

S. Manasi · K. V. Raju

Coping Mechanisms for Climate Change in Peri-Urban Areas

 Springer

Coping Mechanisms for Climate Change in Peri-Urban Areas

S. Manasi • K. V. Raju

Coping Mechanisms for Climate Change in Peri-Urban Areas

 Springer

S. Manasi
Centre for Research in Urban Affairs
Institute for Social and Economic Change
Bengaluru, Karnataka, India

K. V. Raju
Policy and Impact, Asia Program
International Crops Research Institute
for the Semi Arid Tropics (ICRISAT)
Hyderabad, Telangana, India

ISBN 978-3-030-18516-9 ISBN 978-3-030-18517-6 (eBook)
<https://doi.org/10.1007/978-3-030-18517-6>

© Springer Nature Switzerland AG 2020

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

This book is a detailed study by Dr. S. Manasi and Prof. K.V. Raju on land use change, on public-private people partnership on rural health programmes and on the environment with a special focus on understanding the role of culture in the environment, waste management and use of AYUSH systems of medicine. The authors have covered the aspects of climate changes, groundwater depletion and agricultural patterns and expanse of other resources. The focus is on traditional knowledge of ecology, protecting the environment indicating linkages between cultural practices and ecological protection, benefits of the usage of medicinal plants and the complete ecosystem which is the key for health promotion implicating climate change effects.

I believe that there is a huge difference between the healthcare service available in the city, which is world-class, and the healthcare service in the peri-urban area, which is of a very low level. Even their income levels are much better than the rural areas. Healthcare services are not in good state. The holistic approach in healthcare considers environmental, ecological, sociological and nutritional health and well-being. The focus is more on the prevention and early intervention with the treatments of homoeopathy, Ayurveda and naturopathy rather than depending only on western medical intervention. Several diseases can be prevented by nutritional support, environmental changes, proper hygiene and lifestyle modifications.

Environmental pollution and excessive usage of chemicals, pesticides and fertilisers have caused a huge impact on health, thereby causing several disease conditions including cancer. Environment and health is an important subject, which is now getting a lot of attention, and studies are showing some insights into this aspect. The traditional eating habits with locally grown foods are replaced by factory-made chemical-filled processed foods which is causing huge nutritional and health effect on the growing population. The focus on locally grown chemically free, fresh and nutritional vegetables, greens and millets is very important to improve health.

SOUKYA Foundation's experiment goal with Jadigenahalli Panchayat, Hoskote Taluk (Bangalore Rural), in establishing Dr. Mathai Rural Holistic Health Centre is to provide AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy) systems of medicine as an alternative to the western medicine with

an aim to promote holistic health. Our experiment showed us a huge positive impact in and around several villages of Jadigenahalli Grama Panchayat. This was addressed by improving their nutrition, changing their lifestyle and introducing yoga which in turn reduced the dependence on western allopathic medicines, and these interventions are well documented in this book. This model has proved that the holistic health approach, which is more health oriented than disease oriented, will help people to take responsibility of their health with improved nutrition, proper sanitation and appropriate lifestyle habits.

I feel this study and research findings will be of help to the government in changing policies in the peri-urban areas. Besides, it will help researchers and students working on peri-urban areas, climate change and environment.



I. Mathai
Chairman, Managing and Medical Director
Soukya International Holistic Health Centre
Bengaluru, India

Preface

Peri-urban areas, as part of growing urbanisation, have drawn greater attention from planners, researchers and scientists in recent decades. Peri-urban areas comprise the characteristics of both urban and rural areas and are located in the midst of rural landscape, with emerging challenges. The ecology of peri-urban areas gets neglected in the planning process resulting in increased risks of climate change. These areas have attracted several studies focusing on peri-urban interface, investigating urban forms, spatial patterns, implications, etc.; however, there are few studies that have emphasised the role of ecological ethics and cultural practices in the context of development versus conservation conundrum. Given this backdrop, a global city like Bengaluru in India has been witnessing a wide range of changes. The local residents (including the authors) have experienced the city expansion and its magnitude and have for sure not only felt overwhelmed but also petrified of the several challenges, both for the present and the future. Our interest in this dimension was increased with several readings by urban planners, environmentalists, geographers, economists, sociologists and research studies that we were closely involved over the years.

