

Contents

Themes	Page No.
Dedication	ii
Declaration	iii
Certificate	iv
Plagiarism report	v
Preface	vi
Acknowledgement.....	x
Abstract	xii
Chapter-1: Introduction	1-27
1.1. Introduction	1
1.2. Statement of the problem	3
1.3 Location of the study area	4
1.4. Literature Review	10
1.5. Research Gap.....	15
1.6. Aims and objectives of the study	16
1.7. Hypotheses	17
1.8. Methodology	17
1.8.1. Primary Data	17
1.8.1.1. Coverage and design of sample.....	17
1.8.2. Secondary Source of Data	21
1.8.3. Method of data analysis.....	21
1.8.3.1. Statistical Tools	21
1.8.3.2. Lower bound and upper bound at 95 % interval	21
1.8.3.3. TOPSIS method.....	22
1.8.3.4. Likert scale	22
1.8.3.5. Socio-Economic-Health Vulnerability Index (S.E.H.V.I)	22
1.8.3.6. ANCOVA.....	23
1.8.3.7. Karl Pearson's technique of product-moment coefficient of correlation and 't test.'	23
1.8.3.8. Willingness to Pay (WTP).....	23
1.8.4. Cartographic Techniques.....	24

1.8.5. GIS	24
1.9. Limitation of the study	24
1.10. Conclusion.....	24
References	24

Chapter 2 Spatial variation and causes of arsenic concentration in groundwater in groundwater28-68

2.1. Introduction	28
2.2. Data source and methodology	29
2.2.1. Descriptive statistics.....	29
2.3. Causes of spatial variation in groundwater arsenic concentration	29
2.3.1. Depth of water table	30
2.3.2 Geogenic factors of high arsenic concentration in Maldah district.....	38
2.3.2.1. Relation of arsenic concentration level with geology and geomorphology of the study area.....	38
2.3.2.2. Relation of arsenic concentration level with topography and slope of the study area.....	42
2.3.2.3 Relationship between drainage and level of arsenic concentration	48
2.3.2.4. Relationship between soil texture and level of arsenic concentration	50
2.4. Spatial distribution of groundwater arsenic contamination in Maldah district	57
2.4.1. Spatial distribution of groundwater 'As' contamination in Manikchak block.....	59
2.4.2. Spatial distribution of groundwater 'As' contamination in Kaliachack-I block.....	60
2.4.3. Spatial distribution of groundwater 'As' contamination in Kaliachack-II block.....	61
2.4.4. Spatial distribution of groundwater 'As' contamination in Kaliachack-III block	62
2.4.5. Spatial distribution of groundwater 'As' contamination in English Bazar block	64
2.4.6. Spatial distribution of groundwater 'As' contamination in Ratua-I block.....	65
2.4.7. Spatial distribution of 'As' contamination in Ratua-II block.....	65
2.5. Summary and Conclusion	66
References	67

Chapter 3 Socio-economic status of Arsenicosis inhabitants	69-99
3.1. Introduction	69
3.2. Data source and methodology	69
3.2.1. Method of data analysis.....	70
3.2.2. Cartographic Techniques.....	71
3.3. Socio-economic background of the study area	71
3.3.1. Density of Population.....	71
3.3.2. Sex ratio.....	72
3.3.3. Distribution of scheduled castes and the scheduled tribes' population	73
3.3.4. Literacy Rate	73
3.3.5. Religious Composition.....	75
3.3.6. Occupational structure.....	75
3.3.7 Drinking water facilities.....	78
3.3.8. Irrigation Status	79
3.3.9. Transport	81
3.4. Socio-economic status of arsenicosis inhabitants in Maldah district.....	82
3.4.1. Sex ratio of the respondent of arsenicosis patients	83
3.4.2. Caste Composition of the respondent of arsenicosis patients	83
3.4.3. Education level of the respondent arsenicosis patients	84
3.4.4. The Religious compositions of the respondent arsenicosis patients	86
3.4.5. Family type of respondent arsenicosis patients.....	86
3.4.6. Family size of the respondent arsenicosis patients.....	87
3.4.7. Mother tongue of the respondent arsenicosis patients	88
3.4.8. Marital status of arsenicosis affected respondents	89
3.4.9.a. The employment status of the respondent arsenicosis patients.....	91
3.4.9.b. Permanency of the job status of the respondent arsenicosis patients.....	91
3.4.10. Average income of the respondent arsenicosis patients.....	92
3.4.11. Expenditure status of the respondent arsenicosis patients	92
3.4.12. Loan status of the respondent arsenicosis patients.....	93
3.4.13. Savings status of the respondent arsenicosis patients	94
3.4.14. Present sources of drinking water	95
3.4.15. Health care services acquired by the respondent arsenicosis patients	96
3.5. Summery	98
References	98

