

**Effects of Resettlement Schemes
on the Biophysical
and Human Environments:**

The Case of the Gambela Region, Ethiopia

Mengistu Woube

Universal Publishers
Boca Raton, Florida
USA • 2005

*Effects of Resettlement Schemes on the Biophysical and Human Environments:
The Case of the Gambela Region, Ethiopia*

Copyright © 2005 Mengistu Woube
All rights reserved.

Front Cover: Resettlement village with *Cordia abyssinica* R.Br (Boraginaceae) in Central Gambela.

Photos: Except Figure 29, all photos in this book were taken by the author.

Universal Publishers
Boca Raton, Florida • USA
2005

ISBN: 1-58112- 483-X

www.universal-publishers.com

**To the memory of my father, Woube Mengesha and
My mother, Mantegbosh Gubena**

TABLE OF CONTENTS

1 ACKNOWLEDGEMENTS.....	9
CHAPTER 1: INTRODUCTION.....	10
1.1 THE ISSUES	10
1.2 THE OBJECTIVES	10
1.3 METHODOLOGY AND DATA SOURCES.....	11
1.4 SIGNIFICANCE OF THE STUDY.....	13
1.5 ORGANISATION OF THE BOOK.....	13
2 CHAPTER 2: A PROPOSED ANALYTICAL MODEL FOR SETTLEMENT AND RESETTLEMENT PROCESSES IN AFRICA.....	14
2.1 THE SPATIO-ENVIRONMENTAL APPROACH.....	14
3 CHAPTER 3: THE SETTLEMENT THEORIES, PROCESSES AND TYPOLOGIES.....	19
3.1 MORPHOLOGY AND LOCATION	20
3.2 THE DIFFUSION AND ECOLOGICAL DISTRIBUTION THEORIES.....	22
3.3 THE RESETTLEMENT PROCESSES AND TYPOLOGIES OF RESETTLEMENTS.....	24
3.4 The Non-Planned Resettlements.....	25
3.4.1 Spontaneous resettlement.....	25
3.4.2 The historical evolution of settlements.....	26
3.4.3 Resettlement through trading.....	28
3.4.4 Resettlement through colonisation.....	28
3.4.5 Emergency and Forced Resettlement.....	29
3.4.6 Natural calamities	29
3.4.7 Population and environmental factors.....	29
3.4.8 Human-induced factors.....	30
3.4.9 External factors.....	31
3.5 The Planned Resettlement Schemes.....	31
3.5.1 The voluntary resettlement schemes.....	31
3.5.2 The involuntary resettlement schemes.....	33
3.6 SUMMARY.....	35
4 CHAPTER 4: THE EFFECTS OF THE SETTLEMENT AND RESETTLEMENT PROCESSES ON THE BIOPHYSICAL AND HUMAN ENVIRONMENTS IN ETHIOPIA.....	37
4.1 ETHIOPIA'S RESETTLEMENT MORPHOLOGIES.....	38
4.1.1 Nucleated or compact resettlements.....	38
4.1.2 Closely spaced settlements.....	39
4.1.3 Widely spaced settlements.....	39
4.1.4 Dispersed settlements.....	39
4.1.5 Pastoral-nomadic settlements.....	39
4.1.6 Centralised/nucleated settlements.....	39
4.2 Factors influencing settlement patterns.....	40
4.3 The Non-Planned Resettlements.....	43
4.3.1 The southward non-planned resettlements.....	43
4.3.2 The northward non-planned resettlement.....	43
4.3.3 Emergency and forced resettlements.....	45
4.4 The Planned Resettlements.....	45

4.4.1 The Relocation of People.....	52
4.5 The New Resettlement Programme	56
4.6 SUMMARY	57
5 CHAPTER 5: CHARACTERISTICS OF SETTLEMENT AND RESETTLEMENT IN THE GAMBELA REGION	60
5.1 The location and areas of Gambela.....	60
5.2 The Biophysical Environment	62
5.2.1 Physiography.....	62
5.2.2 Climate.....	62
5.3 The Human Environment.....	65
5.3.1 Settlement activities	65
5.3.2 Land-use activities	65
5.3.3 Social services.....	66
5.4 Pre-and Post-Resettlement Administrative Systems and Settlement Patterns	66
5.4.1 The pre-resettlement administrative system and settlement patterns.....	66
5.4.2 The resettlement administrative system.....	68
5.4.3 The traditional settlement patterns.....	68
5.4.4 The socio-economic system and population change in the traditional settlement	70
5.5 The Influence of the Resettlement Schemes on the Traditional Settlement and Population Patterns.....	71
5.6 Constraints Encountered by the Resettlers.....	71
6 CHAPTER 6: THE SOILS OF THE GAMBELA REGION	73
6.1 Research on the soils of the Gambela region.....	73
6.2 Effects of Resettlements on the Soil Resources.....	73
6.3 SUMMARY	79
7 CHAPTER 7: LAND-USE AND FARMING SYSTEMS IN PRE- AND POST-RESETTLEMENT GAMBELA	80
7.1 The indigenous farming systems.....	80
7.1.1 Rain fed farming	81
7.1.2 The river-bank farming	82
7.1.3 The spring season farming.....	82
7.2 Farming in the Resettlement Areas.....	83
7.3 The State farming system.....	85
7.4 Farming Constraints.....	86
8 CHAPTER 8: EFFECTS OF RESETTLEMENT SCHEMES ON WATER RESOURCES	87
8.1 The Water Resources of Ethiopia	87
8.2 The Water Resources of the Gambela Region	89
8.3 The Nature of Flooding, Causes and Effects of Flooding.....	93
8.4 SUMMARY	97
9 CHAPTER 9: THE EFFECTS OF RESETTLEMENT SCHEMES ON VEGETATION: AN ETHNOBOTAINCAL APPROACH	99
9.1 The physiognomy of plants.....	99
9.2 Forest Management Practices in the Indigenous Settlements	103
9.3 The Post-Resettlement Deforestation Process	105
9.4 Ethno botanical Analysis of the 23 Selected Plants	107