Like other peri-urban regions, Bengaluru City also has undergone changes that may be similar to other urban areas. Climate change dimension of peri-urban areas is linked to local ecosystems of these regions. Patterns of urban expansion and growth differ extensively by region, with diverse implications for its sustainability. Given the increasing concentration of people and the extent of these areas, together with climate change projections, urban and peri-urban sustainability and safety are a growing concern. Keeping all these features in perspective, we focused on micro level dynamics, vulnerabilities and coping mechanisms of peri-urban regions. Since the peri-urban regions of Bengaluru fall under the semi-arid zone, we chose Jadigenahalli Village Council (*Grama Panchayat*), which could broadly represent a comparable situation in similar regions for an in-depth exploration as part of understanding and analysing some of the pertinent questions related to this peri-urban region.

Our book tracks down the recent changes and its influences on environment in the peri-urban contexts. It has provided insights into the complex issues of

urbanisation and the associated externalities and brought to the fore the challenges faced by the peri-urban areas in terms of health, environment and climate. The book has lucidly analysed the following: (a) land use changes reflecting the impact of urbanisation on water resources, (b) intervention of a healthcare model (public-private partnership) through the Ministry of AYUSH for introducing holistic healthcare and (c) traditional healthcare laced with local cultural practices, which play an important role in local environmental protection. This empirical study ascertains that culture plays a significant role in protecting the environment and thereby in combating climate change implications.

Bengaluru, India
Hyderabad, India

S. Manasi
K. V. Raju

Acknowledgements

This book is largely based on multi-year research study carried out by the Center for Ecological Economics and Natural Resources and Center for Research in Urban Affairs of the Institute for Social and Economic Change, Bangalore, India. At the outset, we express our grateful thanks to our former in-charge Director Prof. MR Narayana, Prof. KS James and current Director Prof. MG Chandrakanth for their support and encouragement throughout the course of the study.

We are extremely thankful to the Soukya Foundation and its senior team, Dr. Isaac Mathai, Director, Dr. Suja Isaac, Dr. Sudha, Dr. Satheesh, Dr. Manjunath and Dr. Ganesh, all from Bengaluru, for providing us all the support, facilitating extensive discussions and providing us access to their secondary data and related documents for the study. Our sincere thanks to ASHA health workers, Gram Panchayat President and Members and respondents in Jadigenahalli who have been cooperative and responsive in providing us their views and sharing their concerns and spending enormous time in responding to the questionnaires.

We thank BR Hemalatha and KP Rashmi, Senior Research Assistants, who helped us throughout the study and made valuable contributions.

We deeply mourn the demise of Ms. S Poornima, Research Assistant, in October 2015 and gratefully acknowledge her valuable contribution to the study. She deserves enormous appreciation for all the hard work, diligence and sincerity in contributing to this study right from its inception.

Our special thanks and appreciation to manuscript reviewers and for their critical suggestions and inputs.

We thank ISEC's administration, Prof. Manohar Yadav, the then in-charge Registrar, and the then Accounts Officer Smt. Sharada, Smt. Jyothi and Ms. Niveditha for their support.

S. Manasi
K. V. Raju

Contents

1 Introduction	1
1.1 Why This Book?	1
1.2 Peri-Urban Areas	4
1.3 Evolution of Peri-Urban Areas Around Indian Cities	6
1.3.1 Peri-Urban Ecosystems	8
1.3.2 Vulnerability in Peri-Urban Settlements	11
1.3.3 Water Crisis and Insecurity in Peri-Urban Contexts	12
1.3.4 Peri-Urban Changes and Concerns Over Food and Nutrition	13
1.3.5 Threats to Peri-Urban Forestry	14
1.4 Urbanization in Peri-Urban Areas	14
1.4.1 Urbanisation – Influence of Development Process	14
Annexures	20
Annexure 1.1: Jadigenahalli – Peri-Urban Fringe of Bengaluru City	20
Annexure 1.2: Study Area	21
Annexure 1.3: Socio-Economic Status	24
Annexure 1.4: Population and Households	24
Annexure 1.5: Literacy Rate	25
Annexure 1.6: Gender Status	25
Annexure 1.7: Domestic and Drinking Water Sources	26
References	26
2 Land Use Changes and Groundwater Overuse	29
2.1 Background	29
2.2 Methodology	30
2.2.1 Land Use Classes	30
2.2.2 Description of Land Use Classes	31
2.2.3 Well Inventory	32

