

ENERGY FOR RURAL DEVELOPMENT IN ZIMBABWE

Edited by
Richard H. Hosier

Published by
THE BEIJER INSTITUTE
The Royal Swedish
Academy of Sciences
Stockholm, Sweden

and

**THE SCANDINAVIAN INSTITUTE
OF AFRICAN STUDIES**
Uppsala, Sweden

CONTENTS

I.	Energy for Rural Development in Zimbabwe: Concepts and Issues for Growth with Equity	1
1.	Introduction	1
2.	Energy for Rural Development in Zimbabwe	1
3.	Approaches to Energy Planning in Developing Countries	3
4.	Zimbabwe's Rural Structure and Energy System	10
5.	Zeap Rural Energy Studies	14
6.	Rural Energy Policy Issues	16
II.	Energy Use in Zimbabwe's Agricultural Sector	20
1.	Introduction	20
2.	Energy Use in Agriculture	21
3.	Zimbabwe's Natural Resource Base	23
4.	Zimbabwe's Agrarian Structure	25
5.	Energy Use in Zimbabwe's Agricultural Sector	32
6.	The Energetics of Agriculture in Zimbabwe	35
7.	Key Issues for Agricultural Energy Development	45
8.	Summary and Recommendations	52
III.	Methodology for the Assessment of Land-Use in Zimbabwe	60
1.	Introduction	60
2.	Land Areas and Ecological Zones	60
3.	Distribution of Cultivation	67
4.	Indigenous Forest and Grazing Land and Non-Utilizable land	71
5.	Agricultural Productivity	73
	Appendices: The distribution of Land by Natural Region, 1982	75
	Appendix III-1: Communal Land	75
	Appendix III-2: LSCF and State Farms	77
	Appendix III-3: Resettled Areas	79
	Appendix III-4: SSCF	
IV.	Household Energy Use in Zimbabwe: An Analysis of Consumption Patterns and Fuel Choice	83
1.	Introduction	83
2.	Physical and Conceptual Background	84
3.	Residential Energy Consumption in Zimbabwe	87
4.	Household Fuel Choice	91
5.	Conclusions	105

V.	Women and the Rural Energy Economy of Zimbabwe: Research Findings and Policy Issues	110
1.	Introduction	110
2.	Women and Rural Energy	111
3.	Towards a Women-Oriented Rural Energy Development Policy	133
VI.	Performance Testing Domestic Cookstoves for Zimbabwe	142
1.	Introduction	142
2.	The Program	143
3.	The Stoves	146
4.	Results and Discussion	149
5.	Conclusions	155
VII.	Fuelwood Consumption and Supply Patterns, Tree- Planting Practices, and Farm Forestry in Rural Zimbabwe	160
1.	Introduction	160
	Part I. Fuelwood Consumption Patterns and Supply in Rural Zimbabwe	160
2.	Background	160
3.	Fuel Types, Appliances and Preferred Fuelwood Species	161
4.	Wood Storage	162
5.	How Fuel is Obtained	163
6.	Source of Fuelwood	163
7.	Transport	164
8.	Demand and Supply	165
9.	Wood Resource Adequacy	166
	Part II. Tree-Planting Practices and the Potential Role of Farm Forestry in Zimbabwe's Rural Areas	172
10.	Introduction	172
11.	Results of the Tree-Planting Survey	173
12.	Discussion	175
13.	Farm Forestry	176
14.	General Discussion	180
15.	Conclusions	183
VIII.	Woodfuel Harvesting and Soil Erosion in Zimbabwe	185
1.	Introduction	185
2.	Factors Influencing Soil Erosion and Erosion Rates in Zimbabwe	186
3.	Soil Erosion Hazard	190
4.	Soil Erosion Observations	191
5.	Erosion Classification Scheme	193
6.	General Conclusions from Field Observations	194

IX. The Prospect for Application of Renewable Energy Technologies in Zimbabwe's Rural, Domestic and Agricultural Sectors	199
1. Introduction	199
2. Demand	200
3. Renewable Energy Resources	207
4. Review of Applications and Technology	214
5. Cooking and Heating	219
6. Water Heating	226
7. Traction and Transport	228
8. Irrigation, Stock Watering and Domestic Water Pumping	231
9. Conclusions	240
List of Contributors	243
Index	245

LIST OF TABLES

Chapter I

I-1	Classification Matrix for Rural Energy Studies	8
I-2	Zeap Project Studies	15

Chapter II

II-1	Land Areas by Natural Region	25
II-2	Distribution of Agricultural Land	26
II-3	Energy Consumption in the Agricultural Sector	32
II-4	Energy Consumption in the LSCF Sector	33
II-5	Energy Consumption in the LSCF Sector by Crop	34
II-6	Energy Consumption for the Major LSCF Crops	35
II-7	Energetic Efficiency of Maize Production in Zimbabwe's LSCF Sector and the United States	36
II-8	Energetic Efficiency of Wheat Production in Zimbabwe's LSCF Sector and the United States	37
II-9	Energetic Efficiency of Wheat Production on Two Lowveld State Farms in Zimbabwe	38
II-10	Energy Intensity of Irrigated Cotton Production	39
II-11	Production Statistics: Communal Areas	40
II-12	Energy Inputs and Outputs: Communal Areas	41
II-13	Production Statistics: Resettlement Schemes (A)	43
II-14	Energy Inputs and Outputs: Resettlement Schemes (A)	43