Chapter 4 Socio-economic determinants of Arsenicosis	100-145
4.1. Introduction	100
4.2. Data source and methodology	100
4.2.1. Method of data analysis.....	101
4.2.1.1. Likert Scale	101
4.2.1.2. TOPSIS method.....	101
4.2.1.3. Cartographic Techniques.....	103
4.3. Determinants of arsenicosis in the study area	103
4.3.1. Demographic and social determinants of arsenicosis	103
4.3.1.1. Age composition as a demographic determinant of arsenicosis	103
4.3.1.2. Sex composition as a demographic determinant of arsenicosis	106
4.3.1.3. Literacy rate as a social determinant of arsenicosis	109
4.3.1.4. Infrastructure of arsenic-free water supply as a social determinant of arsenicosis.....	110
4.3.1.5. Health infrastructure as a social determinant of arsenicosis	112
4.3.1.6. Inhabitants' awareness, administrative management as social determinants of arsenicosis	114
4.3.2. Economic determinants of arsenicosis.....	116
4.3.2.1. Occupational structure as an economic determinant of arsenicosis	116
4.3.2.2. Respondents' income level as an economic determinant of arsenicosis	118
4.3.2.3. Poverty level as an economic determinant of arsenicosis	119
4.4. Prevalence of arsenicosis in the study area	120
4.4.1. Prevalence of clinical illness (signs/symptoms) among study participants.....	121
4.4.2. Prevalence of knowledge, attitude, and practice about arsenicosis.....	128
4.4.2.1. Knowledge of the study participants about arsenicosis	128
4.4.2.2. Attitude of arsenicosis patients towards arsenicosis ailments.....	130
4.4.2.3. Practice of respondents on arsenicosis ailments	131
4.5. Assessment of prevalence of arsenicosis using TOPSIS method	133
4.6. The relationship between the prevalence of arsenicosis and socio- economic determinants	140
4.7. Summary and conclusions.....	141
References	143

Chapter 5: Impact of arsenicosis on health and socio-economic condition of the Inhabitants	146-219
5.1. Introduction	146
5.2. Data source and methodology	146
5.2.1. Method of data analysis.....	146
5.2.2. Likert Scale	147
5.2.3. Social Vulnerability Index (S.V.I)	147
5.2.4. Economic Vulnerability Index (E.V.I)	148
5.2.5. Health Vulnerability Index (H.V.I)	149
5.2.6. Socio-Economic Health vulnerability index	149
5.2.7. ANCOVA.....	150
5.2.8. Karl Pearson’s product-moment coefficient of correlation technique	150
5.2.9. Cartographic Techniques.....	151
5.3. Perception of respondents regarding the social impact of Arsenicosis.....	151
5.3.1. Social unstability due to arsenicosis	153
5.3.1.1. Forced to leave the village due to arsenicosis	155
5.3.1.2. Migration due to arsenicosis illness	155
5.3.1.3. Untouchability	157
5.3.1.4. Relatives discontinued to visiting the arsenic-affected villages.....	158
5.3.1.5. Conflict within the family	158
5.3.1.6. School of drop-out.....	159
5.3.1.7. Child labour.....	160
5.3.1.8. Non-cooperation.....	161
5.3.1.9. Refused to water collection	162
5.3.1.10. Problem of selling cultivated products.....	163
5.3.1.11. Arsenicosis patients Avoided in social activities	164
5.3.2. Ostracism and depression.....	165
5.3.2.1. Preference of remain unidentified	166
5.3.2.2. Feeling hidden hatred brew	167
5.3.2.3. Loss of faith.....	168
5.3.2.4. Parent’s depression.....	169
5.3.2.5. Hamper the child education.....	170
5.3.2.6. The thought of spending money on treatment is a waste	171
5.3.2.7. Tendency to suicide.....	172
5.3.3. Impact on women	173