2.3	Results	33
2.3.1	Land Use Changes	33
2.3.2	Groundwater Over Exploitation	43
2.3.3	Distribution of Bore Wells as Against Land Use	52
2.3.4	Farmers' Perceptions and Interventions	57
2.3.5	Farmers' Coping Mechanisms	65
2.3.6	Adaptations to Water Scarcity: Technological Adaptation	66
2.3.7	Non-Technological Adaptation: Changing the Cropping Pattern	68
2.4	Changing Ecosystem of Jadigenahalli – Push and Pull Factors	68
2.4.1	Agroforestry	70
2.4.2	Status of Environment in Jadigenahalli	73
2.4.3	Natural Resources Stock – Land Use and Groundwater	73
2.5	Societal Responses	74
2.6	Summary	76
	Annexures	77
	References	91
3	Holistic Health for Well-Being	93
3.1	Background	93
3.2	Dr. Mathai's Rural Health Centre (DMRC) Soukya Foundation	98
3.3	Key Findings	99
3.3.1	Awareness Creation	99
3.3.2	Experiences and Perceptions	106
3.3.3	Challenges	110
3.4	Towards a Sustainable Approach	113
3.4.1	Youth Organisations	114
3.4.2	Improving Communication Strategies – Home Remedies in Printed Form	116
3.4.3	Influencing People on Life Style Changes and Holistic Treatment	116
3.4.4	Need to Promote Organic Farming	117
3.4.5	Need for Improved Sanitation	117
3.5	Summary	119
	Annexures	120
	References	120
4	Cultural Influences on Health, Traditions and Ecology	123
4.1	Background	123
4.2	Local Ecology and People's Health	128
4.2.1	Common Ailments	129
4.3	Socio-Cultural Practices and Ecological Significance	138

- 4.4 Sacred Trees, Temples and Ponds. 140
 - 4.4.1 Ashwath Katte (Sacred Trees) 141
 - 4.4.2 Ownership & Management of Sacred Trees 142
 - 4.4.3 People Worshipping Trees 143
- 4.5 Temples and Natural Resources Conservation. 144
 - 4.5.1 Village Temples 144
 - 4.5.2 Sacred Ponds 147
- 4.6 Summary. 150
- References. 151
- 5 Summary 155**
 - References. 160
- Index. 161**

List of Figures

Fig. 1.1	Bangalore metropolitan region with LPAs	16
Fig. 1.2	Study area and location of villages.	20
Fig. 1.3	Location of Jadigenahalli gram panchayat.	22
Fig. 1.4	Villages Surveyed under Jadigenahalli gram panchayat. (Source: Google earth map, Scale 1:2 km).	23
Fig. 1.5	Annual rainfall	23
Fig. 1.6	Growth rates of Jadigenahalli in terms of HHs and population at two different points of time (%)	24
Fig. 1.7	Literacy rate	25
Fig. 2.1	Land use in Jadigenahalli during 1973.	36
Fig. 2.2	Land use pattern under Jadigenahalli – 2003	36
Fig. 2.3	Land use pattern under Jadigenahalli – 2009	37
Fig. 2.4	Land use pattern under Jadigenahalli – 2013	37
Fig. 2.5	Land use pattern under Jadigenahalli – 2017	38
Plate 2.1	Brick kiln near Govindapura	38
Plate 2.2	Unoccupied residential layout near Kolathur	39
Plate 2.3	Eucalyptus plantation near Jadigenahalli (Forest Plantation)	39
Plate 2.4	Kharif crop (Ragi) near Vadigehalli	40
Plate 2.5	Grape garden near Jadigenahalli	40
Plate 2.6	Rocky area near Haralur.	41
Plate 2.7	Eucalyptus plantation in agriculture land near Govindapura.	41
Plate 2.8	Scrubland near Jadigenahalli	42
Fig. 2.6	Land use under Jadigenahalli GP from 1973 to 2017	48
Fig. 2.7	Variations in the extent of built-up land under Jadigenahalli GP.	48
Fig. 2.8	Increasing trend of layouts under Jadigenahalli GP.	48
Fig. 2.9	Decreasing trend of agricultural lands under Jadigenahalli GP.	49
Fig. 2.10	Varying pattern of agricultural gardens under Jadigenahalli GP.	49
Fig. 2.11	Extent of eucalyptus (Commercial) plantations under Jadigenahalli GP.	50