9.5 The Tree Species	108
9.6 Tree Crop Species	112
9.7 The Grass Species	113
9.8 SUMMARY	114
10 CHAPTER 10: THE EFFECTS OF FIRES ON THE PLANT COMMUNITIES AND SOILS	117
10.1 The Effects of Fires on the Plant Communities and Soils in the Gambela Region.....	117
10.1.1 The naturally-caused uncontrolled fires.....	117
10.1.2 The human-induced controlled fires	121
10.2 SUMMARY	123
11 CHAPTER 11: THE EFFECTS OF FIRE AND WAR RELATED INCIDENCES ON THE WILDLIFE IN THE BARO-AKOBO (GAMBELA) AND PIBOR-SOBAT SUDAN RIVER BASINS	124
11.1 The Absolute and Relative Locations of the Study Area	125
11.2 The Spatial Distribution of Wildlife	126
11.3 Wildlife Ecological Cycle.....	128
11.4 Habitat destruction	128
11.5 Poaching Activities	130
11.6 The Need for Biodiversity and Habitat Conservation Strategies	132
11.7 SUMMARY	135
12 CHAPTER 12: THE EFFECTS OF THE RESETTLEMENT SCHEMES ON HEALTH CONDITIONS WITH EMPHASIS ON THE SPATIAL SPREAD OF MALARIA.....	137
12.1 The Nature of Malaria.....	137
12.2 The Global Spatial Spread of Malaria.....	138
12.3 The Spatial Spread of Malaria in Ethiopia.....	140
12.4 The Prevalence of Malaria in the Gambela Region and its Impact on the Settlement and Resettlement Processes.....	142
12.5 The Physical and Environmental Factors.....	143
12.6 Land-Use Changes and Epidemiology.....	144
12.7 The Health Stations in the Study Area.....	144
12.8 SUMMARY	146
13 Concluding Remarks	147
14 APPENDICES	149
14.1 Appendix 1: The geology of the Gambela Region.....	149
14.2 Appendix 2: Soil types of the Gambela Region.....	150
14.3 Appendix 3. The Prevalence of Non-Malaria Diseases and their Impact on the Settlement and Resettlement Processes. See Chapter 12.....	154
14.3.1 Trypanosomiasis	155
14.3.2 Yellow fever.....	155
14.3.3 Intestine parasites	156
14.3.4 Onchocerciasis	156
15 REFERENCES	157
16 NOTES ON THE AUTHOR	168

LIST OF FIGURES

Figure 1. The conceptual model showing the relationship among the resettlement processes and the biophysical and human environments.	18
Figure 2. Analytical model for the resettlement processes.....	25
Figure 3. Areas of human origin and early settlement processes in twentyeight main stages.....	27
Figure 4. A nucleated or compact resettlement type (Dejen, Gojam, 1988).....	39
Figure 5. Relationship between spatial population distribution, the highland and lowland geographical regions.	42
Figure 6. Planned resettlement between 1975 and 1991.....	50
Figure 7. The 14 Regions (Killils).....	54
Figure 8. The locations of the administrative sub-divisions of the Gambela Region.....	61
Figure 9. The locations of the Peasant Associations within Abobo (refer Figure 8).....	61
Figure 10. Map of Gambela: relief and contours with hydrometeorological stations.	63
Figure 11. Monthly temperature and precipitation distribution.....	64
Figure 12. The traditional settlement and resettlement patterns.....	69
Figure 13. A typical Anuak hut.....	70
Figure 14. The soil types of Abobo.....	73
Figure 15. A cotton pile before being burnt down (1991).....	85
Figure 16. The major drainage basins of Ethiopia.....	88
Figure 17. Runoff correlation coefficient with time.....	93
Figure 18. Abnormal flooding of the Baro River.....	95
Figure 19. Geobotanical boundary of plant species in the Gambela Region.....	99
Figure 20. The endangered evergreen forest in southern Abobo (1994).....	101
Figure 21. The land-use succession model.....	103
Figure 22. Land-use/land-cover of Abobo.....	106
Figure 23. Traditional settlement, food and non-food biomass before the resettlement schemes.	114
Figure 24. Cotton crop in the mechanised farmland after the resettlement schemes.....	115
Figure 25. Effects of uncontrolled forest-grass fire during the dry season (1994).	119
Figure 26. Post-fire vegetation during the dry season (1994).....	120
Figure 27. Cutting grasses and bushes before burning (1998).....	122
Figure 28. Absolute and relative locations of the study area.....	125
Figure 29. An elephant killed by a wildlife officer.....	131
Figure 30. The vicious cycle of malaria.....	138
Figure 31. A Thatch-roofed health station (1989).....	145

LIST OF TABLES

Table 1. Key to Figure 3.....	27
Table 2: Receiving and Sending Regions between the 1960s and 80s.....	47
Table 3. Numbers of resettlers by sending and receiving regions.....	51
Table 4. Soil properties in different land-uses.....	74
Table 5. Fertility gap between forestland and mechanised farm land.....	77
Table 6. Planting and harvesting periods of traditional crops under the three farming systems.....	81

Table 7. Land-use and crop output of the three types of farms in Abobo, 1985-1991	84
Table 8. Drainage basins, discharge rates, sediment loads and irrigable areas in Ethiopia	89
Table 9. A summary of hydrological data in major rivers in Gambela.....	90
Table 10. Annual rainfall and runoff statistics for Alwero River at Abobo.....	92
Table 11. Land-use change before and after the resettlement schemes in Abobo	107
Table 12. Selected plant species	108
Table 13. List of wild animal species along the Ethiopian-Sudanese border	126
Table 14. Wildlife counted in some parts of the study region, 2001	128
Table 15. Environment and malaria relationships.....	141
Table 16. Prevalence of malaria species in Gambela, 1986-93	142
Table 17. A summary of soil formation factors, approximate elevation divisions, soil vegetation types and hydrological characteristics in the study region.....	150

1 ACKNOWLEDGEMENTS

I wish to express my heartfelt thanks to my dear wife, Woizero Almaz Kebede, without whose assistance, understanding and encouragement, I would not have been able to complete this book. I also wish to express my gratitude other members of my family: Ato Jemberu Dessalegn, Woizero Birtukan Endale, Yetnayet, Abyu and Kirubel Jemberu who supported me in many ways. Through Prof. Darge Wole, two other anonymous referees read the final manuscript and offered detailed criticisms and useful suggestions, which helped me to make more substantial improvements. I am extremely grateful to all of them. Some of the sections in Chapters 4, 8, 10 and 12 were adapted from my own published articles with kind permission from the following publishers: Northeast African Studies, Elsevier Science Ltd., John Wiley and Sons Ltd. and Malaria Research Centre in India for which I am grateful. Some of this work was written when I had a Visiting Research Position at the African Study Centre and the Department of Geography, Michigan State University, USA. I therefore would like to thank all the staff particularly Prof. David Wiley, Prof. Assefa Mehretu and Dr. Yacob Fisseha for their kind administrative support and friendship. As a Visiting Research Fellow at the Department of Geography and Associate Researcher at the Institute of Development Research, Addis Ababa University, I enjoyed their friendly co-operation and encouragement from all the staff for which I am thankful to all and Prof. Mekete Belachew in particular for the critical comments and suggestions on the earlier version and Dr. Beyene Doilicho for his administrative skills. I wish to express my thanks to the staff of the National Herbarium at the Addis Ababa University and the National Soil Service Project in Ethiopia for their laboratory assistance. And also thanks to Ato Lealem Birhanu who allowed me to use his photo cited in Figure 29. I owe special thanks to Ms Sue Edwards for language checking. I am indebted to Associate Prof. Abdulaziz Lodhi and Edward Ledwaba for their continuous encouragement and technical support. I also thank Dr. Beyene Petros and Prof. Afework Bekele for their constructive criticisms on earlier versions on malaria and wildlife Chapters respectively. Finally, I thank to Håkan Selin, David Gloriam and Tahir Mazloomian for their technical support.

