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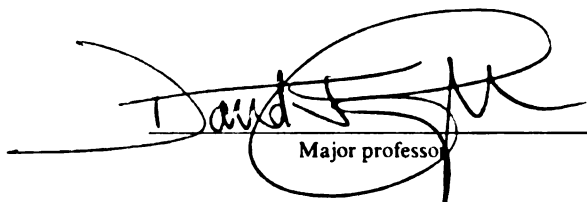
ENERGY AND ENVIRONMENT:
A POLITICAL ECOLOGY OF WOODFUELS IN SENEGAL

presented by

E. Mark Pires

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Geography



Major professor

Date January 15, 1999

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**ENERGY AND ENVIRONMENT:
A POLITICAL ECOLOGY OF WOODFUELS IN SENEGAL**

By

E. Mark Pires

A DISSERTATION

**Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of**

DOCTOR OF PHILOSOPHY

Department of Geography

1999

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ABSTRACT

ENERGY AND ENVIRONMENT: A POLITICAL ECOLOGY OF WOODFUELS IN SENEGAL

by

E. Mark Pires

This study examines relationships between energy use and the exploitation of woodland natural resources in the West African nation of Senegal. As in many other countries in the developing world, the majority of the population in Senegal depend on woodfuels, i.e., firewood and charcoal, to satisfy most of their household energy needs. Consequences of this situation include added pressure on the country's limited natural resource base, and increased socioeconomic hardship, particularly for women, as woodfuel resources become increasingly scarce.

Woodfuel energy problems in developing countries are typically described in terms of an imbalance between supply and demand that is driven by rapid population growth. However, recent research suggests that a number of other factors should be explored in order to achieve a more thorough understanding of the relationship between woodfuel energy and forest resource management. This study attempts to determine what some of these factors are, and to explain how they inform the energy-environment situation in the case of Senegal. In addition, I examine the scope for

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addressing Senegal's woodfuel problem through greater local community participation in managing energy and natural resources, a current thrust in many international initiatives designed to help the country cope with this persistent problem.

A relatively new conceptual framework for the analysis of human-environment relationships - viz. political ecology - is employed in this study. I attempt to show how political ecology can contribute to the resolution of Senegal's energy-environment dilemma by considering a more inclusive suite of social, economic, political, and environmental variables than has been explored by previous approaches.

Findings from the research demonstrate the ability of the political ecology approach to capture many heretofore unexplored factors related to the energy-environment nexus in Senegal. A detailed matrix is generated that illustrates the complexity of issues surrounding the exploitation and management of woodfuel resources. In the context of one local rural community in central Senegal, an effort is made to show how these issues are interrelated and how they affect the possible outcomes of promoting community participation in natural resource management. Results of this study indicate that numerous obstacles stand in the way of implementing effective community-based initiatives designed to alleviate the country's pressing energy-environment situation.

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E. Mark Pires
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**In loving memory of
Ursula Paine**

**Au peuple sénégalais
*Yal na leen Yàlla sottiil yiw ak naataange***

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ACKNOWLEDGEMENTS

It is no small understatement to say that the road to completing this dissertation was a long and winding one, pitted with far too many detours and diversions. But having finally arrived at my destination, mine is now the pleasant task to recognize those who helped to guide me along the way. To acknowledge each and every person who provided assistance at various points during my journey would be to risk yet further delay since the list of individuals is long enough to fill a second volume. The persons mentioned below are recognized for their particularly important contributions; to those who remain unnamed, I offer a collective heartfelt acknowledgement of my gratitude.

I am indebted to the members of my dissertation committee at Michigan State University. I would especially like to thank my advisor in the Department of Geography, Professor David J. Campbell, for his sage guidance and boundless patience and perseverance. I am indeed fortunate to have had the privilege to study under his leadership. Also in the Department of Geography, I am most grateful to Professors John M. Hunter and Assefa Mehretu for graciously accepting to serve on my dissertation committee, and for their sound advice and constructive criticism of my work. I owe a special debt of gratitude to Professor Michael Gold of the Forestry Department for his willingness to serve on

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my committee. Conscious of the numerous demands placed on his time, I am honored to be able to count myself among those graduate students at Michigan State who have benefitted from his energy and expertise.

While in Senegal, I was blessed to have had the full cooperation and kind assistance of countless individuals. To begin with, I am grateful to Dr. Mark Freudenberger, formerly of the Land Tenure Center at the University of Wisconsin, for arranging for me to meet with his contacts at the Institut des Sciences de l'Environnement (ISE) at the Université Cheikh Anta Diop in Dakar. Association with ISE offered me access to an intellectual community in which I could discuss ideas and share the successes and challenges of conducting my research. My sincere appreciation goes both to Dr. Tidjane Ba, director of ISE, and to Dr. Bienvenu Sambou. Dr. Sambou gave generously of his time to act as my informal in-country advisor, and went the extra step to graciously welcome me and my wife into his home on numerous occasions and to honor us with an invitation to his wedding.

I acknowledge the valuable assistance and kind consideration offered to me by numerous officials in the Government of Senegal. Among these, I would like to mention the following: Messieurs Bocar Sall, Ibrahima Gueye, Yero Sow, Gora Ndiaye, and Moustapha Lo of the National Forest Service; Monsieur Philippe Laura of the Energy Directorate of the Ministry of Industry and Commerce; Messieurs Michael Rasmusson and Racine Kane of

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the Ecological Monitoring Centre; and Monsieur Babacar Diouf of the Ministry of Rural Development. I would also like to express my gratitude to the staff of the Energy Programme at ENDA-Tiers Monde, an international non-governmental organization, especially its director, Monsieur Youba Sokona, as well as Messieurs Libasse Ba and Masse Lo.

Many individuals in the Rural Community of Lour Escale offered warm hospitality and shared their knowledge of local issues during my stay. I am particularly grateful to my hosts in the village of Touba Aly Mbenda, Monsieur Modou Lo and his family, and especially to Abdourahmane Lo for taking me under his wing. Much of what I was able to accomplish would not have been possible without the generous help of my research assistants, Monsieur Mbaye Diom dit "Grand-père", Monsieur Abdoulaye Ndiaye, Monsieur Alioune Sene, and Madame Ndeye Top. I would also like to thank everyone in the villages of Touba Aly Mbenda, Lour Escale, and Touba Thiarène who took part in the research survey.

Much ground was covered while working my way from Dakar to Lour Escale and points in between. Along the way I was fortunate to come to know many individuals whose friendship and hospitality helped to ease the moments of loneliness encountered during research. For this, sincere thanks go to Jens Madsen and Susan Gannon in Dakar; to the staff at the Senegalese Agricultural Research Institute station and to Monsieur Amadou Lamine Ndiaye and Madame

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Khady Mbengue Gueye in Kaolack; and to David and Maribeth Walker and the Oumar Diakhaby family in Kounghoul.

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over the years. I can only promise that now that it's over, she and our beautiful daughter Nicole will get the attention they so justly deserve. This dissertation is dedicated to the memory of my late grandmother, Ursula Paine, who, with great confidence, always encouraged me to get my doctorate. May her soul rejoice in the knowledge that this has finally come to pass.