Chapter III

III-1	Related Farming Systems	
III-2	Provincial Land-Use Totals by Natural Region	63
III-3	Land-Use Categories and Agro-Ecological Regions	65
III-4	Land-Use Categories in Zimbabwe	66
III-5	Forest Lands	67
III-6	Projection of Cropped Land	69
III-7	Projected Increases in Agricultural Production	70
III-8	Non-Utilizable Land in Zimbabwe	71
III-9	Indigenous Forest/Grazing Land in Zimbabwe	72
III-10	Distribution of Non-Utilizable Land	72

Chapter IV

IV-1	Fuel Consumption by Residential Subsector	88
IV-2	Fuel Consumption by Income Category	89
IV-3	Fuel Consumption by Natural Region	91
IV-4	Definition of MNL Variables: National Level	95
IV-5	Analysis of Individual Parameters: National Level	97
IV-6	Sign Effects of Variables: National Level	98
IV-7	Definition of MNL Variables: Urban Areas	100
IV-8	Analysis of Individual Parameters: Urban Areas	101
IV-9	Sign Effects of Variables: Urban Areas	102
IV-10	Definition of MNL Variables: Rural Areas	103
IV-11	Analysis of Individual Parameters	104
IV-12	Sign Effects of Variables: Rural Areas	105

Chapter V

V-1	Population Pressures and Timber Shortages	114
V-2	Heads of Households by Age and Sex	115
V-3	Women's Labor Contribution per Task	115
V-4	Karange TTL Labor Input in Agriculture	116
V-5	Major Food Crop Cycles and Labor Input by Sex	117
V-6	Labor Input In Rural Zimbabwe by Task	117
V-7	Age and Gender Composition of Labor	118
V-8	Tasks: Timing and Labor Input for Maize	121
V-9	Labor Input by Task: Percentage of Working Hours	122
V-10	Seasonal Schedule of Daily Activities for Women	123
V-11	Length of Day for Men and Women	124
V-12	Labor Intensity by Age and Gender	125
V-13	Household Labor Times for Fuelwood Collection	126
V-14	Family Decision-Making in Rural Zimbabwe	127
V-15	Age and Gender Composition: Crop Production	129
V-16	Peasant Crops Grown for Food or Cash	130

Chapter VII

VII-1	Tree-Part Use as Fuel	161
VII-2	Distance to Fuel Source	164
VII-3	Forms of Transport	164
VII-4	National Fuelwood Supply and Demand Relationships	165
VII-5	Provincial Fuelwood Supply and Demand	166
VII-6	Fuelwood Supply and Demand for Three Provinces	169
VII-7	Type/Frequency of Trees Planted in Communal Areas	173
VII-8	Percentages of Seedling Sources	174
VII-9	Percentages of Tree-Planting Initiatives	174
VII-10	Percentages of Tree-Planting Purposes	175

Chapter VIII

VIII-1	Soil Loss from Crops Having Varying Cover Values	188
VIII-2	The Categories of Erosion in Zimbabwe	189
VIII-3	Soil Erosion Hazard in Communal Areas	190
VIII-4	Erosion Observations in Makoni District	192
VIII-5	Erosion Observations in Marange District	193

Chapter IX

IX-1	Final Consumption by Sector	200
IX-2	Fuel Consumption by End-Use	202
IX-3	Fuel Consumption, by End-Use	203
IX-4	Fuel Consumption by End-Use	204
IX-5	Average Monthly Rainfall by Catchment Area	209
IX-6	Technical Characteristics: Selected Applications	216
IX-7	Technical Characteristics: Selected Technologies	217
IX-8	Selected Application/Technology Matches	218

LIST OF MAPS

Map II-1	Distribution of Natural Regions by Province	24
Map II-2	Distribution of Large-Scale Commercial and Communal Farm Areas by Natural Region	27
Map II-3	Distribution of Resettlement Schemes by Natural Region	30
Map II-4	Tillage Zone Map of Mechanical Tillage Program	51

LIST OF FIGURES

Figure II-1	Effect of Fertilizer on Maize Yields	48
Figure V-1	Age-Gender Pyramid in Communal Areas	113
Figure VI-1	Constant Power Tests: Efficiency v Output	155
Figure VII-1	Fuelwood Supply Balance: Base-Case Scenario	168
Figure IX-1	Typical Daily Rural Cooking/Heating Schedule	220