While all the above and many others have contributed immeasurably, I alone am responsible for the views and conclusions presented in this book.

Mengistu Woube
Afro-Scandinavian Service (ASS)
March 2005.

CHAPTER 1: INTRODUCTION

1.1 The Issues

The main theme of the study, on which this book is based, is a comprehensive assessment of the effect of the traditional settlement patterns and resettlement schemes on the biophysical and human environments in Ethiopia in general, with special emphasis on the Gambela Region, south-western Ethiopia. The book initially dwells on the effects of settlement and resettlement processes in Africa and in other countries together with resettlement theory processes and typologies. Thereafter, the concern is the characteristics of the settlements and resettlement processes in the Gambela Region, which is the area of Ethiopia that has been exposed to large-scale resettlement schemes. This is accompanied by discussions on the overall impact of the settlement and resettlement processes on biophysical and human environments.

What follows is an analysis of the effects of the resettlements on the natural resources of soil, water and vegetation, land use and the farming systems in the area, and health conditions in the pre-and post resettlement Gambela. The impacts of fires on the plant communities and soils, as well as wars and settlement changes on the wildlife and their natural habitats are also discussed.

The main findings of this work are the following:

Most of the resettlement projects were designed with only short-sighted political gains in mind. Hence, they have operated as isolated entities, rather than as integrated development programmes. This has led to land-use and ethnic conflicts, deforestation, and land degradation, damaging floods, food shortages and outbreaks of various diseases. Such environmentally damaging experiences resulting from misconceived and misdirected policies should provide important lessons to those countries that wish to embark up on workable resettlement schemes or programmes.

It is unfortunate that Ethiopia has not succeeded in introducing sustainable rehabilitation schemes. The ones launched since the 1950s have ended up in population displacement, disruption of local agrarian and biophysical structures, and overall human and environment crises. The ethnic-based regional policy and the structural adjustment programme have aggravated these crises. The findings from the Gambela Region case study show that the 1980s Resettlement Schemes ignored the recommendations provided by experts as well as the indigenous people's time-and-experience-tested traditional knowledge regarding the value and conservation of the natural resources. With appropriate planning, alternative land-use and resettlement systems and conservation measures could have been adopted and implemented.

1.2 The Objectives

The specific objectives of this investigation are to: (a) examine settlement theories, processes and typologies; (b) describe the characteristics of the settlements and resettlements in the Gambela Region; (c) point out the effects of the settlement and resettlement processes on the overall biophysical and human environments in Ethiopia; (d) examine the effects of the resettlement schemes on the natural resources, land use, and farming systems; (e) discuss the effects of fires on the plant communities and

soils; (f) indicate the effects of fires, wars and settlement changes on the wildlife and their natural habitats along the Baro-Akobo (Gambela) and Pibor-Sobat (Sudan) River Basins; (g) and to investigate the effects of the resettlement schemes on the health of the population with emphasis on the spatial spread of malaria in pre- and post-resettlement Gambela.

1.3 Methodology and Data Sources

The main methodology used is qualitative, i.e. observations and descriptions of the various phenomena or themes treated in the study. But where appropriate statistical or quantitative techniques, Geographic Information System (GIS) and other cartographic methods have been used. Generally, secondary data have been used to discuss global settlement and resettlement patterns and processes. Many of these have been obtained through visits to resettlement sites in Israel, South Africa, India, Tanzania, Kenya etc. The data on the Ethiopian settlements and resettlement schemes are mostly primary being original collected by the author through field surveys and observations carried out in the northern, southern, south-western and eastern parts of the country. The data on the Gambela Region were made available through extended field surveys and observations carried out in repeated visits.

To be able to determine the soil nutrient status of the post-resettlement periods, 35 soil samples were collected in 1991 from the five land-use types (forest, grass, traditional settlement and farmland, resettlement and a mechanised farm) in the Abobo District. The pH was measured in a 1:1 soil: H₂O ratio using standard glass and calomel electrodes. Available phosphorous (P) was determined by the Bray II method (Bray & Kurtz, 1945) and organic carbon was determined by the Walkley and Black (1935) method. The percentage of organic matter was calculated by multiplying the Walkley-carbon value by a factor of 1.724. Total Nitrogen (N) was determined by the macro Kjeldhal procedure as described by Wang (1986). The K and Cation Exchange Capacity (CEC) were determined by ammonium acetate extraction, magnesium (Mg) by atomic absorption, and sodium (Na) and calcium (Ca) by flame emission spectroscopy. Texture was identified in the field by physical observation and also determined in the laboratory by the pipette method.

In order to understand whether the post-resettlement floods were caused by high amounts of rainfall or by resettlement (land-use) activities, the 1977–1989 Alwero River discharge data at Abobo, calculated from the catchment area of 2790 km², were used. Since some data from the Alwero River were missing or incomplete, the mean was taken from the deviation of the Gilo River discharge, which was complete. The statistical analytic method developed by the Land Water Development Project (1986) was used to derive the missing information. The following statistical formula was used:

$$a = \frac{\sum (x-x^1)(y-y^1)}{\sum (x-x^1)^2}$$

$$b = y-ax$$

Where:

- x is the discharge of Gilo River (m³-y⁻¹);
- x¹ is the mean discharge of Gilo River;
- y is the discharge of Alwero river (m³ y⁻¹);
- y¹ is the mean discharge of Alwero river and

a and b are constants, giving the result
 $y = 0.1076x - 0.0185$

As far as vegetation was concerned the physiognomy of the plants, and forest management in the traditional settlement and the resettlement areas were studied. In order to understand the post-resettlement environmental changes concerning the degradation of vegetation and land, XS-SPOT images (band 1, scene 229/334 and band 2, scene 230/334, December 1986 and see also Figure 22) and topographic maps (scale 1:50000, 1982) were used. The types of techniques and methods are mentioned below.

In order to understand the effects of the resettlement schemes on the forest resources, 23 plant species were selected that the indigenous people and the author classified as the most indispensable ones in the region. In the field, an attempt was also made to understand whether these plants were unique for the Gambela region, the cultural attachments and advantages of these plants for the people and the environment, how they had been treated before and why they were threatened after the resettlement schemes, and what measures should be taken to save these plants. The method for doing this included estimating the biomass (leaves, fruits, flowers, roots and bark) and the height and surface cover of the selected species. Samples for identification were put in press in numbered folded sheets of newspaper and taken to the National Herbarium, Addis Ababa University, for identification. Voucher specimens of the species have been preserved at the National Herbarium.