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PEOPLE, NATURE UNDERSTANDING

Geography's long
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Introduction

This dissertation
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¹ Originally referred to as
human-environment themes
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"nature-society" and
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CHAPTER ONE

PEOPLE, NATURE AND GEOGRAPHY: ONE DISCIPLINE'S QUEST TO UNDERSTAND HUMAN-ENVIRONMENT RELATIONSHIPS

Geography's long concern with the relationship between people and their environment.....has now become the goal of many other sciences in the rush to meet the increasing political demands for reliable information on local pollution, regional and trans-boundary impacts and global changes. The challenge for geography is to continue to offer new conceptual approaches and new technologies for evaluating environmental problems. Failure to be at the forefront will reduce geography to merely one grouping of environmental technicians supplying maps and data but not developing policy or new ideas for environmental management and sustainable development.

(Douglas, 1991)

Introduction

This dissertation is a modest contribution to the body of knowledge in the human-environment tradition of geography.¹ In this study, I explore a number of issues surrounding the environmental and socioeconomic impacts of the exploitation of forest resources for the production of woodfuels in the West African nation of Senegal. This topic offers a stimulating opportunity to examine the diverse aspects of a society's relationship to the natural environment which, in sum, is the hallmark of the human-environment tradition in geography.

Biomass resources continue to supply a majority of the energy consumed in many of the world's developing

¹ Originally referred to as the "man-land" tradition, the human-environment tradition is one of four overarching themes in geography suggested by Pattison (1964); the other three are the spatial (locational), area studies, and earth science traditions. Terms such as "people-environment" and "nature-society" are also used to refer to the human-environment theme.

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countries, a situation which often has adverse consequences for both people and the natural environment. These include an incremental contribution to deforestation and environmental degradation, and socioeconomic hardship for people trying to meet their basic needs. For the most part, problems associated with woodfuel consumption have been framed in terms of an imbalance between supply and demand driven primarily by rapid population growth. Resolution of the problems, however, has been stymied by an incomplete accounting of the multiple factors that affect people-environment relationships in general, and the exploitation of forest resources for woodfuel energy in particular.

In this study, I employ a conceptual framework for analysis of human-environment problems that attempts to capture the complexity of the energy-environment dynamic. Application of this framework generates a matrix of key environmental, economic, social, and political variables along a global-local continuum, together with an examination of how these variables are related to each other, that contributes to a more informed understanding of this particular human-environment problem. Findings from the study illustrate the problematic nature of local-level community-based strategies that have been proposed by national and international agencies as a means to resolve Senegal's energy-environment dilemma.

In the following section of the chapter, I discuss the current status of geographic research within the human-

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environment tradition. I then proceed to describe briefly the relationship between woodfuel energy use and the natural environment in developing countries. Following this, I elaborate on the conceptual framework used in this study, viz. political ecology, and discuss how the subject of energy-environment relationships is suited to analysis using this framework. The discussion on political ecology is followed by an outline of the specific objectives and research questions posed in this study. Finally, I conclude Chapter 1 with an overview of the remaining chapters of the dissertation.

Human-environment Questions in Geography

Geography is concerned with such a vast array of subject matter that it sometimes seems to defy concise definition as an academic discipline. The dichotomy that is traditionally drawn between the broad subfields of human and physical geography scarcely begins to capture the depth and breadth of geographical inquiry. Attempts by geographers to describe succinctly what their discipline is about variously claim that geography is, among other things, the science of spatial distributions and relationships, the study of areal differentiation of physical and human phenomena throughout the world, or the study of the earth as the home of humanity. Although practitioners sometimes find it difficult to articulate clearly what geography is and what geographers do, most would probably agree that it is futile to seek monistic

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definitions of what is essentially a pluralistic discipline.

In general, Western academic geography in the twentieth century has been influenced by a series of paradigms, e.g., environmental determinism, regional geography, quantitative spatial analysis, Marxism, and humanism, that has shaped the way geographers view their work and the way their work is viewed by other scholars.² The esteem with which the wider academic community regards geography appears to vacillate over time according to the perceived strengths, weaknesses, and relevance of the field's prevailing ideas. Today, when many geographers, particularly in the United States, are preoccupied with reasserting the discipline's place as an essential university subject, we are witnessing a renewed thrust in geographic research that focuses on the interaction between people and their natural surroundings. The resurgence of the human-environment theme has assumed prominence in what is in many ways a campaign to persuade observers, both within and outside academia, of the value of what geography has to offer society at large.³

To illustrate this point one need only consider the substantial attention global environmental issues now receive in the media and other public fora. As people around the world become more conscious of local, regional,

² See Johnston 1986.

³ For a number of different perspectives on the resurgence of the human-environment tradition in contemporary geography, see: Kates 1987, Guelke 1989, Mather 1993, Knight 1992, Pepper 1987, and Stoddart 1987.

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and transnational environmental concerns such as air and water pollution, deforestation, global warming, declining biodiversity, and various forms of natural resource degradation - and their myriad social, economic, and political ramifications - geographers whose work is grounded in the human-environment tradition are attempting to highlight the contributions their research can make to the analysis and resolution of such problems. Many argue that their professional training equips them with the skills necessary to synthesize disparate forms of information and data concerning the human-environment interface, to, as Kates puts it, "sit astride the natural and social science boundary to provide analysis, integration, and leadership," and thereby arrive at useful recommendations to better manage the world's natural resources.⁴

How uniquely qualified geographers are to undertake the formidable task of interpreting highly complex human-environment relationships is certainly open to debate: that many now recognize the advantage, indeed the imperative, of interdisciplinary investigation is, nevertheless, an encouraging sign. The salient point here is that geographers working in the human-environment tradition sense a window of opportunity through which they believe their research can deliver practical, socially relevant results, while contributing simultaneously to a

⁴ Kates 1987: 526; see also the discussion on environmentalism and geography in Johnston (1991: 204-209).

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reaffirmation of geography's academic standing at the crossroads between the natural and social sciences.⁵

There are certainly many examples of contemporary human-environment problems to which geographers can apply their skills of analysis and integration. In the following section I discuss the nature of energy use in the developing world, and illustrate how this particular problem is well suited to examination from the perspective of geography's human-environment tradition.

Energy Use in the Developing World: A Quintessential Human-environment Problem

Technological achievements associated with the process of industrialization have led to the widespread use of fossil fuels, hydroelectricity, and nuclear power as the major sources of energy consumed in the world's more economically developed nations. In the developing world, however, traditional woodfuels remain the dominant energy resource.⁶ They constitute the primary source of energy consumed by most households, and play a significant role in meeting many commercial and artisanal energy needs.

Although estimates vary considerably, approximately 90% of the population in developing countries depend on

⁵ See Turner 1989.

⁶ In this study I use the term "woodfuel(s)" in reference to a combination of firewood and its derivative, charcoal. It should be noted that while use of the alternate term "fuelwood" appears frequently in the literature on biomass energy, again in reference to both firewood and charcoal, many forestry professionals use it when referring to firewood only. To avoid confusing the reader, I shall use the individual terms "firewood" and "charcoal" where appropriate; use of the term "fuelwood" appears only in direct quotation.

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woodfuels as their principal source of energy.⁷ Wood consumed as firewood or charcoal accounts for about one-half of the world's raw wood production (i.e., wood used for all purposes combined), and approximately 85% of all wood used for fuel is produced and consumed in developing countries.⁸ In sub-Saharan Africa, woodfuels account for an estimated 80% of total energy consumption, based on an equivalent-energy-content comparison of all types of fuels used in the household.⁹

Recognizing the Woodfuel Problem

The relationship between woodfuel energy use and environmental degradation in the developing world has received considerable attention since the mid-1970s. Erik Eckholm, an environmentalist writing for the Worldwatch Institute, first described this relationship as the "other energy crisis" of receding forests and cold hearths at a time when industrial countries were preoccupied with the dramatic consequences of increased oil prices instigated by the Organization of Petroleum Exporting Countries. Subsequently, numerous development specialists and academic researchers have written voluminously on the subject.¹⁰ Although most studies concede that energy-related

⁷ Eckholm et al. 1984.

