INTRODUCTION

Developments in mountain zones in South East Asia	
The need for holistic and systems research	4
Objectives and structure of this book	-
CHAPTER 1	
MOUNTAIN ZONES AND RESEARCH CONCEPTS	
1.1 The mountain zones in South East Asia	(
1.1.1 Natural resources and environment	Ć
1.1.2 Population and hill tribes	18
1.1.3 Mountain systems development and emerging problems	23
1.2 Study areas in South East Asia	30
1.2.1 Criteria for the selection of countries and study areas	30
1.2.2 Study areas with focus on Natural Resource Management	32
1.2.3 Study areas with focus on Living Standard and Rural Livelihood	39
1.3 Concepts and methodologies	42
1.3.1 The decision-oriented systems approach (DOSA)	44
1.3.2 Information and knowledge systems	48
1.3.3 Classification: clusters and groups	57
1.3.4 Living standard and rural livelihood concepts 1.3.5 Remote sensing and GIS in rural development	61
1.5.5 Remote sensing and GIS in tural development	68
CHAPTER 2	
NATURAL RESOURCES MANAGEMENT	
2.1 Forest resources and farming systems in rural development – a case from	75
northern Thailand	,,,
by Suwanna Praneetvatakul	
2.1.1 Objectives and research concept	75
2.1.2 Family resources and living stanard	79
2.1.2.1 Family resources and energy	79
2.1.2.2 Living standard of the families	84
2.1.3 Potential improvement at family level to protect forests	91
2.1.3.1 Reduction of wood energy consumption	92
2.1.3.2 Reforestation, community forestry and woodland plantation	99
2.1.3.3 Agro forestry	101
2.1.4 Family level assessment: The impact of future strategies	102
2.1.4.1 Definition of family and environmental/regional models	103
2.1.4.2 Impact of more efficient woodstoves and fruit trees at family level	104
2.1.4.3 Price reduction of modern energies	109
2.1.4.4 Summary of the future impact analysis at family level	110
2.1.5 Society level assessment: The environmental impact of future strategies	110
2.1.5.1 The gap between family and environmental/regional model results	111
2.1.5.2 Introduction of woodstoves and fruit trees	112
2.1.5.3 Impact of improved wood engery strategies in the region	116
2.1.5.4 Summary of the future impact analysis at the regional/societal level	118
2.1.6 Summary and conclusions	119

2.2	Water resources management and irrigation farming systems - a case	123
	from northern Thailand	
	by Acharee Sattarasart	
	2.2.1 Objectives and research concept	123
	2.2.2 Water resources and irrigation management	127
	2.2.2.1 Water resources capacity and use	127
	2.2.2.2 State Managed Irrigation System	131
	2.2.2.3 Farmer Managed Irrigation System	132
	2.2.3 Irrigation Water Pricing	134
	2.2.3.1 Philosophy and concepts of water pricing	134
	2.2.3.2 Payment for Irrigation Services	135
	2.2.3.3 Cost of operation and maintenance for the organizations	138
	2.2.3.4 Farmers willingness and ability to pay	141
	2.2.4 Living standard of the families and decision-making	146
	2.2.4.1 Family income, liquidity and credit	148
	2.2.4.2 Household expenditures and family household supply	152
	2.2.4.3 Farmers opinion and perceptions for decisions	154
	2.2.5 The impact of future water resources management strategies	156
	2.2.5.1 Definition of models and strategies	156
	2.2.5.2 The impact of increasing water availability	158
	2.2.5.3 The impact of different water pricing strategies	160
	2.2.6 Summary and conclusions	163
2.3	Land resources: availability, ownership and use – a case from northern Thailand	167
	by Nuchanata Mungkung	
	2.3.1 Objectives and research concept	167
	2.3.2 Land tenure and land use	170
	2.3.2.1 Land tenure and user rights	170
	2.3.2.2 Land use change over time	174
	2.3.2.3 Family land resources	177
	2.3.2.4 Families` willingness to move to another region in search of land	179
	2.3.2.5 Farmers perceptions of land	180
	2.3.3 Living standard of the families and decision making	183
	2.3.3.1 Farm and family income	183
	2.3.3.2 Liquidity, credit and household expenditures	186
	2.3.3.3 Household supply	189
	2.3.3.4 Decision-making: families` perception, objectives and preferences	192
	2.3.3.5 Summary of the living standard and decision analysis	195
	2.3.4 The impact of future land development strategies	195
	2.3.4.1 Definition of strategies and models	195
	2.3.4.2 Impact of worsening land scarcity through fragmentation of land	197
	2.3.4.3 Land ownership programme without improvement of credit access	199
	2.3.4.4 Land ownership programme with improved credit access	201
	2.3.5 Summary and conclusions	203