Fig. 2.12	Distribution of wells under Jadigenahalli gram panchayat	52
Plate 2.9	Old open well (currently not in use) near Kolathur	53
Plate 2.10	One of the open wells having good storage near Vadigehalli.	53
Plate 2.11	Old water storage structure (Kalyani) near Jadigenahalli	54
Plate 2.12	Functional bore well providing irrigation to vegetables near Jadigenahalli.	54
Plate 2.13	Functional bore well used for irrigation of maize near Kolathur.	55
Plate 2.14	Unused bore well located in Scrubland near Haralur.	55
Plate 2.15	Defunct bore well Located in eucalyptus plantation (earlier Crop Land) near Haralur	56
Plate 2.16	Bore well drilled in tank bed near Kolathur.	56
Fig. 2.13	Overall status of groundwater withdrawal structures under Jadigenahalli GP.	57
Fig. 2.14	Variations in the depth of bore wells under Jadigenahalli GP	57
Fig. 2.15	Depths of bore wells in different villages under Jadigenahalli GP.	58
Fig. 2.16	Distribution of bore wells under Jadigenahalli gram panchayat	58
Fig. 2.17	Status of bore wells under Jadigenahalli GP	59
Fig. 2.18	Bore well depths indicated by farmers.	59
Fig. 2.19	Status of bore wells across different land use classes	61
Fig. 2.20	Land use-wise distribution of open wells.	61
Fig. 2.21	Defunct open wells under Jadigenahalli GP.	62
Fig. 2.22	Ground water depletion: scanty rain fall	62
Fig. 2.23	Increased number of borewells: over extraction of ground water	63
Fig. 2.24	Respondents' views on tank degradation across the study villages	64
Fig. 2.25	Respondents' views on deforestation across the study villages.	64
Fig. 2.26	Livelihood impacts of groundwater depletion	65
Fig. 2.27	Coping mechanisms and adaptations	66
Plate 2.17	Dried and abandoned open well and bore well	67
Plate 2.18	Cultivation of coriander (left), carrot (right) using drip irrigation	67
Plate 2.19	Mulching done for growing rosemary, Jadigenahalli Village	68
Plate 2.20	Transporting of eucalyptus leaves for brick industrial units.	69
Fig. 3.1	Awareness creation and popularity (%)	101
Plate 3.1	Children practicing yoga in schools, Jadigenahalli village	104
Plate 3.2	Eating healthy – promoting nutritious food habits among children by Ayush Grama Soukya Foundation	105
Fig. 3.2	New patients visiting DMRC, SOUKYA Foundation (May-Nov 2013).	106
Fig. 3.3	Patients with different kinds of ailments (% to total).	107

Fig. 3.4	Perceptions about ayurveda and homeopathy	109
Fig. 3.5	Rating of ayurveda and homeopathy	109
Fig. 3.6	Number of patients visiting AYUSH Grama DMRC, Soukya Foundation (2013–14)	111
Fig. 3.7	Progress in toilet construction	118
Fig. 4.1	Common health problems	129
Fig. 4.2	People growing medicinal plants	130
Fig. 4.3	Medicinal plant usage (%)	136
Fig. 4.4	Usage of medicinal plants for different ailments (% share)	137
Fig. 4.5	Parts of medicinal plants used (%)	137
Fig. 4.6	Medicinal plant usage methods	138
Plate 4.1	Worshipping Tulsi plant	140
Plate 4.2	Worshipping sacred trees	141
Fig. 4.7	Sacred trees worship.	142
Fig. 4.8	Caste groups worshipping sacred trees	143
Fig. 4.9	Reasons underlying worshipping of sacred trees	143
Fig. 4.10	People worshipping trees	144
Plate 4.3	Lamps made of Lemon (left), Lamps made of rice flour- jaggery – Ugadi festival (right)	146
Plate 4.4	Kala Byraveshwara temple in Vadgehalli	147
Plate 4.5	Sacred pond as part of the cultural heritage	148
Plate 4.6	Mango leaves tied to the entrance of house(right) and the temple entrance(left side)	149