⁸ de Montalembert & Clement 1983; World Resources Institute 1994: 170-71.

⁹ World Resources Institute 1990.

¹⁰ The often-cited initial publication is Eckholm 1975. Other key references on the subject include: Agarwal 1986; Bogach 1985; Cecelski, Dunkerley & Ramsay 1979; Chatterji 1981; Eckholm et al. 1984; Moss & Morgan 1981; and Smil 1980.

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exploitation of forests and woodlands is not as significant a factor in global deforestation as is land clearance for agriculture, many nevertheless acknowledge that dependence on woodfuels does contribute in some cases to severe local deforestation, environmental degradation, declines in agricultural productivity and increased rural poverty.¹¹

In the two decades since the "woodfuel problem" was first recognized as a serious environmental issue affecting millions of people worldwide, international development organizations such as the World Bank and the United Nations have proposed numerous strategies designed to achieve environmentally sustainable energy supply.¹² Typically, such strategies include the establishment of capital-intensive woodfuel plantations to enhance supply, or the promotion of appropriate technology interventions such as fuel-efficient cookstoves to reduce demand. In general, these strategies have failed to produce the desired results.

With the benefit of accumulated experience, many observers and researchers now contend that development agencies have consistently based their interventions on fundamental misunderstandings of the woodfuel problem. Prominent among these is the belief that rapidly rising population is the primary causal factor of the gap between supply and demand. Dewees, and Cline-Cole and colleagues,

¹¹ Rosillo-Calle & Hall 1992; Pimentel et al. 1986; Smith 1981.

¹² For example, see de Montalembert & Clement 1983 and World Bank 1979.

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among others, argue convincingly that the time has come to reconsider the dynamics of woodfuel supply and demand.¹³ They suggest that the prevailing Malthusian view of resource scarcity obscures more complex issues. These include variability in woodfuel supply over space and through time, the effective relationship between population growth and per capita energy consumption, household consumption behavior in response to changes in energy cost and supply, and how the availability of rural labor influences whether households collect firewood from locally available resources or purchase it in emerging local markets - and whether the latter case is in fact a sign of physical scarcity, as some suggest, or simply the outcome of the process of economic specialization and exchange.

O'Keefe and Munslow, who have worked extensively on this issue in southern Africa, claim that many attempts to solve the woodfuel problem falter due to various misinterpretations or miscalculations on the part of well intentioned development agencies.¹⁴ These include tendencies to isolate woodfuel supply as a forestry-production problem rather than a more integrated land management problem, to overestimate the problem's geographic magnitude and underestimate its highly localized nature, and to proceed with supply enhancement and demand reduction interventions without first having satisfactory

¹³ Dewees 1989; Cline-Cole, Main & Nichol 1990.
¹⁴ O'Keefe & Munslow 1989.

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An important lesson to draw from these critiques is that any attempt to respond to the woodfuel problem must first recognize the considerable variety of circumstances that may obtain at a given place and time. This point is underscored by Cline-Cole and colleagues who state that "affected populations are never amorphous and environments are rarely homogeneous; the 'fuelwood crisis' is consequently not everywhere manifest in the same forms or amenable to the same solutions."¹⁵ In addition to recognizing the diversity of situations in which a woodfuel problem can emerge, I would argue that analysis of the problem must go beyond issues of resource scarcity and population growth and take into consideration a number of variables which heretofore have received only marginal attention. Among these are many social, economic, political, and environmental factors that affect how, where, when, for whom, and at whose expense available natural resources are exploited to satisfy a given population's energy needs. In this study, I examine the case of woodfuel energy use in Senegal using an approach that captures a diverse array of relevant variables.

Woodfuels in the Senegalese Context

In Senegal, a nation of 8.8 million people with a current annual population growth rate of approximately

¹⁵ Cline-Cole, Main & Nichol 1990: 524.

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2.7%, there are numerous constraints to economic and social development.¹⁶ One of these is an extremely limited natural resource endowment. Located in the drought-prone Sahel region, with an export-based economy long oriented toward extensive soil-depleting groundnut production and dependence on modest forest resources to supply most of its energy needs, Senegal's natural resource base is subject to a variety of development-related pressures. In this section, I offer some general comments on the nature of the woodfuel energy situation as it pertains to Senegal. A more detailed discussion of the country's forest and woodland resources, and problems concerning energy production, consumption, and conservation, is presented later in Chapter 3.

Senegal's energy-environment dilemma is characterized by persistent dependence on dwindling woodfuel resources, a weak national economy that hinders large-scale substitution of petroleum-based fuels, the lack of viable alternative sources of energy, and government policy that appears to exacerbate the conflicting imperatives of meeting short-term energy needs and maintaining long-term environmental productivity. Although Senegal does not face the prospect of cutting down its last energy-yielding tree in the immediate future, localized pockets of severe deforestation do exist near some settled areas. Consequently, the country is presented with the challenge to devise sound

¹⁶ Demographic data reported in the Population Reference Bureau (Washington, D.C.) *1997 World Population Data Sheet*.

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natural resource management policies that simultaneously satisfy the energy needs of a rapidly growing population and protect the productive capacity of the natural environment.

Presently, most Senegalese are able to satisfy their household energy requirements, albeit at increasing costs of time and/or money in many instances. At stake, however, is the threat of slipping deeper into a situation whereby primarily urban-based increases in woodfuel demand result in the further degradation of rural-based natural resources, with attending negative socioeconomic consequences for rural populations. The situation in Senegal resembles that of many other countries where, as Whitney and colleagues note, "the economic benefits of fuelwood mining flow primarily to the urban population, the locus of political power and decision-making...[while] the environmental costs are largely invisible to the latter and are borne by rural populations who have little political clout."¹⁷

Analyses of the woodfuel problem in Senegal suggest that the situation will get worse before it gets better. A major investigation conducted jointly by the United Nations and the World Bank states that woodfuel demand will exceed supply at the turn of the century, and continue on a downward trend for several decades thereafter.¹⁸ Other

¹⁷ Whitney et al. 1987: 332. The notion of urban bias with regard to woodfuel issues is also discussed by Leach and Mearns (1988: 193-194).

¹⁸ See UNDP/World Bank 1983. I examine this study more closely in Chapter 3.

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research concludes that interventions carried out to improve woodfuel production, substitution, and conservation have so far done little to reverse this trend.¹⁹

Allowing that woodfuel consumption will continue to pose serious challenges to the energy and environment sectors in the coming decades, and given the failure thus far of most interventions to thwart a worsening situation, it would appear that the time is ripe to apply a different conceptual framework for problem analysis. Such a framework requires an integrated approach that takes into account the complex and varied dimensions of the overall energy-environment relationship. I argue, therefore, that the search for a sustainable energy supply system should seek to incorporate standard analyses of supply and demand with a wider suite of economic, social, political, and environmental factors.

In the following section I discuss a conceptual framework - political ecology - used here to analyze the energy-environment problem in Senegal. Drawing upon examples from the recent research literature, I summarize the important conceptual issues, essential components, and fundamental challenges of the political ecology framework. In the succeeding section, I explain how I apply this approach in my research.

