

INSTITUTE OF REGIONAL DEVELOPMENT PLANNING, UNIVERSITY OF STUTTGART

CHINESE ACADEMY OF SCIENCES, SOUTH EAST RESOURCES ENVIRONMENT,
COMPREHENSIVE RESEARCH CENTRE

Sustainable Development by Integrated Land Use Planning (SILUP)

Final Report on a Co-operative Research Project

Edited by
Peter Treuner, Zhixiang She, Jingsha Ju

Participating Institutes:

Institute of Landscape Planning and Ecology of the University of Stuttgart, Germany (ILPOE)
Institute of Photogrammetry of the University of Stuttgart, Germany (IFP)
Institute of Hydraulic Engineering of the University of Stuttgart, Germany (IWS)
Institute of Regional Development Planning of the University of Stuttgart, Germany (IREUS)

Nanjing Institute of Geography and Limnology of Chinese Academy of Sciences, Nanjing, China
Department of Urban and Resources of Nanjing University, Nanjing, China
Hydraulic Bureau of Nanjing, Nanjing, China
Department of Water Resources of Hohai University, Nanjing, China
Nanjing Institute of Soil Science of Chinese Academy of Sciences, Nanjing, China

Stuttgart, September 2001

List of Contents

Preface of the German Project Co-ordinator (<i>Treuner</i>)	1
Preface of the Chinese Project Co-ordinator (<i>She</i>)	3
1 Summary (<i>She, Treuner, Ju</i>)	5
1.1 Project Background.....	5
1.2 Principle Objectives of the Project	6
1.2.1 Developing Interdisciplinary Methods for Integrated Land Use Planning	6
1.2.2 Providing Administratively Applicable Tools for Planning and Management of Land and other Natural Resources	6
1.3 Project Achievements	7
1.3.1 FCM Integration	7
1.3.2 Information Management	8
1.3.3 Water Management	9
1.3.4 Ecological Aspects	10
1.3.5 Socio-Economic Aspects	11
1.4 Training Requirements and Further Co-operation Resulting from the Project	12
1.5 Dissemination of the Project Results	12
1.6 General Experience of the Project.....	13
1.6.1 The Difficulty of Reaching a Common Methodical Understanding among Researchers from Very Different Fields of Competence	13
1.6.2 The Unavailability of MOMS Remote Sensing Data	13
1.6.3 Financial Constraints	13
1.7 Concluding Remarks.....	14
2 Objectives of the SILUP Project (<i>Treuner, Ju</i>)	15
2.1 Developing Interdisciplinary Methods for Integrated Land Use Planning.....	15
2.2 Providing Administratively Applicable Tools for Planning and Management of Land and other Natural Resources	18
3 The Test Area: Jiangning	19
3.1 Developmental Situation and Trends (Demography and Economy) (<i>She, Shen</i>)	19
3.1.1 A Brief Introduction of Jiangning and the SILUP Study Area	19
3.1.2 The Social and Economic Characteristics of the SILUP Study Area.....	20

3.1.3	Economic Development Trends of the SILUP Study Area	21
3.2	The Natural Situation (<i>Shen, Cai</i>)	22
3.2.1	Landform	22
3.2.2	Water System and Water Resources	23
3.2.3	Climate	24
3.2.4	Soil	26
3.2.5	Vegetation	27
3.3	Land Use Changes and Trends (<i>Feng, Shen, He</i>)	27
3.3.1	General Analysis of Land Use Changes	27
3.3.2	Obtaining of Dynamic Information on Land Use	29
3.3.3	Study of Dynamic Change of Land Use	30
4	Research Concept of the SILUP Project	32
4.1	The Concept of a "Final Classification Matrix (FCM)" (<i>Ju</i>)	32
4.1.1	FCM Design	32
4.1.2	FCM Matrices System (FCM-Tree)	33
4.1.3	Characteristics of the FCM System	35
4.1.4	Information Requirements	36
4.2	Methodical Aspects of the "Final Classification Matrix" Approach (<i>Ju, Riegger, Schwarz-von Raumer, Zhang</i>)	36
4.2.1	Structure of the FCM	36
4.2.2	FCM Integration	37
4.2.3	Feedback Function Leading to Revision of FCM	41
4.2.4	Scales of FCM Maps	41
4.3	Development of a FCM-Evaluation Tool (<i>Schwarz-von Raumer</i>)	42
5	Geo-Information Derivation and Management (<i>Feng, Fritsch, Wang, Liu, Hild</i>)	43
5.1	General Review	43
5.1.1	Main Research Work	43
5.1.2	General Results	43
5.1.3	Persisting Problems	45
5.2	Information Extraction and Mapping	45
5.2.1	Thematic Information Extraction	45
5.2.2	Thematic Information Mapping	53
5.2.3	DEM Generation	61