Regarding the impact of fires, data were obtained through close observation of the different seasons throughout the study period. These observations were coupled with discussions with the local people and development workers in the Region. As far as the impact of resettlements, fires and war on wildlife and their natural habitats were concerned, the data were obtained through observation of the various ecological zones in the different seasons, as well as discussions with the local people and development workers. The data concerning malaria were collected through observation and discussions with the settlers from the different resettlement sites and from the health stations as well as the Gambela Hospital.

Various cartographic, including pantographic techniques and statistical methods were used using the programmes EXCEL, POWER DRAW and GIS for statistical analysis, computer-based mapping and to carry out digital processing and image analyses of the SPOT data.

The socio-economic data were derived from discussions with the local people and their officials and from various documents.

An attempt has been made to examine the effects of resettlement using a large number of parameters that have been discussed rather extensively. Even after having done this, one cannot claim absolute satisfaction, as there are still other factors that have not been touched on. Among these are the religious and ethnic dimensions.

1.4 Significance of the Study

The results of the study can contribute meaningfully to the following areas of concern: the debate on the effects of settlements and resettlement schemes on the biophysical and human environments; the provision of supplementary teaching and reference materials in environmental and agricultural geography; the production of a theoretical model that represents, more accurately, the sequences of cause and effect in settlement and resettlement schemes or programmes, in particular in the study area, in order to provide planners and policy makers with important lessons for solving the problems associated with settlement and resettlement programs.

1.5 Organisation of the Book

The book commences with this introduction that covers the aims of the study, its objectives, methodology, and data sources and significance.

Chapters 2 and 3 deal with the development of a proposed analytical model, as well as theories, processes and typologies of settlement and resettlement processes in Africa.

Chapter 4 discusses the effects of the past settlement and resettlement processes on the overall biophysical and human environments in Ethiopia. The present resettlement programme is also briefly outlined.

Chapter 5 deals with the characteristics of the settlements and resettlements in the Gambela Region.

Chapters 6 and 7 cover the effects of the resettlements on the soil resources, land-use and farming systems.

Chapters 8, 9 and 10 and 11 include the effects of resettlement schemes on water, vegetation and plant communities in pre-and post-resettlement Gambela; and the effects of fires, wars and settlement on the wildlife and their natural habitats in the Baro-Akobo (Gambela) and Pibor-Sobat (Sudan) River Basins.

Further, the effects of resettlement on health with emphasis on the spatial spread of malaria are discussed in **Chapter 12**.

Finally, appendices, concluding remarks and references are presented.

2 CHAPTER 2: A PROPOSED ANALYTICAL MODEL FOR SETTLEMENT AND RESETTLEMENT PROCESSES IN AFRICA

2.1 The Spatio-Environmental Approach

An understanding of the spatio-environmental approach helps to explain, in part, how the spatial and biophysical environment, political and socio-economic factors, cultural and administrative systems affect the spatial distribution of settlement and resettlement patterns.

People have moved into and out of (re)settlement sites either by their own free will or because of exogenous factors. Over time humanity has moved from its original settlements in eastern Africa to new ones throughout the world. Such spatial processes were gradual, irregular, spontaneous, voluntary, and involuntary. The physical and social distances were short or long depending mainly on the availability of local resources, including fertile soils, water supply points, crop and grazing land, firewood, markets, fishing places, building materials and employment opportunities.

Prior to and during the mercantilist, colonial, post-colonial and post-industrial periods, and voluntary and involuntary global resettlements had occurred. Many countries have also developed and implemented planned settlement schemes. However, most of these schemes have not succeeded in improving the basic necessities of life. Rather, they had led to increase human suffering and environmental degradation (Chambers 1969, Schudder 1981, Hansen & Oliver-Smith, 1982).

Ironically, however, a number of governments in developing countries are still introducing settlement and resettlement schemes. One reason for this is that resettlement schemes are relatively easier to launch than, for example, agricultural reform programmes, introduction of new agricultural technologies, and the development of rural towns with conservation of natural resources. Various resettlement schemes have led to the concentration and intensification of human activities in environmentally sensitive areas like frontier and coastal ecosystems (Moran, 1989: 69-81).

In view of the gravity of environmental degradation problems world-wide, it is appropriate to examine their root causes and effects on soil, water, biodiversity, spatial spread of new diseases and the decline of agricultural productivity. Many studies have already been conducted including: the World Commission on Environment and Development (1987), the Earth Summit in Rio de Janeiro (UNs, 1992) and that on Human Settlement in Istanbul (HABITAT, 1996). Over 1998-1999, there were major fires in Asia and Greece, floods in China and USA, and devastating hurricane-related landslides in Honduras and Nicaragua. These are a few examples of the environmental disasters that are probably the result of human activities upsetting the climate of the world. Many studies advocate the adoption of sustainable approaches to balance the requirements of environmental stability and development to mitigate the problem of environmental degradation. According to Upreti (1994: 21), Sustainable Environmental Development “is the management and conservation of the natural resource base and the orientation of technological and institutional changes in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations”. Unfortunately, however, the problem of environmental degradation has remained unchanged or has worsened.

Hitherto, most research findings have indicated that resettlement schemes have not alleviated land use problems, nor have they transformed traditional subsistence economies into modern economies. In fact, the settlement patterns in many countries of the developing world, particularly those in Africa, have brought about negative changes in both the biophysical environment, such as land-degradation, and in the human environment leading to the social disorganisation of indigenous people.

Through the spatio-environmental approach, the push and pull factors of the resettlement processes can be better understood. For instance, factors that once pulled people from other areas can be treated as push factors at other times. This means that when the factors that attracted people to resettle are no longer able to provide for their basic well being due to environmental degradation, the settlers can be forced to move either back to their original settlements or elsewhere. Land-use right can be one of the push or pull factors. For instance, during the resettlement process the introduction of a new land-holding system will inevitably result in a change of land-use patterns, which, in turn, will affect the forms and types of settlement patterns. Changes in settlement patterns, introduction of new rural and urban institutions, and physical and social infrastructures (e.g. dams and roads) also contribute significantly to changes in the lifestyles of people. Changes in the government system can also bring about alterations to the existing relationship between people and the way they exploit their natural resources. Such readjustments or modifications lead to the restructuring of settlement sites, with changes in technology, crop specialisation and the conversion of grazing and forest land into cropland, or vice versa. The conversion of a natural landscape into a cultural landscape and the conversion of agricultural land into urban settlement have become common in many parts of the world.