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A Conceptual Framework for Problem Identification and Analysis

Over time, geographers have employed a variety of different theoretical and conceptual frameworks in their investigations of nature-society relationships. Broadly speaking, one can point to a sequence of propositions from environmental determinism, which dates from the late-19th and early-20th centuries, to the perspectives of possibilism and human and cultural ecology, whose roots can be traced to the work of Sauer and other Berkeley school geographers beginning in the 1920s and 1930s.²⁰

The once dominant thinking behind environmental determinism, that social, cultural, and economic characteristics of human populations are conditioned by the nature of their physical surroundings, is now roundly discredited on empirical as well as philosophical grounds. Human and cultural ecology perspectives, often applied by anthropologists and sociologists as well as by geographers, typically consider nature-society relationships in the context of specific adaptations made by individuals and groups to a given physical environment.²¹ Although these perspectives continue to influence the work of geographers concerned with human-environment questions, they have also been subject to criticism on the basis of their limited

²⁰ On environmental determinism see Huntington 1924, Semple 1911, and Taylor 1937; on possibilism see Febvre 1925 and Tatham 1951; on human ecology see Barrows 1923, Eyre & Jones 1966, and Porter 1978; and on cultural ecology see Bytzer 1989, Cohen 1974, and Turner 1989.

²¹ For examples of contributions from anthropology see Bennett 1976, Geertz 1968, Rambo 1983, and Steward 1955.

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spatial and static temporal scales of analysis, and a marked unidirectional emphasis on humans' adaptation to their physical surroundings that overlooks equally important questions of human impact on the natural environment.

While efforts have been made to achieve more complex, reciprocal analyses in human and cultural ecology - notably through the application of ecosystem concepts and general systems theory used to model human-environment interactions²² - these perspectives are still seen as insufficient in terms of understanding the broad array of factors, particularly those intervening at different spatial and temporal scales, that help to explain human-environment relationships. As Porter remarked in recognizing its emphasis on micro-level analysis, "human ecology has an appropriate scale and it can deal only with a limited level of complexity."²³ Consequently, perspectives on human-environment relationships in geographic research continue to evolve.

The relatively new approach of political ecology can be seen as the latest stage in the search for a more comprehensive understanding of human-environment relationships, one which, according to Peet and Watts, emerged as a response to "the theoretical need to integrate

²² For an overview of general systems theory/analysis, see Odum 1971. For an interesting reconsideration of these ideas as incorporated into the work of human geographers see Zimmerer 1994.

²³ Porter 1978: 19. The "appropriate scale" Porter mentions here has usually been interpreted to mean small, "primitive" societies in the developing world.

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land-use practice with local-global political economy."²⁴
 In a seminal publication on land management and
 environmental degradation, Blaikie and Brookfield depict
 political ecology as a combination of ecology and a broadly
 defined political economy; Pickles and Watts later refine
 this to *cultural* ecology and political economy.²⁵ Bryant
 describes political ecology as an emerging research agenda
 that is "complex and challenging, requiring analytical
 refinement as well as empirical exploration."²⁶

Beyond these broad statements, however, most attempts
 to define political ecology, and to explain how it can be
 used as a conceptual framework to guide research, begin to
 take off in a variety of directions that introduce a host
 of different and often conflicting views on epistemology,
 methodology, practical purposes, and theoretical
 expectations. This sometimes confusing situation can be
 attributed to the experimental stage at which political
 ecology currently resides as a research tool, and
 underscores the importance for those who employ this
 perspective to define terms and set boundaries.

An innovative aspect of political ecology is the
 explicit attention paid to human-environment interactions

²⁴ Peet & Watts 1993: 238.
²⁵ Blaikie and Brookfield 1987: 17; Pickles and Watts 1992:
³⁰⁹ 9. The volume by Blaikie and Brookfield has done much to
 stimulate work under the rubric of political ecology, which
 its authors also refer to as "regional political ecology"
 as an attempt to emphasize spatial considerations of the
 environment. Several antecedents to the recent surge in
 political ecology work include Wolf 1972, Enzensberger
¹⁹⁷⁴ 1974, and Yapa 1979.
²⁶ Bryant 1992: 27.

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at multiple, nested scales of analysis. In contrast to the micro-level analysis characteristic of most earlier work in human and cultural ecology, political ecology incorporates micro- (local ecology and populations), meso- (regional/national contexts), and macro- (global arena) level analyses of the environmental, economic, social, and political variables identified as relevant to an understanding the specific human-environment relationship under consideration.²⁷

Consequently, political ecology considers national and international factors in addition to local forces that affect the outcome of land management practices in a specific place. Clear examples of how multi-scale considerations are incorporated into the analysis of human-environment problems are illustrated in the work of Bassett on herder-farmer conflict and state-supported livestock development in the Ivory Coast, as well as that of Horowitz regarding international donor involvement in pastoral land use systems and large-scale river basin projects throughout the Sahelian region in Africa.²⁸ Additionally, in what is primarily a theoretical and methodological discussion that falls somewhat outside the main body of political ecology literature, Bradshaw and colleagues offer some interesting insights into the importance of multi-scale analysis with respect to problems of African development.²⁹

²⁷ Campbell & Olson 1991a; Blaikie 1994: 7.

²⁸ Bassett 1988; Horowitz 1990.

²⁹ Bradshaw, Kaiser & Ndegwa 1995.

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Another attribute of the political ecology framework that distinguishes it from previous approaches is an emphasis on understanding relationships between people and the environment within their historical, economic, and political contexts, paying specific attention to production processes at various spatial and temporal scales of analysis. The introduction of multidimensional, as well as multi-scale, analysis therefore responds to previous arguments in development geography, particularly those from the dependency school, for a broader approach that incorporates issues related to the political economies within which land managers operate.³⁰ A component is thus added to the study of human-environment relationships that considers the importance of the state and international capitalism, i.e., forces of political and economic power that are removed from the immediate physical environment but which nevertheless influence in-situ access to and control over locally available resources.³¹

The adoption of a political economy perspective helps to advance analysis beyond the sometimes reductionist explanations of human agency and natural causes that are often evoked to explain environmental degradation in many parts of the world.³² Instead, as Blaikie and Brookfield

³⁰ Slater 1974; Santos, 1979. See Riddell (1989) for a more recent, useful review of the translation of political economy concepts into ecological and spatial terms.
³¹ See Blaikie (1989) for an explication of how this can be examined in the African context.
³² An interesting discussion that reexamines many prevailing orthodoxies about the management (and degradation) of Africa's natural environments is found in Chapter 1 of the edited volume by Leach and Mearns (1996).

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suggest, we can begin to piece together a "chain of explanation" linking the site-specific physical outcome of various land use practices to economic, social, and political factors operating at different scales from the local to the global.³³ Work by Grossman in the Caribbean, Campbell and Olson in Kenya, and, separately, Carney and Schroeder in The Gambia, offer convincing examples of how political-economic relationships are integrated with environmental variables to help explain the outcome of local natural resource use patterns.³⁴

Most researchers currently experimenting with the approach would probably agree that, in principle, political ecology strives to combine natural science perspectives from ecology with social science perspectives from political economy in an historical context at multiple geographic scales of analysis. Beyond this general statement, however, what some consider as an attempt to theorize environmental degradation or land management is seen by others as a less grandiose effort to develop a more integrated and comprehensive framework that can accommodate the exceedingly complex questions of nature-society relationships. At the very least, it is clear that the notion of complexity is a recurrent theme in various attempts to explain what political ecology is all about.