5.2.4	Fusion of RS Data.....	71
5.3	Data Integration and Data Base Management	74
5.3.1	Description of the Data and the Data Format	74
5.3.2	Data Base Structure.....	76
5.4	Distribution and Application of the Data Base	76
6	Socio-economic Aspects of the Final Classification Matrix.....	80
6.1	Population Forecasts for the Towns and Townships of Jiangning (<i>Xu, She</i>)	80
6.1.1	Introduction	80
6.1.2	Basic Elements	81
6.1.3	Migration Population	83
6.1.4	Conclusion	84
6.2	Socio-economic Forecasting and Evaluation.....	85
6.2.1	Evaluation and Classification of the Socio-economic Developmental Situation (<i>Zhu, She</i>).....	85
6.2.2	The Employment Forecasting (<i>Gaspers</i>).....	89
6.3	Estimation of Relative Pressure for Land (<i>Zhang</i>).....	92
6.3.1	Introduction	92
6.3.2	Approach for Inter-zone Distribution of Demand for Land	93
6.3.3	A Belt Approach for Local Distribution of the Demand for Land	94
6.3.4	Estimating the Relative Pressure for Land	97
6.3.5	Results and Analysis.....	97
6.4	Evaluation of Land Resources for New Settlement Development (<i>Ju</i>).....	98
6.4.1	Evaluation Objectives and Framework	98
6.4.2	Date Bases for the Evaluation	101
6.4.3	Evaluation of "Potential of Transferable Land for New Development".....	102
6.4.4	Evaluation of Fragmentation Aspects of Transferable Land.....	103
6.4.5	Evaluation of the "Situation of Land Availability"	106
6.5	Comparison of the Categories of "Socio-economic Needs" Resulting from Different Integration Matrix Structure (<i>Zhang, Ju</i>)	107
6.5.1	Integration Framework.....	107
6.5.2	Definitions of Integration Matrices	107
6.5.3	Results	109

7	The Water System	112
7.1	Integration of Water Aspects into the Integrated Land Use Planning Approach of SILUP (<i>Riegger, Kobus, Chen, Wang, Süß</i>).....	112
7.1.1	Specific Conditions in Jiangning District.....	112
7.1.2	Water Assessment Approach.....	113
7.1.3	Aspects Considered in the FCM Approach.....	113
7.1.4	Aspects Considered by Impact Analyses.....	114
7.1.5	Aspects Not Considered in the Water Assessment Approach.....	114
7.2	The Qinghuai/Jiangning Water System (<i>Chen, Lu, Wang</i>).....	115
7.2.1	The Climatic Background.....	115
7.2.2	Geography Background.....	116
7.2.3	Complicated Water System.....	117
7.2.4	Flood and Drought.....	118
7.2.5	Present Water Need and Groundwater.....	118
7.2.6	Water Quality.....	119
7.2.7	Review of Methodology.....	120
7.3	Assessment of the Water System (<i>Riegger, Süß</i>).....	120
7.4	Local Assessment (<i>Süß, Riegger</i>).....	121
7.4.1	Value of Land for Flood Protection (VLFP).....	121
7.4.2	Value of Land for Protection of Local Water Resources (VLPWR).....	124
7.4.3	Value of Land for Water Aspects.....	124
7.4.4	Result of the Local Assessment.....	126
7.5	Impact Analyses.....	129
7.5.1	Approach and Elements of Impact Analyses (<i>Riegger, Süß</i>).....	129
7.5.2	Upper Land (<i>Süß, Yang, Riegger, Wang</i>).....	129
7.5.3	Polder Area (<i>Lu, Chen</i>).....	134
7.6	Summary (<i>Riegger, Kobus, Süß</i>).....	138
8	Consideration of Ecological Aspects within the Final Classification Matrix ... 140	
8.1	General Considerations on Landscape Ecology in Jiangning (<i>Shen</i>).....	140
8.2	Agricultural Evaluation of Land (Soils) (<i>Schwarz-von Raumer, Cai</i>).....	142
8.2.1	General Considerations and General Approach.....	142
8.2.2	Available and Model-based Generated Information and Data.....	143
8.2.3	Method Used for the Estimation of the Ecological Value of Land for Agriculture....	147

8.2.4	Results	148
8.3	Evaluation of Land with regard to Biodiversity (<i>Schwarz-von Raumer, Kaule</i>)	149
8.3.1	Introduction	149
8.3.2	Correlation between Species Diversity and Structural Diversity.....	150
8.3.3	Evaluation of the Value of Land with regard to Biodiversity	152
8.3.4	Results	156
8.4	The Final "Ecological Value of Land" (<i>Schwarz-von Raumer, Riegger</i>)	156
8.5	Summary and Conclusion (<i>Schwarz-von Raumer</i>)	157
9	Necessities of Further Research (<i>Treuner, Ju</i>)	159
9.1	Elaboration and Finalisation of an Extended Operational Concept for the Final Classification Matrix (FCM) that Can Take into Account Feed-Back Effects	159
9.2	Elaboration of Feed-back Mechanisms Suitable for Taking into Account Effects on the Inputs into the FCM Resulting from FCM-based Land Use Decisions	160
9.3	Specific Aspects of Necessary Further Studies.....	160
9.3.1	Socio-Economic Aspects	160
9.3.2	Water Aspects.....	161
9.3.3	Improvement of Methods to Consider Ecological Phenomena.....	163
9.3.4	Information Support	164
9.4	Improving Present Methods for FCM Development and Integration	165
9.5	Studies on Legal and Institutional Conditions Necessary for an Operational Integrated Land Use Management for Sustainable Development.....	165
9.6	Dissemination of Results	165