introduction
 - 1.1. What is FAO and what it does?
 - 1.2. The International Conference on Nutrition (ICN)
 - 1.3. World Food Summit (WFS)
 - 1.4. Community-centered Food-Based Approach
2. Nutritional Status and its Determinants
 - 2.1. Definitions of Malnutrition and Household Food Security
 - 2.2. The Current and Projected Food and Nutrition Situation
3. The Role of Agriculture for Alleviating and Preventing Malnutrition
 - 3.1. Developing an Enabling Policy Environment

- 3.2. Appropriate Macro-Economic Framework
- 3.3. Agricultural Policies
- 3.4. Population Concerns
- 3.5. Environmental Concerns and Sustainable Agriculture
4. Improving the Nutritional Impact of Food and Agriculture Based Strategies
 - 4.1. Increasing Food Production
 - 4.2. Increasing Access to Foods
 - 4.3. Increasing and Maintaining the Nutrient Content of Foods
 - 4.4. Improving the Nutrient Content of the Diet
 - 4.5. Increasing the Consumption of a Nutritionally Adequate Diet
5. Community-centered Food-Based Strategies for Improving Nutrition
6. Conclusions

Developing Sustainable Horticultural Production Systems for Socioeconomic and Nutritional Development in Asia **186**

Ali, M., Asian Vegetable Research and Development Center, Shanhua, Tainan, Taiwan

1. Introduction
2. General Information
 - 2.1. Current Status of Vegetables in Asia
 - 2.2. Problems in Vegetable Production
 - 2.2.1. Irregular Supply
 - 2.2.2. Seasonal Supply
 - 2.2.3. Production and Marketing Constraints
 - 2.3. Vegetable Groups
 - 2.4. Agroecological Zones and Vegetable Production
3. Vegetable Production Systems
 - 3.1. Systems Based on the Proximity to Consumption Centers
 - 3.1.1. Peri-Urban Production System
 - 3.1.2. Home Gardening
 - 3.1.3. Trucking System
 - 3.2. Intensity Based Production system
4. Diversification of Cereal-based System with Horticulture Crops
 - 4.1. Benefits of Diversification
 - 4.2. Possibilities and Limitations to Diversification
5. Vegetable Research Focus
 - 5.1. Year Round Intensive Vegetable Production System Program
 - 5.1.1. Peri-urban System in the Lowlands
 - 5.1.2. Home Garden
 - 5.1.3. Intensive System in the Highlands
 - 5.2. Cereal-based Vegetable System
 - 5.2.1. Legumes in the Cereal-based System
 - 5.2.2. Vegetables in the Cereal-based System
6. Successful Examples

Soil Climatology and Meteorology

217

Jean L. Steiner, US Department of Agriculture, Agricultural Research Service, Watkinsville, Georgia, USA

1. Introduction
 - 1.1. Macroclimate and microclimate
 - 1.2. Soil-plant-animal-atmospheric interaction
2. Radiation
 - 2.1. Radiation Laws
 - 2.2. Radiation balance
 - 2.3. Biological responses to light

3. Soil heat flux and soil temperature
 - 3.1. Conduction
 - 3.2. Daily and seasonal patterns of soil temperature
 - 3.3. Frozen soils
 - 3.4. Temperature effects on organisms
4. Water
 - 4.1. The state of water in soil
 - 4.2. Evaporation
 - 4.3. Flow of water in soil
 - 4.4. Moisture effects on soil organisms
5. Oxygen and other gaseous materials
6. Wind and atmospheric transport
 - 6.1. Boundary layer
 - 6.2. The logarithmic wind speed profile
 - 6.3. The Reynolds analogy
7. Practices to modify the soil microclimate
 - 7.1. Mulching
 - 7.2. Crop geometry
 - 7.3. Slope and aspect
 - 7.4. Windbreaks
8. State of the art in soil microclimate

Land Classifications, Sustainable Land Management, and Ecosystem Health **244**

J. Dumanski, *Centre for Land and Biological Resources Research (CLBRR), Canada*

Prem S. Bindraban, *Plant Research International, Wageningen University and Research Centre, The Netherlands*

W.W. Pettapiece, *National Soil Resources Institute, Cranfield University, UK*

Peter Bullock, *National Soil Resources Institute, Cranfield University, UK*

Robert J. A. Jones, *National Soil Resources Institute, Cranfield University, UK*

A. Thomasson, *National Soil Resources Institute, Cranfield University, UK*

1. Land Evaluation
 - 1.1. Soil Interpretations
 - 1.2. Land Capability and Land Suitability
 - 1.2.1. Development of the Land Capability Classification in USA
 - 1.2.2. The Canada Land Inventory (CLI) - A Modified Land Capability Classification
 - 1.2.3. Land Capability Systems in Europe
 - 1.3. Physical and Integral Land Evaluation
 - 1.4. The International Framework for Land Evaluation
 - 1.5. Quantitative Land Evaluation Using Computer Models
 - 1.6. Yield Potential Analyses - A Computerized Application of Land Evaluation
 - 1.7. The International Framework for Evaluation of Sustainable Land Management
 - 1.8. Land Quality Indicators
2. Sustainable Land Management and Ecosystem Health
 - 2.1. Opportunities for Sustainable Land Management and Improved Ecosystem Health through the International Conventions
3. Sustainable Land Management and Sustainable Agriculture-Capturing Opportunity