³³ Blaikie & Brookfield 1987; Blaikie 1994: 11-18.

³⁴ Grossman 1993; Campbell & Olson 1991b; Carney 1993; Schroeder 1993. Both Carney and Schroeder take a significant look at factors of gender relations and land tenure arrangements.

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The challenge of defining political ecology is summed up in the words of one biologist who states:

The only clear and undebatable fact about political ecology is that it is a multifactor [political-social-ecological] system in which factors are interacting with one another in a complex fashion and the behavior of the system is a consequence of the particular structure of that system, not simply the sum total of the behavior of the individual parts.³⁵

Such convoluted attempts to define political ecology lead one pioneering thinker to suggest that efforts to establish a universal definition be bypassed in the interest of transforming the perspective into a vehicle for "identifying productive contradictions between and within its parent disciplines and ordering these into a set of mutually interacting discourses."³⁶ This, however, may prove to be no less of a challenge.

In practice, political ecology struggles with an interdisciplinary quality that in some ways may be its greatest attribute, while in others it remains a crippling liability. Uncertainties exist about how to reconcile a plurality of approaches into a coherent whole, how to accommodate flexibility in methodological and analytical procedure without sacrificing scientific rigor, and how to deal with contextual outcomes to human-environment scenarios that make it difficult to develop acceptable theory. Ultimately, these uncertainties lead some observers to question the suitability of political ecology as a useful tool in a vital area of geographic research,

³⁵ Vandermeer 1994.
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while for others it underscores the importance of precisely spelling out the context within which the approach is employed. The challenge, noted succinctly by Black, is to deal with the inherent plurality of political ecology without opening a "Pandora's box of possible processes and outcomes" when attempting to explain human-environment relationships.³⁷

Whitesell and Zimmerer echo this concern with careful reflections on these perplexing issues. Whitesell, in considering the emergent nature of political ecology and its potential contribution to theory building, describes its current usefulness as a "theoretical compass" to guide research.³⁸ Zimmerer, employing the term "new ecology," suggests that this conceptual framework holds promise in terms of "advanc[ing] human geography's explanatory capacity, scientific creditability, and its policy contributions," especially when applied to thorny issues of reconciling the necessity for economic development with the imperative of environmental conservation.³⁹

In addition to epistemological and methodological challenges, the emerging theme of political ecology struggles with two other issues, one minor and the other more troublesome. The minor issue concerns the criticism that research conducted under this rubric emphasizes problems in developing economies to the neglect of other

³⁷ Black 1990: 45.

³⁸ Whitesell 1993: 42.

³⁹ Zimmerer 1994: 118.

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regions of the world.⁴⁰ Although it is true that the overwhelming number of recent studies focus on locations in the so-called Third World, there is no convincing reason to suggest that political ecology is inapplicable to problems in industrial nations. In fact, precursors to the current wave of political ecology studies examined issues in places such as the European Alps, while more recent research on environmental management in New Zealand and land use rights in the southwestern United States exhibit many attributes amenable to analysis from this perspective.⁴¹ In theory, the approach could be employed anywhere in the world considering that there now remain very few examples of truly isolated human populations. While the degree to which exogenous variables affect the outcome of local land use practices may differ significantly from place to place, this does not necessarily call into question the inherent applicability of the approach.

The more significant concern relates to what is seen as the generally weak or unsatisfactory treatment of the

⁴⁰ Indeed, the majority of studies employing a political ecology framework focus on the developing world, particularly the Africa and Latin America regions. For Africa see: Bassett 1988, Bell & Roberts 1991, Campbell & Olson 1991b, Carney 1993, Jarosz 1993, Moore 1993, Schroeder 1993, and Uvin 1996; for Latin America: Chapman 1989, Grossman 1993, Hecht 1985, Schmink & Woods 1987, Stonich 1993, Vandermeer 1991, Whitesell 1993, and Zimmerer 1991; for Asia: Hershkovitz 1993 & Peluso 1992. There is also a notable, and constructively critical, paper on Portugal by Black 1990.

⁴¹ Wolf (1972) provides commentary on work done in the Alps, reported in a special issue of *Anthropological Quarterly*. The examples from New Zealand and the United States are reported in Cocklin and Furuseth (1994), and Mahler (1996) and Morehouse (1996), respectively.

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natural science side of human-environment relationships, i.e., the *ecology* of political ecology.⁴² As I suggested earlier in this chapter, rare is the geographer, reputed to have the requisite knowledge and skills straddling the social and natural sciences, who is truly expert in his or her understanding of the interdisciplinary nature of human-environment relationships. Given the complexity of these relationships, political ecology by its very nature demands significant collaborative effort.⁴³

So far, however, work done in this vein has been dominated by those whose expertise is in the social sciences. A notable exception to this pattern is the research reported by Bell and Roberts.⁴⁴ These two geographers successfully weave together analyses of the physical characteristics, distribution, and variations in wetland soils in Zimbabwe and the context of land use policy stipulations imposed by the state, during both colonial and post-independence periods, to explain farmers' access to productive land resources. Work by Zimmerer, a human geographer, on potato cultivation in Peru is another rare example of balanced human-physical analysis and interpretation.⁴⁵ Nevertheless, the bias toward social

⁴² See discussion in Whitesell (1993: 83).

⁴³ Building effective collaboration might be more difficult than initially expected. One biologist's dour, albeit amusing, perspective on the chances of effectively merging different backgrounds in political ecology goes like this: "In the case of political ecology there are two initial problems: First, natural scientists think they know far more about ecology than they really do, and second, social scientists believe them" (Vandermeer 1994).

⁴⁴ Bell & Roberts 1991.

⁴⁵ Zimmerer 1991.

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science perspectives poses some fundamental questions concerning the high claims that political ecology transcends disciplinary barriers that impede a more advanced and complete understanding of nature-society relationships.

Woodfuel Analysis from a Political Ecology Perspective

The application of a political ecology framework, as exemplified in the works mentioned above by Bassett and Bell and Roberts, demonstrates how variations in the quality and quantity of natural resources over space and through time, and the various ways in which different user groups gain access to or are excluded from these resources, ultimately affect the extent to which environmental degradation occurs in a given situation. In a similar vein, I argue that a political ecology framework can also be applied to analyze the exploitation of Senegal's forest resources for woodfuel supply and the resultant environmental consequences of this activity. In so doing, one can expect to gain a more thorough understanding of the multiple factors that influence the outcomes of this type of human-environment relationship.

An example from East Africa helps to shed some light on the way in which the woodfuel problem is suited to examination within a political ecology framework. The example is based on Wisner's consideration of the structural determinants of woodfuel resource availability

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in rural Kenya.⁴⁶ In this particular case, Wisner demonstrates how adequate woodfuel supply is only one of many other basic needs, e.g., nutrition, water, housing, and education, met through judicious allocation of the available household resources of time (particularly women's), cash, and land. He makes the important observation that availability of woodfuel is not simply a function of the quantity and distribution of biomass resources, but that, in addition, "socioeconomic factors interact with demography and ecology to produce an unseen landscape of class-stratified scarcity and abundance."⁴⁷

Wisner sketches a picture of unequal access to woodfuel resources which he refers to as the local "fuelscape." He illustrates how access to woodfuel may be restricted not only by physical parameters affecting the level of biomass productivity, but also by property ownership arrangements, uncertain usufruct rights to land, and other socioeconomic conditions, particularly among the landless or the land-poor, that ultimately make it more difficult for some households to meet their energy needs. Wisner argues that villagers who are on the socioeconomic and political margins of access to natural resources are "forced into vicious spirals that produce environmentally marginal conditions [i.e., degradation]."⁴⁸

This analysis of variable access to woodfuel resources in Kenya demonstrates how multiple factors surrounding the

⁴⁶ Wisner 1989: 237-45.