5.3.3.1 Mental stress.....	173
5.3.3.2. Denied of Marriage	174
5.3.3.3. Divorce	175
5.3.3.4. Dowry.....	176
5.3.3.5. Debarred from the social function.....	177
5.3.4. Social vulnerability Index (SVI)	178
5.4. Impact of Arsenicosis on Economic condition of the inhabitants.....	179
5.4.1. Occupational disadvantages	181
5.4.1.1. Physical weakness and cannot do hard work	182
5.4.1.2. Physical weakness and loss of earning capacity	183
5.4.1.3. Shrinking of job opportunities.....	184
5.4.1.4. Discontinuation of the business.....	185
5.4.1.5. Eligible person are refused to acquire jobs	186
5.4.2. Impact on livelihood pattern	187
5.4.2.1. Drop the family income.....	188
5.4.2.2. Poor becomes poorer	189
5.4.2.3. Selling off whatever his bit of land	190
5.4.2.4. Arsenicosis increases the economic burden of dwellers	192
5.4.2.5. Financial constraint	193
5.4.2.6. High indebtedness	195
5.4.2.7. Inadequacy of nutritious food	196
5.4.2.8. Impact on agriculture	197
5.4.3. Economic Vulnerability Index (EVI).....	198
5.5. Impact of Arsenicosis on Human Health	199
5.5.1. Health hazards due to cancer.....	200
5.5.2. Health hazards due to non-cancer diseases	201
5.5.2.1. Skin related health hazards.....	201
5.5.2.2. Neurological disorder.....	202
5.5.2.3. Tension	203
5.5.2.4. Impact on the immune system.....	204
5.5.2.5. Gradual loss of energy.....	205
5.5.2.6. Physical weakness	206
5.5.2.7. Lethargy	207
5.5.3. Health Vulnerability Index (HVI)	208
5.6. Overall vulnerability Index	209

5.7. Relationship between social, economic, and health hazard indices	211
5.8. Relationship between social, economic, health impact of arsenicosis and socio-economic determinants.....	213
5.9. Summary and conclusion	216
References	217

Chapter 6: Present status of mitigation strategy.....220-254

6.1. Introduction	220
6.2. Data source and methodology	220
6.2.1. Method of data analysis.....	221
6.2.2. Likert Scale	221
6.2.3. Willingness to pay	221
6.3. The status of water supply and water demand	223
6.3.1. The status of the availability of the PHED pipeline.....	223
6.3.2. The status of the present condition of the PHED pipeline	224
6.3.3. The status of the identification of the danger level of Arsenic in sample respondents' tube-well	224
6.3.4. The status of stand posts for arsenic-free water supply	225
6.3.5. The maintenance status and related defunctionability of the stand post	227
6.3.6. Opinion of the respondents regarding the implementation of arsenic-free water supply as promised by Government officials	229
6.3.7. The causes of non-consumption of arsenic-free water.....	230
6.3.8. The distance of arsenic-free water treatment plant	232
6.3.9. Status of suffering from the inadequate supply of arsenic-free water.....	233
6.3.10. Source of drinking or cooking water before knowing the arsenic problem.....	233
6.3.11. Present sources of drinking or cooking water	235
6.3.12. Status of time spent for collecting water	236
6.3.13. Different purposes of purchasing the arsenic-free water.....	236
6.3.14. Using status of purchased arsenic-free water by family members.....	237
6.3.15. Presence of an alternative option of arsenic-free water	238
6.3.16. Satisfaction level with the present status of arsenic-free water supply	239
6.4. Willingness to pay	240
6.4.1 Reasons for refusing to pay	241

6.4.2. Alternative options of different sources for collecting arsenic-free safe water	242
6.4.3. Establishment and Operational cost of different alternative options for arsenic-free water supply sources	243
6.5. Characteristics of explanatory variables	244
6.5.1. Factors effects on WTP	248
6.6. Hypothesis test	249
6.7. Summary and conclusion	251
References	253
Chapter7: Summary and conclusions	255-268
7.1. Introduction	255
7.2. Major findings	255
7.3. Hypotheses testing.....	260
7.4. Mitigation approaches	262
7.4.1. Intervention Options for Maldah district.....	262
7.4.1.1. Short term approaches	262
7.4.1.2 Long term approaches	262
7.4.1.2. A. alternative safe water sources	263
7.4.1.2.B. Mitigation strategies in the provision of health consequences	264
7.4.1.2.C. Mitigation strategies for social problem	265
7.4.1.2.D. Mitigation strategy for reducing economic crisis.....	266
7.4.1.2.E. New awareness, social cohesion and community participation.....	266
7.4. Conclusions	267
References	268
Bibliography	269-278
Appendices	279-331
Appendix-A Research questionnaire.....	279
Appendix-B List of abbreviation.....	288
Appendix-C Copy of certificates of paper presentation in a Seminar	289-292
Appendix-D List of publications	293-331