	207
Sumatra, Indonesia	
by Mathias Grüninger	205
2.4.1 Objectives and research concept	207
2.4.2 Land resource management by upland farmers	211
2.4.2.1 Natural vegetation and land use	211
2.4.2.2 Slop steepness and digital surface modeling 2.4.2.3 Farmland and land tenure	211
	214
2.4.3 Socio-economics of upland farming families	218
2.4.3.1 Living standard, income and income distribution 2.4.3.2 Relation between income and fertilization	218
2.4.3.3 Relation between family income and soil degradation	226 228
2.4.3.4 Liquidity and expenditures	230
2.4.4 Impact modelling and analyses of future strategies	233
2.4.4.1 A dynamic resource degradation and quality model	235
2.4.4.2 Future farming systems development without soil conversation	233
2.4.4.3 Families` benefit forgone: the families` costs	241
2.4.4.4 Impact assessment of soil conversation offered to farmers	241
2.4.4.5 Impact assessment of soil conversation enforced on all uplands	242
2.4.4.6 Impact of not allowing any degrading cropping activities	247
2.4.4.7 Soil degradation costs at regional level and subsidization	251
2.4.5 Summary and conclusions	251
CHAPTER 3 LIVING STANDARD AND RURAL LIVELIHOOD	
3.1 Improving living standard of different ethnic groups in northern Thailand:	259
the socio-economic approach	
by Jirawan Kitchaicharoen	
3.1.1 Objectives and research concepts	
	259
3.1.2 Resources and production analyses	
3.1.2 Resources and production analyses 3.1.2.1 Resource availability and use	
3.1.2.1 Resource availability and use3.1.2.2 Production system and resource use efficiency	262 262 267
3.1.2.1 Resource availability and use3.1.2.2 Production system and resource use efficiency3.1.3 Living standard of families and decision-making	259 262 262 267 270
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income	262 262 267
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures	262 262 267 270 271 274
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing	262 262 267 270 271 274 275
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education	262 262 267 270 271 274 275 277
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk	262 262 267 270 271 274 275 277 279
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk 3.1.3.6 Social security and safe live	262 262 267 270 271 274 275 277 279 280
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk 3.1.3.6 Social security and safe live 3.1.3.7 Living standard assessment and livelihood indicators	262 262 267 270 271 274 275 277 279 280 280
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk 3.1.3.6 Social security and safe live 3.1.3.7 Living standard assessment and livelihood indicators 3.1.4 The impact of future strategies to improve living standard	262 267 270 271 274 275 277 279 280 280
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk 3.1.3.6 Social security and safe live 3.1.3.7 Living standard assessment and livelihood indicators 3.1.4 The impact of future strategies to improve living standard 3.1.4.1 Strategies and dynamic programming with Monte-Carlo simulation	262 262 267 270 271 274 275 277 279 280 280 284 284
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk 3.1.3.6 Social security and safe live 3.1.3.7 Living standard assessment and livelihood indicators 3.1.4 The impact of future strategies to improve living standard 3.1.4.1 Strategies and dynamic programming with Monte-Carlo simulation 3.1.4.2 Impact of Thai farmers` investment in water resource development	262 262 267 270 271 274 275 277 279 280 284 284 284
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk 3.1.3.6 Social security and safe live 3.1.3.7 Living standard assessment and livelihood indicators 3.1.4 The impact of future strategies to improve living standard 3.1.4.1 Strategies and dynamic programming with Monte-Carlo simulation 3.1.4.2 Impact of Thai farmers` investment in water resource development 3.1.4.3 Impact of changes in credit conditions	262 262 267 270 271 274 275 277 279 280 284 284 284 286
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk 3.1.3.6 Social security and safe live 3.1.3.7 Living standard assessment and livelihood indicators 3.1.4 The impact of future strategies to improve living standard 3.1.4.1 Strategies and dynamic programming with Monte-Carlo simulation 3.1.4.2 Impact of Thai farmers` investment in water resource development 3.1.4.3 Impact of changes in credit conditions 3.1.4.4 Impact of changes in land resource availability	262 262 267 270 271 274 275 277 280 280 284 284 284 287 289
3.1.2.1 Resource availability and use 3.1.2.2 Production system and resource use efficiency 3.1.3 Living standard of families and decision-making 3.1.3.1 Farm, off-farm and family income 3.1.3.2 Cash availability, liquidity and household expenditures 3.1.3.3 Food supply, drinking water and housing 3.1.3.4 Health conditions and education 3.1.3.5 Independence from resource owner and risk 3.1.3.6 Social security and safe live 3.1.3.7 Living standard assessment and livelihood indicators 3.1.4 The impact of future strategies to improve living standard 3.1.4.1 Strategies and dynamic programming with Monte-Carlo simulation 3.1.4.2 Impact of Thai farmers` investment in water resource development 3.1.4.3 Impact of changes in credit conditions	262 267 270 271 274 275 277 279 280 284 284 284