⁴⁷ Wisner 1989: 240.

⁴⁸ Wisner 1989: 242.

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issues of woodfuel supply and environmental quality fit into the political ecology conceptual framework. In this case there are identifiable, multiple linkages between society, political economy, and the natural environment which constitute the core of the framework. Although Wisner incorporates elements of multidimensional analysis, the influence of power on access to resources, and variability in the physical environment, this example remains incomplete in that it does not adequately address the impact of exogenous variables in shaping the contours of the local fuelscape.

Campbell and Olson remind us that political ecology, as a tool to organize analysis of human-environment issues, seeks to understand the interrelationships between political, economic, social, and ecological variables over space, through time, and at various scales of analysis from the local to the global.⁴⁹ Therefore, to examine woodfuel energy issues within a political ecology framework, one must first identify the relevant constituent elements of the political, economic, social, and environmental variables - as they are represented along the local-global continuum - that define the basis of the multidimensional analysis. According to Whitesell, we can consider this first step in the applying political ecology approach as the "categorization phase."⁵⁰ In the following paragraphs I offer examples of representative elements of the

⁴⁹ Campbell & Olson 1991a, 1991b.

⁵⁰ Whitesell 1993.

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different variables that one might choose to examine in any given woodfuel energy problem.

Ecological factors relevant to woodfuel analysis include those directly concerned with tree growth and the productive capacity of the physical environment such as soil conditions, water availability, climatic conditions, and pest and fire ecology. Knowledge of these factors helps to identify the possibilities and limitations of various natural forest management and reforestation strategies for a given location.

Social and cultural factors important to the analysis of woodfuel problems include aspects of energy choice (i.e., fuel preference), division of household labor - especially that of women and children - with respect to fuel provision, indigenous technical knowledge of local natural resources, and issues of cultural prohibitions or taboos related to land, tree, or fuel use.

Political factors that figure prominently in woodfuel analysis include institutional arrangements that determine land tenure and land use patterns, the allocation of usufruct rights to common property resources vis-à-vis the ability to restrict access to resources through rights in private or state ownership of land, and procedures for the adjudication of land-related disputes. Questions related to who has access to resources, how access is determined, who makes decisions, who benefits and who loses when resource use decisions are made are all important considerations. Insight into how these issues are handled

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helps us to better understand why inequities may be apparent in the quality and quantity of woodfuel resources available to various members of a particular population.

Economic factors to consider include the prospects and feasibility of using alternative fuels, relative prices between different types of fuels where these have been transformed into market commodities, and the valuation of trees and woodlands in terms of the functions they provide not only as sources of energy, but for the many other economically productive and environmentally protective functions they play as well.

Once the categorization stage is complete, the next step involves determining the nature of the connections and interdependencies among the identified variables. This is what Whitesell describes as the "process phase" in the Political ecology approach.⁵¹ This is, in effect, an exercise in synthesizing the available data in order to determine the processes that help to explain the nature of the human-environment relationships and the outcome of the particular land use practices under consideration.

Objectives of the Investigation

In this study, I set out to explore the applicability of a political ecology perspective to elucidate the intricacies of the woodfuel energy-natural resource management problem in Senegal. I argue here that the political ecology conceptual framework allows for an

⁵¹ Whitesell 1993.

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inclusive and diachronic consideration of a suite of relevant variables, thereby enhancing previous approaches based on more limited sets of variables, geographic scales, and time frames.

As mentioned earlier in this chapter, woodfuel energy use in the developing world has been the subject of considerable examination. This is no less true in the case of Senegal. In addition to the major United Nations/World Bank study noted above, many other international development agencies, bilateral donor programs, and non-governmental organizations have been involved in numerous studies, projects, and evaluations of the country's woodfuel situation.⁵² On the part of North American researchers, the most noteworthy contribution to date is Ribot's comprehensive analysis of the political economy of Senegal's charcoal markets.⁵³ The substantial amount of research and project involvement in the woodfuel energy sector notwithstanding, important information still needs to be gathered and questions answered in order to improve our understanding of this specific human-environment issue in this particular locale. Consequently, my study builds upon previous work in order to gain new insights into the nature of the problem and to suggest some possible avenues to pursue in the search for solutions.

⁵² The following have figured prominently in the woodfuel energy sector in Senegal: the United States Agency for International Development, the energy division of the Dakar-based non-governmental organization ENDA-Tiers Monde, and the French environmental organization Association Bois de Feu.

⁵³ Ribot 1990.

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Previous research conducted in Senegal suggests that, despite disappointing results experienced thus far in terms of fuel substitution, energy conservation, and reforestation, alternative strategies to redress the energy-environment situation might be identified through a comprehensive reexamination of a number of key issues related to the woodfuel problem. Such issues include customary and contemporary land tenure arrangements, forestry codes and other environmental legislation, regulation of the charcoal industry, woodfuel pricing policy, the scope for cooperation between rural populations and government agencies responsible for energy and natural resource management, as well as the agro-ecological conditions related to biomass production.⁵⁴ In this study, I employ a political ecology framework to organize a reexamination of these and other issues concerning the energy-environment problem.

Research Questions

The suggested utility of conducting a more comprehensive examination of issues surrounding the energy-environment situation in Senegal evokes three specific research questions that guide this study. First, what are the constituent elements of the political, economic, social, and environmental variables, manifest at various spatial and temporal scales of analysis, that govern natural resource management practices for woodfuel energy

⁵⁴ For example, see Ribot (1989) and Tibesar and White (1990).

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production? Second, how do the interrelationships among these variables help to explain the environmental and socioeconomic outcomes of current woodfuel production practices? Identification of the constituent elements of the main variables and the interrelationships between them begins to reveal the complexity of the search for solutions to the energy-environment problem at hand.

In considering new strategies to improve natural resource management practices in general, and woodfuel energy production in particular, it is essential to identify the variety of players involved with these issues at international, national, and local levels. The range of players includes, among others, representatives of international development agencies, members of non-governmental organizations, government technicians in the national forest service and the environment ministry, entrepreneurs in the forest-products business engaged in woodfuel production and commerce, and the many and varied interests represented among local rural populations. It is important to understand who is represented among these individuals and groups, and to discern what their respective interests are regarding the exploitation and/or conservation of natural resources. Knowledge of who these players are, their relationships with one another, and their attitudes toward natural resource management is essential in order to understand the environmental and social outcomes of woodfuel production practices.

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The third research question guiding this study stems from one particular suggestion to consider in re-examining Senegal's energy-environment situation. The issue has to do with the nature of cooperation between national and local entities. Specifically, what is the scope for effective local participation in the search for solutions to the national woodfuel problem? Addressing this issue is important in light of the fact that many national and international agencies involved in environmental matters are currently refocusing their attention on the imperatives of local community involvement in natural resource management. In Senegal, as well as many other parts of Africa, emphasis on decentralized natural resource management has become a major thrust in the development planning process.⁵⁵

The concepts of "community-based natural resource management" and "village land management" in Senegal represent new models of decentralization predicated on a "transfer of responsibility" (*responsabilisation* in French) from the central government to the local population.⁵⁶ In the spirit of "less government is better government" that

⁵⁵ For example, see République du Sénégal (1993d), Gueye (1994), Gueye and Laban (1992), Resch (1994), and Fortmann & Nihra (1992).