List of Tables

Table 1.1	Proportion of members who reported to have received any training to carry out their principal activity by type of activity (in percentage)	10
Table 1.2	Composition of Jadigenahalli gram panchayat	21
Table 1.3	Types of housing under Jadigenahalli gram panchayat (%)	22
Table 2.1	Land use/land cover schema adopted for Jadigenahalli	31
Table 2.2	Land use/land cover over the years in Jadigenahalli area in acres	33
Table 2.3	Land use pattern under Jadigenahalli gram panchayat: 1973–2017.	34
Table 2.4	Current land use pattern (2017) under Jadigenahalli GP – % distribution of classes across villages	35
Table 2.5	Groundwater withdrawal structures under Jadigenahalli gram panchayat	51
Table 2.6	Location of wells in relation to land use	60
Table 2.7	Distribution of defunct open wells under Jadigenahalli GP	61
Table 2.8	Status of bore wells as of 2014	62
Table 2.9	Investment on functional bore-wells (Rs. Lakh)	63
Table 2.10	Distribution of eucalyptus plantations under Jadigenahalli GP	71
Table 2.11	Village-wise and land use-wise distribution of wells under Jadigenahalli GP	72
Annex 2.1	Current land use pattern (2017) under Jadigenahalli GP	78
Annex 2.2	Land use pattern (2013) under Jadigenahalli GP	79
Annex 2.3	Land use pattern (2009) under Jadigenahalli GP	80
Annex 2.4	Land use pattern (2003) under Jadigenahalli GP	81
Annex 2.5	Land use pattern (1973) under Jadigenahalli GP	82
Annex 2.6	Depth (variation) of bore wells under Jadigenahalli GP	83
Annex 2.7	Village-wise and land use-GP wise distribution of wells under Jadigenahalli GP	84

Annex 2.8	Bore well depth and land use relationship under Jadigenahalli gram panchayat	86
Annex 2.9	Distribution and status of borewells under Jadigenahalli Gram Panchayat	88
Annex 2.10	Bore well depth and land use relationship under Jadigenahalli gram panchayat	90
Table 3.1	Activities and status. (Source: Soukya Foundation Documents)	100
Table 3.2	People's opinion about DMRC, Soukya Foundation according to ASHA worker	111
Annex 3.1	NGOs involved in Ayush Grama	120
Table 4.1	Medicinal plant usage and practices	128
Table 4.2	Medicinal plants grown in Jadigenahalli gram panchayat	131
Table 4.3	Medicinal plants grown in percentage.	135
Table 4.4	Religious significance and belief systems attached to plants/trees.	139
Table 4.5	Temples and belief systems.	145

Chapter 1

Introduction



Abstract This chapter introduces the challenges of peri-urbanization and its implications with references to climate change. It also introduces the key questions that will be answered in the consecutive chapters on land use change and implications, public-private partnership governance model of health care under the AYUSH program and role of culture in protecting environment and health traditions combating climate change. An introduction to the study area, the semi-arid region of Bengaluru, Jadigenahalli, and methodology is also discussed in-depth in this chapter.

Keywords Peri-urban · Climate change · Jadigenahalli gram panchayat

1.1 Why This Book?

The rural urban linkages, their interdependence and interrelations have always been prevailing with far-reaching impacts on ecosystems and development at large. However, in the recent times, newer forms of these relations have been observed, as to state ‘periphery areas’ are hazy to distinguish as rural or urban; more so in the present context of a rampant urban expansion. Urbanization has been significantly high, especially since the Industrial Revolution and given the projections, the proportion of people living in cities and peri-urban areas will reach to 66% by 2050, with a majority of the million-plus cities and megacities concentrated in India and China (UN 2018). In the Indian context, 2011 census indicated, for the first time in seven decades, the urban population recording a higher growth than the rural population. Rapid urbanization and related changes in land use patterns have led to transformations that are affecting the ecosystems and urban environs at large. As a resultant effect, predominantly, we observe prominent land use changes and associated economic activities in the vicinity of rural regions.

In peri-urban contexts, rural and urban areas are juxtaposed with increased landscape changes being witnessed, caused mainly by anthropogenic activities. These areas are being termed as ‘peri-urban’ areas by experts (Adell 1999; Alen 2003; Davis 2004). However, debates over conceptualizing the ‘peri-urban’ have also been diverse (Adell 1999). This may be attributed to the ‘Changes’ observed, while