Crop Production Capacity: A Global Perspective **267**

K. D. Wiebe, *Economic Research Service, U. S. Department of Agriculture, USA*

P. Crosson, *Resources for the Future, USA*

1. Introduction
2. Trends in Demand
 - 2.1. Population
 - 2.2. Income

- 2.3. Urbanization
- 2.4. Future Demand
3. Sources of Production Growth: Natural Resources
 - 3.1. Land
 - 3.1.1. Land Quantity
 - 3.1.2. Land Quality
 - 3.1.3. Land Degradation
 - 3.1.4. Land Use Projections
 - 3.2. Water
 - 3.3. Climate
 - 3.4. Genetic Resources
 - 3.5. Summary: Supplies of Natural Resources
4. Sources of Production Growth: Knowledge and Technology
 - 4.1. Improved Crop Varieties
 - 4.2. Fertilizer
 - 4.3. Machinery
5. Trends in Crop Yields and Production
 - 5.1. Yields
 - 5.2. Past Production
 - 5.3. Future Production
6. The Critical Role of Markets and Institutions
 - 6.1. Prices
 - 6.2. Institutions
7. Challenges for Policy and Research
 - 7.1. The Quantitative Dimension
 - 7.2. The Direction of Future Research
 - 7.3. Summary: Policy and Research
8. Conclusion

Crop Production Capacity in Africa

299

Shahla Shapouri, *Economic Research Service, U.S. Department of Agriculture, USA*
 Stacey Rosen, *Economic Research Service, U.S. Department of Agriculture, USA*
 Johann Kirsten, *University of Pretoria, South Africa*

1. Introduction
2. Past Trends in Demand
 - 2.1. Population
 - 2.2. Income
3. Past Trends in Crop Inputs and Production
 - 3.1. Policy issues
 - 3.2. Resource issues
 - 3.2.1. Land
 - 3.2.2. Water
 - 3.2.3. Fertilizer
 - 3.2.4. Machinery
 - 3.3. Production
4. Projections of Future Trends
 - 4.1. Production
 - 4.2. Policy issues
 - 4.3. Resource issues
5. Conclusions

Fertilizer Use in Western Europe: Types and Amounts

315

K.F. Isherwood, *Formerly of the International Fertilizer Industry Association, Paris, France*

1. Introduction

2. Crops
3. Fertilizers and Their Types
 - 3.1. Nitrogen
 - 3.2. Phosphate
 - 3.3. Potash
 - 3.4. Multi-nutrient fertilizers
4. The West European fertilizer industry
5. Fertilizer Consumption
 - 5.1. Outlook

Fertilizer Use in Sub-Saharan Africa: Types and Amounts

327

V.A. Kelly, *Department of Agricultural Economics, Michigan State University, USA*

A. Naseem, *Department of Agricultural Economics, Michigan State University, USA*

1. History of Fertilizer Use in Sub-Sahara Africa
 - 1.1. Background
 - 1.2. Quantities of Fertilizer Consumed
 - 1.3. Intensity of Fertilizer Use
 - 1.4. Types of Fertilizers Used
2. Factors Influencing the Growth of Fertilizer Use
 - 2.1. Historical and Policy Influences
 - 2.2. Agro-ecological Zones and Other Geographic Factors
 - 2.3. Colonial Heritage
 - 2.4. Demography
 - 2.5. National Income
 - 2.6. Infrastructure
 - 2.7. Crop Choice
 - 2.8. Prices and Profitability
3. The Effect of Fertilizer Use on Crop Production and the Environment
4. Future Trends Anticipated

Fertilizer Use in South Asia

340

J. C. Katyal, *National Academy of Agricultural Research Management, Hyderabad, India*

M. N. Reddy, *National Academy of Agricultural Research Management, Hyderabad, India*

1. Introduction
 - 1.1. Geographical Setup
 - 1.2. Demography
 - 1.3. Cropland and Soil Fertility
2. Fertilizer use in South Asia
 - 2.1. Consumption and production
 - 2.2. NPK consumption pattern
 - 2.3. NPK – product profile
3. Elements of fertilizer use in South Asia
 - 3.1. Irrigation
 - 3.2. Price and non-price factors
 - 3.3. Crop-nutrient specificity
4. Fertilizer use and sustainability of agriculture
 - 4.1. Area expansion
 - 4.2. HYVs and irrigation
 - 4.3. Fertilizers
 - 4.3.1. Efficiency of use
5. Conclusions

Rangeland Communities: Structure, Function, and Classification	365
<i>Kurt O. Reinhart, United States Department of Agriculture- Agricultural Research Service, Fort Keogh Livestock and Range Research Laboratory, USA</i>	

1. Vegetation composition, structure, and life-history
 - 1.1. Composition
 - 1.2. Structure
 - 1.3. Life-History Traits
 - 1.4. Structure and Composition Linkage
2. Ecosystem function
 - 2.1. Structure and Function Linkage
 - 2.2. Diversity and Function Linkage
3. Vegetation classification
 - 3.1. Introduction
 - 3.2. Basis for Classifying Vegetation
 - 3.3. Major Classes of Vegetation
4. Rangeland classification systems
 - 4.1. Range Succession Model
 - 4.2. Ecological Sites Model
 - 4.3. Landscape Function Analysis
 - 4.4. Interpreting Indicators of Rangeland Health
5. Current state of vegetation classification systems

Index	389
--------------	------------

About EOLSS	397
--------------------	------------