⁵⁶ In Senegal, the term *responsabilisation* is employed by the government to indicate the increased role local communities are now expected to play in managing their own affairs (including natural resource management) with less state involvement. However, some observers argue that this policy reflects instead the failure of the state to achieve its development objectives and, moreover, represents an abandonment of state responsibility vis-à-vis the rural population (see Sylva 1992: 183-84).

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reflects the state's attempt to disengage from certain sectors of the economy - itself a response to pressure from international actors to streamline an inefficient and bloated bureaucracy, local populations are expected to become more directly responsible for the management of resources within their territorial jurisdictions. In theory, having a greater voice in determining the way in which local resources are exploited, not to mention having more secure rights to the benefits that accrue therefrom, encourages communities to engage in better resource management practice. Emphasis is often placed on the participation of women, reflecting once again the priorities of foreign donors who fund many natural resource programs.

The logic behind decentralized natural resource management assumes, among other things, the existence of an effective implementing structure. As Minis and colleagues point out, this structure requires functional local government units with a degree of independence from direct control by the central authority, clear and legally recognized geographical boundaries over which they exercise authority, the corporate status needed to raise funds to provide services and functions, and a working reciprocal relationship between local and central levels of government.⁵⁷ In other words, successful decentralization requires the effective devolution of decision making authority to local governing bodies.

⁵⁷ Minis et al. 1989: 19.

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The renewed focus on decentralization and local community participation in natural resource management presents an opportunity for yet another reexamination; namely that of the purported benefits of the so-called "bottom-up" as opposed to "top-down" approach to rural development. A considerable body of literature in development geography addresses this dichotomy.⁵⁸ In the following paragraphs I draw upon some of this literature as it pertains to both socioeconomic and spatial aspects of rural development that are relevant to the present discussion of natural resource management in Senegal.

In socioeconomic terms, the bottom-up or so-called "people-first" approach is based on the premise that development strategies must be oriented toward helping local populations meet their basic subsistence needs and enhance their long-term livelihood security.⁵⁹ In many instances, this includes making provisions for protecting important local natural resources. Trees, which provide a number of domestic needs such as food, fiber, and energy, are often cited as critically important resources for the rural poor.⁶⁰ Obviously, protection of this particular natural resource is at the heart of the energy-environment discussion in Senegal.

In spatial terms, the bottom-up development perspective is couched in terms of "selective spatial

See, for example, Chapman (1969), Corbridge (1991), Friedmann (1979), Friedmann and Weaver (1979), Johnson (1970), and Stohr & Taylor (1981).
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closure," an important concept in regional development thinking expounded in the late 1970s.⁶¹ According to Gore, selective spatial closure entails "the devolution of power to local and regional 'communities' so that they can not only plan the development of their own resources according to their own needs, but also control any external relationships that have any negative effects upon them."⁶² These negative effects are characterized by the "leakage of vital regional resources" which results from the undesirable polarizing ("backwash") effects of unequal exchange between the core and periphery of a national economy.⁶³ Friedmann and Weaver discuss selective spatial closure in the context of a territorial approach to regional planning, viz., "agropolitan" development, a basic principle of which is that "[socioeconomic] development should aim at the maximum development of physical [i.e., natural] resources consistent with principles of conservation."⁶⁴

The socioeconomic and spatial aspects of bottom-up development thinking offer a theoretical reference point for examining the current shift in emphasis on decentralization and local community participation as ways to redress Senegal's energy-environment problem. As will be discussed later in this study, the historical evolution of a centralized forestry management apparatus in Senegal

Friedmann & Weaver 1979; Lo & Salih 1981; Stohr & Dittling 1979.

Gore 1984: 157.

Lo and Salih 1981: 146-47.

Friedmann & Weaver 1979: 199.

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is responsible in part for the "leakage" of vital resources, i.e., rural forests to meet urban woodfuel needs, that has produced overall negative impacts on rural populations and the natural environment. In light of this, the question now becomes one of whether decentralization and the devolution of authority over natural resource management to local communities can bring about a more environmentally and economically sound woodfuel production system.

Given the resurgence of the "development from below" paradigm in Senegal's official rural development policy, a number of questions must be posed that specifically address the prospects for successful local participation in community-based natural resource management. For instance, what is the capacity of local communities and institutions to assume more direct responsibility in managing natural resources for both commercial and subsistence purposes? What are the linkages between local community authorities, private entrepreneurs, central government agencies, and international institutions, and how do these linkages affect commercial woodfuel production? In what ways do the social, political, and cultural realities in local communities affect the prospects for these communities to cooperate amongst themselves and with the state to better manage natural resources, particularly with respect to the production of woodfuels?

One must be wary of the rhetoric of decentralized natural resource management in Senegal, especially as it

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begins to sound increasingly like a panacea for resolving the country's environmental problems. As I explain in this study, the context in which the management of natural resources takes place is complicated, involving multiple linkages between numerous actors who have different vested interests. In other words, local community-based resource management does not operate in a vacuum isolated from the affects of outside influences. By employing a political ecology framework, I demonstrate how consideration of the important elements of scale, power (e.g., influence of international organizations, central state versus local traditional authority), and historical perspective helps to organize and add coherence to the analysis of what is a multifaceted human-environment problem.

Plan of the Dissertation

Following this introductory chapter, the remainder of the dissertation is composed of another six chapters. In Chapter 2, "Files, Forests and Farms," I explain the data collection methods employed to satisfy the various information needs of the study and describe the procedures followed in selecting the field site where I conducted my research. I also indicate the numerous sources from which I obtained assistance during my work, and point out some problems and concerns regarding research procedures and data reliability.

Chapter 3, "Of Forests and Fires," provides substantial background information related to energy and

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Chapter 5

environmental issues in Senegal. I begin with a description of the country's natural resource base, with emphasis on forests and woodlands, and then discuss in some detail issues of energy production, consumption, and conservation. I also offer an overview of how the woodfuels sector operates, and consider issues related to the environmental impact of Senegal's dependence on woodfuel energy.

Chapter 4, "An Historical Perspective on Land Use in the Southeastern Peanut Basin," introduces the study area. The discussion here establishes the historical and geographical contexts of the location in which I concentrated my research efforts.

The aim of Chapter 5, "Multiple Dimensions of the Energy-environment Nexus," is to identify the principal components for the analysis of resource management and woodfuels production central to this study. This chapter is therefore concerned with the categorization phase of the political ecology approach as mentioned above. I identify the separate environmental, social, economic, and political variables of the energy-environment nexus in the case of Senegal, describing their respective elements at the international, national and local levels. Chapter 6, "Towards A Synthesis of Energy-Environment Relationships in the Rural Community of Lour Escalé," is concerned with the process phase of the political ecology framework. Here, I attempt to demonstrate how the variables identified in Chapter 5 are interrelated in the process of exploiting

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In the concluding remarks of Chapter 7, "Political Ecology and Human-Environment Relationships: Lessons from Senegal's Woodfuel Energy Dilemma," I discuss the findings of the study and consider the utility of the political ecology conceptual framework for understanding the energy-environment problem in Senegal. I also address how this approach might be applied to other topics of human-environment studies in different geographic locations.