The spatio-environmental approach is vital to understand human adaptation to natural hazards (such as floods, diseases and drought), changing patterns of land-use, and human and animal movements in any landscape along with the various push and pull factors. Ritter began the spatial study of settlements in the early 19th century. Since then, French and German geographers have developed this branch of geography (Baker, 1963). This approach gained emphasis in the literature during the 1960s (Bylund, 1960; Hägerstrand, 1965; Gould, 1969; Christaller, 1966, Hudson, 1969). However, from the 1970s onwards, only limited studies have been undertaken, mostly by sociologists, for example in Asia (Farmer, 1974 and HABITAT, 1986), in Africa (Prothero, 1976, and Stone, 1965), in Latin America (HABITAT, 1986, and Palmer, 1974). Such studies focused on spontaneous resettlements and gave little attention to the issues of planned settlements and resettlements.

Most geographic research and teaching endeavours in industrialised countries now focus on issues related to industrial-urban relations and technological changes. Geographers do not pay special attention to the issues of rural-urban interaction, landscape conversion, land-use and settlement changes, and biophysical and human environmental relationships. Undoubtedly, geography, as a discipline that straddles the natural and social sciences, can ask more relevant questions than other disciplines regarding the relationships of settlement and environment. Among such questions are: Where are settlement activities occurring? How will they affect the natural resources and human lives? How can the biodiversity and natural habitats be sustained and managed for future generations in the face of changes in settlement patterns?

The resettlement schemes in most African and Asian countries take place in marginal areas, most of which are prone to disasters like drought, flood and diseases. Use of the spatio-environmental approach

would help to describe the biophysical and human environmental systems, man-land relationships and the spatial distribution of populations. As Hudson (1976) argues, the study of (re)settlement processes ought to be viewed in association with certain spatial factors such as climate, topography and access to infrastructure in order to indicate the locations for and accessibility to the resettlement sites, land-use changes and other factors affecting settlement patterns. Well-planned (re)settlements will help considerably to mitigate environmental deterioration.

Gol'ts (1986) contends that the study of (re)settlement processes is one branch of geography, since the (re)settlement areas and their territorial linkages reflect a great diversity of factors of a social, economic, demographic and biophysical character. The absence of integrated work plans among researchers, planners and policy-makers creates major obstacles to the improvement of (re)settlement sites. It is the geographers' duty to devise strategies for the management and conservation of the natural resources and ecosystems to benefit the human as well as all the other biotic communities. Geographers have developed special skills in using Geographic Information Systems (GIS) for the processing and analysing of data. Geographers can also contribute by using the Environmental Impact Assessment (EIA) tool for examining the interactions among biophysical, economic and socio-cultural impacts.

In order to achieve environmentally sustainable (re)settlement projects it is appropriate to comprehend the physical attributes, rural-urban interactions, land ownership and agricultural systems, and the local institutions of the areas under consideration. In short, geographers play a key role in addressing how (re)settlements interact with the biophysical environment in time and space in any region of the world.

Through environmentally sound and economically viable town planning for physical and social infrastructures, effective trade links and communications can be provided. Such measures encourage people to invest in the more labour-intensive light industries and allow migrant workers to move from rural to urban areas. These measures can also lead to the development of appropriate technologies and contribute to the conservation of natural resources.

At this juncture it would be appropriate to grasp clearly the concept of environment. It denotes the whole biotic (living) community in a given area together with its abiotic (non-living) components forming an interacting system through which energy flows and nutrients circulate to create the ecosystem of the area (Strange, 1980). The dynamic interaction between the biotic and abiotic elements creates the distinction between the biophysical and cultural landscape. For the purpose of this study the term environment is defined as the surrounding condition characterised by the interplay between the biophysical and human characteristics of an area.

Figure 1 is the conceptual model, which has been developed to indicate how the human and biophysical environments are related to the (re)settlement processes. In the Figure the first box represents the various elements of the human environment (demography, settlement morphology, land-use, cultural systems, health facilities and cultures) and the second box indicates the components of the biophysical environment (geomorphology, soils, topography, vegetation, climate and energy). The biophysical environment provides man with benefits of air, water, food and shelter, but it is also exposed to hazards like floods, drought, hunger, diseases and deaths. The biophysical environment can either be destroyed or improved by the activities of man. High population density, mobility, and poor

housing conditions and inadequate food (Prothero, 1976), for example, can worsen health problems. They can also be improved through integrated development that mitigates the problems through local, regional and international co-operation. In short, unless balanced socio-economic systems are maintained the biophysical environment can have a negative impact on the human environment and vice-versa.