3.2 Food security through land use alternatives in hill-tribe areas of northern	297
Thailand: a spatial approach	
by Chakkrit Thongthap	
3.2.1 Objectives and research concepts	297
3.2.1.1 Problems and objectives	297
3.2.1.2 Concept and methods	298
3.2.2 Past land use changes	303
3.2.3 Estimating land degradation and soil nutrient deplition	304
3.2.3.1 Spatial data preparation and modeling	304
3.2.3.2 Soil erosion and soil loss	307
3.2.3.3 Soil nutrient balance	308
3.2.4 Land suitability for agricultural production	309
3.2.4.1 Land suitability for different crops	309
3.2.4.2 Land suitability and socio-economic differentiation	315
3.2.5 Determination of the potential of the region	316
3.2.5.1 The socio-economic potential	316
3.2.5.2 Determination of land use potential	324
3.2.6 Summary and conclusions	330
3.3 Micro level perspectives of rural livelihood in mountain regions of northern	333
Vietnam	
by Do Anh Tai	
3.3.1 Contribution to resource management and rural livelihood	333
3.3.2 Specific problems and objectives	333
3.3.3 Research design and methodology	335
3.3.4 Family resources and use	337
3.3.5 Living standard and food security	338
3.3.5.1 Farm and family income	338
3.3.5.2 Liquidity, investment and household expenditures	343
3.3.5.3 Food supply and food security	347
3.3.5.4 Drinking water, health and education	353
3.3.5.5 Independence from resource owners and social security	356
3.3.6 Future impact assessment	358
3.3.6.1 Strategies and scenarios of future development	358
3.3.6.2 Impact of change in credit conditions	362
3.3.6.3 Impact of changes in land availability	363
3.3.6.4 Impact of changes in land quality	365
3.3.7 Summary and conclusions	370
3.4 Spatial analyses and impact assessment for rural livelihood in mountain	377
regions of Northern Vietnam by Peter Lentes	
	200
3.4.1 Contribution to resource management and rural livelihood	377
3.4.2 Specific problems and objectives	377
3.4.3 Concept and study area	380
3.4.4 Spatial analyses and socio-economic development	382
3.4.4.1 Remote sensing data to determine land cover and slopes	382
3.4.4.2 From family survey to spatial analyses: topography and locations	382
3.4.4.3 From statistics towards spatial analyses: demographic trends	385

W		
w		

Table of Contents

3.4.4.4 From household data toward spatial analyses:seasonal food shortage	386
3.4.5 Spatial and socio-economic classification of families	386
3.4.6 Transportation and cost distance to fields and markets	389
3.4.7 GIS modelling: impact assessment	390
3.4.7.1 Income estimation under given land use	392
3.4.7.2 Impact assessment of soil degradation	395
3.4.7.3 Impact assessment of soil conservation measures	400
3.4.7.4 Impact assessment of improved infrastructure	403
3.4.8 Summary and conclusions	409
CHAPTER 4	
SUMMARY AND SYNTHESIS	
4.1 Philosophy and rationale	411
4.2 Methodology and research concepts	413
4.3 Quality of the empirical results of the research projects	423
4.4 General results of past analyses	425
4.5 Future strategy assessment	428
References	433