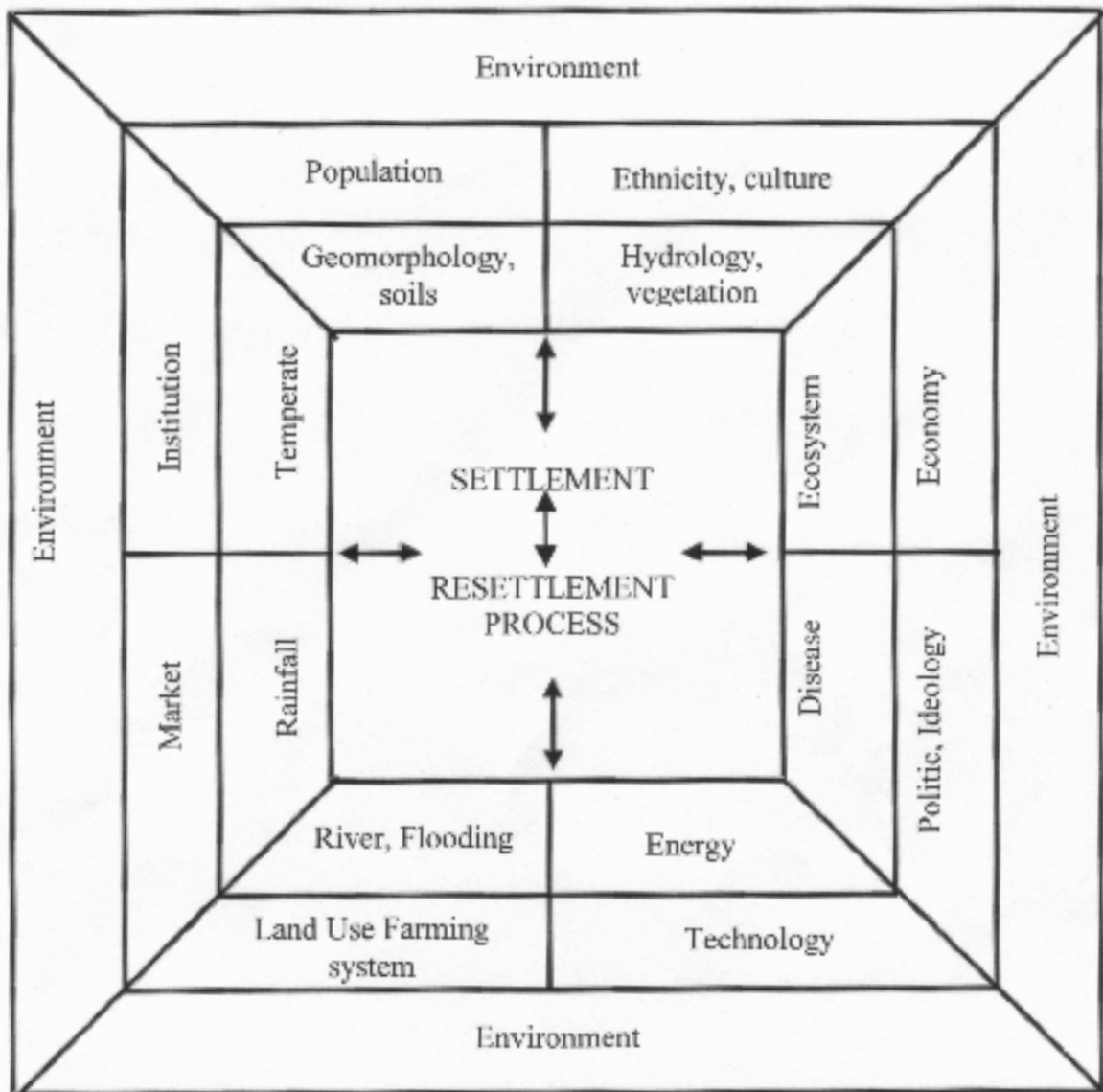


Figure 1. The conceptual model showing the relationship among the resettlement processes and the biophysical and human environments.

Unsustainable utilisation of natural resources often destroys local food resources. It also results in the rapid destruction of the biophysical and human landscapes, which further limits the spaces available for settlement by rural and urban dwellers. As poorly planned settlement and resettlement sites grow in time and space, the deterioration of the biophysical and human environments can not be confined within one landscape but spread out to the surrounding regions or areas.

3 CHAPTER 3: THE SETTLEMENT THEORIES, PROCESSES AND TYPOLOGIES

Settlement Geography has been variously defined and interpreted. It includes settlement units consisting of size, location, function and morphology; settlement groups, including settlement hierarchy, spacing and fields of influence; and settlement society comprising history, population and social cohesion (Whyne-Hammond, 1985). To Stone (1965: 355) “settlement is the description and analysis of the distribution of buildings by which people attach themselves to the land for the purposes of primary production”. To Jordan (1966: 27), the above definition is narrow and unfitting to Settlement Geography. Instead, he defines the term as “the study of the form of the cultural landscape”. Chisholm (1962:126) defines Settlement Geography as “the distribution and patterns of farms and farmsteads, as well as the population movement between and within the (re)settlement sites in the biophysical and cultural landscape”. For the purpose of this study, *settlement* is defined as the original place where individuals or a group of people adapt themselves to the existing biophysical and social systems.

Resettlement is defined as the process by which individuals or a group of people leave spontaneously or unspontaneously their original settlement sites to resettle in new areas where they can begin new trends of life by adapting themselves to the biophysical, social and administrative systems of the new environment. Time is of the essence in (re)settlement processes. During the relocation and adaptation process, resettlers may face both physical and mental stress. The movements can either occur in the form of migration, refugee and mobility, or emergency and forced resettlement processes that are distinguished from resettlement schemes. Mobility can be divided into (a) spatial, which includes all sorts of movements and (b) social, which refers to a change in the socio-economic status of individuals or groups (Kosinski et al. (eds), 1975, and Wood, 1977). A person can migrate or become a refugee due to human-made or natural phenomena, and he can resettle himself or be resettled by others. This form of movement to resettlement sites is often unplanned, irregular, less permanent, cyclical in character and can either be short or long-distance movement (Wood, 1977). However, in some cases the new resettlement sites can be planned after the resettlers have arrived in the new sites.

Under spontaneous resettlement the resettlers may or may not break their ties with their original places. Such resettlement processes take place either by virtue of individual decisions or natural calamity, or due to the availability of economic resources. For example, the worsening of ecological conditions, land-use problems, land scarcity, ethnic conflicts and natural hazards in the original settlement can lead to the need for resettlement. In this respect the push factor can have a negative impact whereas the pull factor attracts people to resettle (Kosinski et al. (eds), 1975 and Prothero, 1976: 32). New ideas and better local economic resources often attract the resettlers.

A *resettlement scheme* may be defined as a planned project or programme involving the transfer of people most probably through selection and control from one region to another. When (re)settlement schemes are considered, governments in developing countries, in general, and in Africa, in particular, make decisions as to when, where and how reestablishment should take place. Private agencies or national or international organisations such as the World Bank can sponsor such schemes. Unlike the

spontaneous resettlement process, movement in the resettlement schemes is brought about by government policy either through a voluntary or involuntary process.

Four main resettlement theories will be discussed: These include morphology, location, diffusion and ecological distribution.

3.1 Morphology and Location

According to Mukherji (1976), three basic elements help explain morphological changes in the (re)settlement process namely: type, form or shape, and patterns. *Type* explains the formal and functional relationship of the resettlement site, i.e. house-to-house, house-to-street and street-to-street relationships. The type of houses and farms are included in this category. *Form* refers to the geometrical shape of the aggregate of buildings and streets. The *shapes* of farms, buildings and streets such as square, circular or rectangular are explicitly indicated. A settlement form can be described as scattered or dispersed in which families form a village or urban community.

In geography, settlement forms refer to the distribution of individual huts, which can be dispersed or clustered. A dispersed settlement is defined as a dwelling situated in the farm site and owned by an individual. A clustered or nucleated settlement is characterised by compact groupings of huts or houses outside the farming area. Farmers are able to design a dispersed settlement through understanding the microenvironment that includes the fertility of the soil and moisture supply, health advantages and physical distance (Chisholm, 1979). With respect to the physical and cultural landscape there is another form of settlement, namely in a row or linear. Settlements can be located along a flood plain, or along roads or railways. Huts are usually formed by a nuclear family. When population increases in size, villages can create clustered settlements known as neighbourhoods. The number of huts can vary from 20 to more than 30. This type of settlement can be formed through kinship affiliation and mutual responsibility.

Pattern describes the geometrical arrangement of a large number of urban and rural settlements that fit into natural and cultural features to determine whether a pattern is clustered, dispersed, linear, in a row, and random, and to what degree of each. Morphological change can also be explained by land-use changes which in turn lead to social and political conflicts, strengthening or weakening of rural institutions and deterioration of the ecological systems. On the other hand, a marginal landscape can be converted into mosaic and beautiful cultural landscape.

Although early geographers contributed significantly to the subject of settlement, Christaller's (1966) contribution was considerable. The Central Place Theory, which Christaller built up, rests on the hypothesis that a certain amount of productive land must support each urban centre, and that the centre exists where it does in order to perform essential services for the surrounding region. Trade is the first of these services. Other services include banking, handicraft industries, state administration, cultural and spiritual offerings (churches, schools, and museums), professional and business organisations, transportation and sanitation.

It is not actually the place or settlement that is central. The concept of centrality refers to the central function being performed by the place. Christaller compares central places with dwellings where settlers live and depend upon agricultural activities, mining, industrial and social services. A settlement site in itself can be considered as a central place if this site provides public services to the neighbouring villages or towns. Christaller's approach of settlement hierarchies is useful to the understanding of the structure, functions, and patterns of settlement schemes and the distance of the central place from which all the individuals living in an area can acquire goods and services and other types of local economic resources. Distance plays a role in the spatial distribution of population, use of basic economic resources, settlements and the like. Christaller expresses geographical-distance in terms of economics or cost-distance including such factors as time spent and freight costs. Like Christaller, Lösch (1954) considered distance between the market area and the settlement sites. As one goes from the central market to a given distance the price of goods becomes relatively higher and the demand for some expensive goods becomes lower.

To Chisholm (1979) a geographical distance equals human time – the cost in time converted into monetary terms. Chisholm based his studies on costs incurred in relation to geographical distance between the (re)settlement sites and the resource bases in the countries of Italy, Spain, Finland and the Netherlands, and attempted to convert physical distance to the time it takes a person to cover a given distance.

Some classical economists, for example Ricardo (1817) and Von Thünen (1826), are known for their theory of Economic Rent and its application to the study of (re)settlement schemes. Economic Rent is not used to explain the relationship between land and land rent, but rather to show the various costs, which include the physical distances between agricultural settlement and human (re)settlement sites and central market places. Although these economists differ from each other in their approaches they arrived at a final conclusion giving the same connotation regarding physical distance and settlement sites. For Ricardo the gain attained from land (e.g. economic rent) is dependent on the fertility of the soil. The process of expansion taking place in and around the central market places and settlement sites affects the degree of demand shown for crops. This demand can be appreciably increased by the cultivation of fertile land. However, since such land often belongs to a few people, the demand becomes high and the increased economic rent benefits only the few. Consequently, the shortage of fertile land creates higher land rent and thus forces many people to resettle on infertile land. Even though land-use rights and land rent are given similar treatment concerning fertile and infertile land, agricultural inputs for the infertile land are less than for the fertile land.

Von Thünen took Ricardo's Economic Rent concept and adapted it to his location theory regarding the transport of agricultural products in Northern Germany. He relates Economic Rent to the problems caused by distance and computed Economic Rent in relation to distance from the central settlement. Von Thünen argues that the economic advantage of the land is dependent upon its distance from the central market or central settlement. In other words, the closer the land is to the market centre the higher its productivity and the socio-economic services also become better.

The differences and similarities of the two approaches can be summarised as follows: for Ricardo the Economic Rent is mainly dependent on the fertility of the land. Hence, the further one goes away from the central settlement the poorer becomes the fertility of the land and the lower the Economic Rent.

According to Von Thünen, however, land is assumed to be homogeneous. What concerned him most was the distance from the central market place and the subsequent transport costs. It is not the fertility of land that matters but the various economic advantages gained, due to the proximity of the land to the central market place. Hence, the shorter the distance from a central market place the higher is the economic rent and vice-versa. Both Ricardo and Von Thünen were concerned about the viability of land and the new settlement site in terms of monetary values. Socio-psychological values were not considered in their studies of settlements. They argued that a longer distance from the central market place results in higher the production costs, with lower prices for the produce so that the land becomes relatively poorer in quality and receives little inputs with increasing distance from the central market. Many recent writers in the West reject the theory of Economic Rent as having no application in the modern world. But Chisholm (1962) argued that it is not the particular findings that count but their methods of analyses, which may be applied to any situation at any time or place.

This author believes that it is important to understand Ricardo's argument regarding the fertility of the land in relation to the (re)settlement processes. This is because since land is associated closely with the political system and socio-economic growth or decline of certain agrarian countries, those who have economic and political power control it. Von Thünen's theory appears to have relevance for most of the developing countries. For example Horvath (1969) studied some of the location and settlement patterns and problems of Ethiopia focusing on the principal urban market of Addis Ababa and the impact of geographical distance on the supply of marketable agricultural produce to urban settlements. Edward (1977) identified remarkable parallels between the agricultural settlement patterns of colonial Mexico during the period of Spanish rule and Von Thünen's land-use theory. Bylund (1960) and Norling (1960) were of the opinion that it is important to measure the geographical-distance (e.g. the time taken to arrive at a given central settlement place) and the evolution of (re)resettlement around it. Dacey (1962) focused on the techniques of nearest-neighbour analysis and their application to the measurement of the geographical-distance between the central settlement places and the peripheral settlements. Assefa (1986) studied the spatial problems related to the distribution of production in Africa. This study provided a good time/space model, which focused on the problems of the distribution of supply from and between the central settlements and the peripheral settlements.

There is also the problem of social distance in the (re)settlement schemes. The social distance problem is realised when the (re)settlers arrive and experience the early stages of adjustment. At that time the social distances between the different ethnic, income, status and professional groups begin to emerge. Moreover, some groups of people cannot afford the high costs of time and cash to travel and visit their families who reside in widely distributed (re) settlement sites. The social distance is created not only between and among resettlers but also between them and officials in the settlement areas and it can be worsened in poorly designed (re)settlement schemes. Such problems may force resettlers to abandon their (re)settlement sites and move to other ecological zones. The relocation and adaptation processes in any resettlement site will be discussed in Chapter 4.

3.2 The Diffusion and Ecological Distribution Theories

It is known that the diffusion theory is widely practised or applied in the natural sciences, particularly in plant and animal studies. It has also become an important concern for researchers in geography.

Geographers are interested in the diffusion or spread of phenomena over space and time. Therefore, for geographers it is spatial diffusion that is of particular interest to them. Hägerstrand (1965); Gould (1969) and Hudson (1972) attempted to interpret the diffusion theory as it applied to the location of (re)settlements. Their studies focused on the interaction, spread, contact, change and growth of (re)settlement patterns and the physical distances separating the original settlements from the new (re)settlements, the local economic resource sites and central settlement places.

Empirical investigations have identified three types of diffusion processes. The first type reveals that the first adapters or innovators, who are the early majority, are followed by the second adapters who are the late majority; and the third adapters are those who arrive last, i.e. the "laggards" (Brown et al., 1971 and Gould, 1969). The reasons why a new area or innovation is adapted rapidly or slowly have to do with the characteristics of geographical barriers such as mountains, rivers, lakes, deserts, languages, cultures, ethnicity, income and bureaucracy (Hägerstrand, 1965).

The second type is the spread of human settlers from the neighbouring places or centres. This phenomenon is divided into expansion and relocation diffusion. The former refers to the diffusion of central settlements and the latter refers to the phenomena that are being diffused. The third empirical regularity explains how the innovation starts first in the central settlement and then spreads to marginal (re)settlement sites. In sum, the linkages between the central settlement places affect the agglomerations of many individuals and peripheral settlements at the local, regional, national and international levels (Hägerstrand 1965 and Gould 1969).

The population movements of a certain area manifest four stages: (a) the first stage refers to the physical transfer of resettlers to the new settlement sites; (b) the adaptation process to the biophysical and human environments; (c) the achievement of socio-economic development by the resettlers; and (d) the resettlers are able to manage the biophysical and human environments. Hudson's "ecological distribution theory" explains the laws of spatial distribution by comparing the process of human settlements to the process of competition in plant ecology. To Hudson the (re)settlements process and plant adaptation in one area pass through three stages of development, namely: colonisation, spread and competition. The author, however, prefers the term occupation to colonisation since the latter term can provide an erroneous impression. But the term occupation explains that resettlers and plants want to adapt themselves to the new geographical territory or environment. The adaptation process involves the spread of settlers and plants in the newly occupied area. Competition connotes the fights over the available geographical space by the resettlers or newcomers.

According to Haining (1982), Hudson's theory provides a complete spatial theory of the resettlement process. He has given more attention to the "spatial derivatives" of the process rather than to the socio-economic and psychological factors. On the other hand Grossman (1971) argued that Hudson's biologically derived principles do not apply to human settlement patterns which are often centrally planned rather than being arranged randomly. But even Grossman himself believes that Hudson's hypothesis has some importance since it applies to a given (re)settlement pattern. Hudson admits that although the non-spatial aspects of ecological theories are quiet unlike the settlement theories the spatial properties are similar. This author argues that the plant species must have places of origin and agents of movement. Plants can be introduced into new areas through biological and human agents. People who are required to move and resettle in new areas do so by government directives. Such

movements take place in three stages: (a) government considers (re)settlement areas and selects people for resettlement; (b) resettlers are moved to re-establish settlement sites; and (c) resettlers require some time to adapt to the new environment. Hudson's approach, however, is less applicable to the government-sponsored resettlement schemes. As he himself admits this is because the ecological distribution theory is not appropriate for the planned resettlements. The settlement distribution and adaptation processes can further be explained through biological evolution of (re)settlements. Before we do that the type of settlements has to be identified.

3.3 The Resettlement Processes and Typologies of Resettlements

Four types of resettlement schemes can be identified in a given country, namely: spontaneous, emergency and forced, voluntary, and involuntary. These may be grouped into non-planned resettlements including spontaneous and emergency, and forced resettlements and planned settlements comprising voluntary and involuntary resettlements. These typologies are presented in Figure 2.

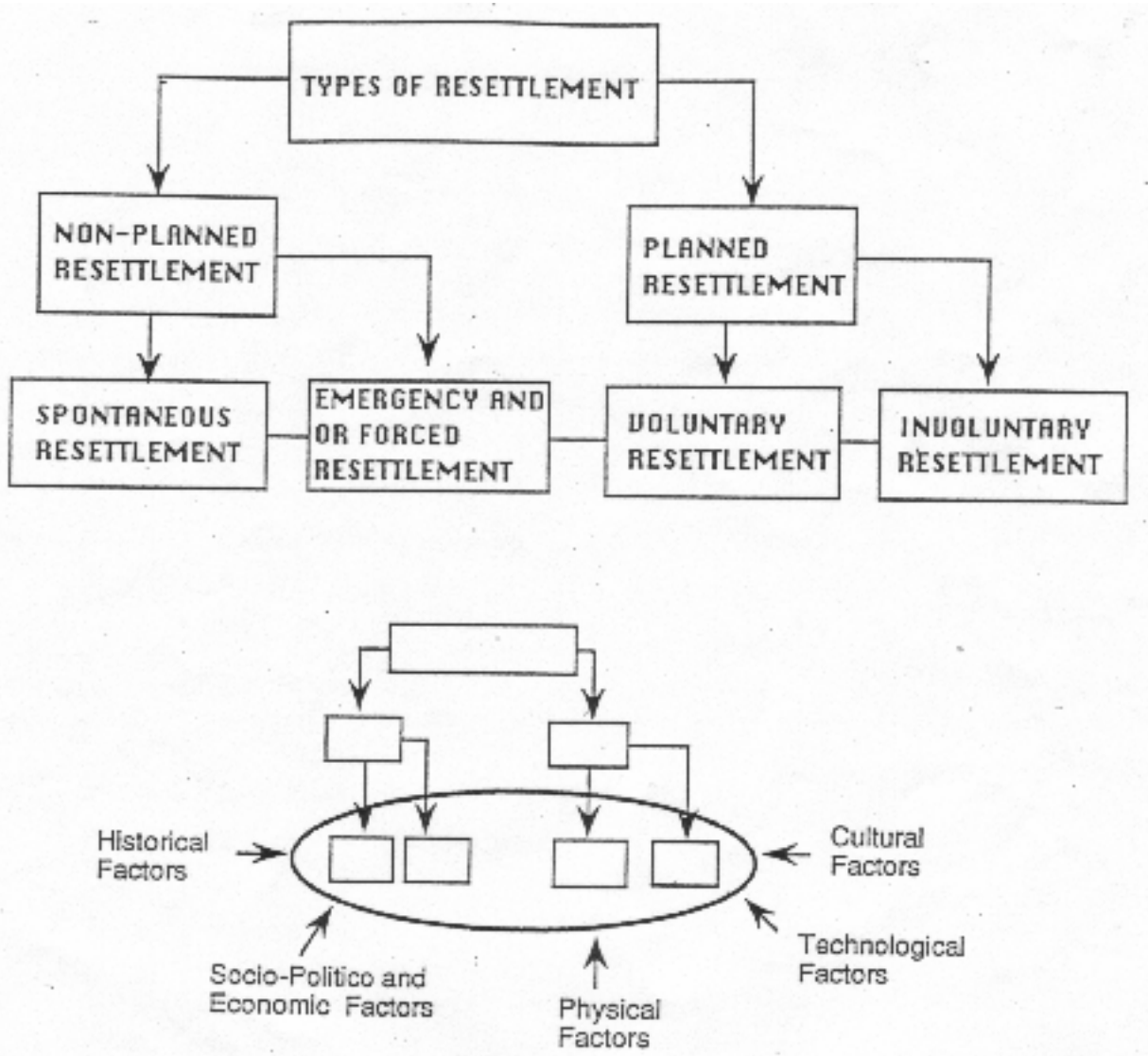


Figure 2. Analytical model for the resettlement processes

Note: The processes fall within five explanatory frameworks. The causes for these processes include historical, ecological, natural calamity, and human factors.

3.4 The Non-Planned Resettlements

3.4.1 Spontaneous resettlement

The spontaneous resettlement process is often associated with agricultural resettlement in which farmers relocate themselves in response to external and internal influences in their original settlements.