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CHAPTER TWO

FILES, FORESTS AND FARMS: FIELDWORK AND DATA COLLECTION PROCEDURES

This study is based on fieldwork conducted in Senegal over a period of 15 months from November 1992 through January 1994. Several weeks were also spent in Paris, France, collecting and examining documentation at various research centers. In Senegal, my investigation progressed through several stages in various locations ranging from government ministries, research centers, and libraries in the capital city Dakar, to regional field offices of the National Forest Service and a number of rural development agencies, to an extensive period of local-level data collection in a rural community in the region of Kaolack.

In this chapter I discuss the procedures employed in conducting my research and collecting the information upon which the study is based. I begin by placing this discussion within the context of the data requirements necessitated by the application of a political ecology framework in order to address the research questions elaborated in Chapter 1. In subsequent sections of the chapter, I go on to describe a number of specific procedural and logistical issues related to my research that provide the reader with an overall appreciation of how the fieldwork was conducted. In these sections I address issues such as the rationale for selecting the study area, primary and secondary data sources, research assistance received in carrying out the study, and problems

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Information Requirements and Research Methods

As mentioned in Chapter 1, the commentary on political ecology as a "theoretical compass" to guide research cautions those who employ the framework about the need to clearly state the context within which the approach is used. In this section, I discuss how the research methods I employ reflect the requirements of the political ecology framework and respond to the specific research questions posed in the study.

The political ecology perspective casts a wide net in order to achieve a more complete understanding of the factors that influence specific human-environment relationships than has been afforded by previous conceptual approaches. The search for a more thorough, holistic account of relevant factors is reflected in the multi-scale, multidimensional qualities of the conceptual framework. This, in turn, requires collection and consideration of a wide range of disparate information and data. In order to respond to the challenge of collecting such information, one's investigation must be conducted on multiple fronts at various geographic scales. In addition, it is important to consider specific human-environment relationships within their historical context as these are subject to change over time.

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Clearly, the political ecology framework and the nature of the research questions I pose in this study require the use of a variety of methods of data collection and analysis. For example, identification of the constituent elements of the political, economic, social, and environmental variables associated with woodfuel production is accomplished through the construction of a multi-scale, multidimensional matrix based on information gathered from many disparate sources. Analysis of the interrelationships among these variables, in order to achieve an understanding of the impact they have on the environmental and social outcomes of woodfuel production practices, involves a process that leads to the elaboration of reasonable explanations of cause and effect that in certain ways remain contingent on interpretation and context. I return to this critical point in greater detail in the concluding chapter of the dissertation.

Responding to the question of whether there is scope for local participation in the formal management of natural resources for woodfuel production requires the application of yet another set of information gathering techniques. Through careful investigation of political, economic, and social circumstances at international, national and local levels, one can begin to piece together a response to this question based on the prevailing conditions in these respective spheres. This process reflects what Blaikie and Brookfield describe as the "chain of explanation" in political ecology that links environmental outcomes of

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specific land use practices to economic, social, and political factors operating at different scales of analysis.¹

The combination of techniques I used in my research reflects the position, supported in previous applications of the political ecology framework, that flexibility in methodological procedure is important and necessary.² It also responds to the suggestion made in a useful text on woodfuel energy surveys in developing countries stating that "no [research] method is superior, all are necessary."³ In the next section of this chapter, I introduce the procedures followed to establish a network of research contacts and select a field site for the focused examination of natural resource management issues surrounding woodfuel production. Following this, I go on to discuss the various data collection methods, based on both primary and secondary sources of information, I employed throughout my stay in Senegal.

Field Site Selection

During the first months after arrival in Senegal I divided my initial investigation into two phases. The first, lasting approximately two months, entailed a series of official contact visits and interviews with representatives of university departments, government agencies, and non-governmental organizations concerned with

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² Blaikie & Brookfield 1987: 27.
³ See Pickles & Watts 1992.
UNFAO 1983: 79.

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environmental issues. During this phase I was also able to complete background searches for documentation on energy resources, forestry management, and other environment-related issues that help to inform the present study.

The second phase of my preliminary investigation, also lasting approximately two months, took place in the city of Kaolack, capital of the region of the same name located in the central part of the country (see Figure 2.1).

Selection of this region was guided by several considerations. First, the city of Kaolack is Senegal's third largest, after Dakar and Thiès, and, as in all of the country's urban areas, household energy use in the city shows a marked dependence on woodfuels which places significant pressure on nearby forest resources.⁴ Second, the Kaolack region is located in a part of the country that is highly susceptible to environmental degradation due to both human and physical factors. Historically, the region has been an area of considerable in-migration associated with agricultural expansion and, more recently, has witnessed significant increases in forest resource exploitation. These factors, together with current overall regional population growth and

⁴ Kaolack had a 1988 estimated population of nearly 160,000 inhabitants (République du Sénégal 1992b: 41).



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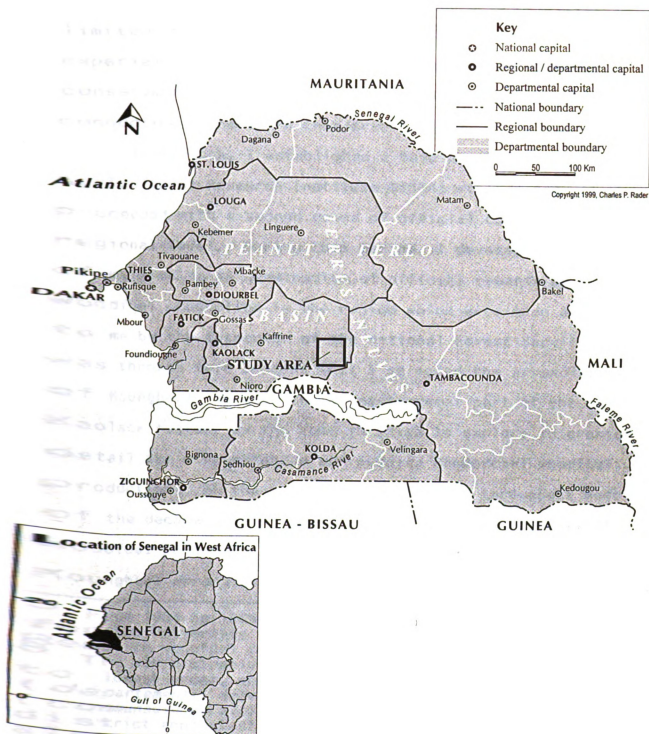


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urbanization rates of 2.6% and 3.5% respectively, combine to place increasing pressure on the region's relatively limited natural resource base. Third, my previous work experience in Kaolack with Senegal's national woodfuel conservation program helped to facilitate many aspects of conducting research in this area.⁵

In Kaolack, I established a base at the Senegalese Agricultural Research Institute (ISRA) station and proceeded with a second round of official contacts at the regional level. During this period, I devoted the majority of my time to an examination of official records on woodfuel production in the region which were made available to me by the inspector of the National Forest Service. It was through this process that I selected the *arrondissement* of Kounghoul, located in the easternmost part of the Kaolack region, as the zone in which to explore in greater detail the circumstances surrounding commercial woodfuel production. At the time of my study, and throughout most of the decade of the 1980s, the overwhelming majority of woodfuel production in the Kaolack region took place in the Kounghoul *arrondissement*.⁶

From 1984 to 1986 I was the Kaolack region coordinator for the University of Dakar's Center for Renewable Energy research woodfuel conservation project. The administrative subdivisions in Senegal, from highest to lowest order, are the region (*région*), department (*département*), *arrondissement*, and rural community (*communauté rurale*). An *arrondissement* is a territorial unit strictly approximating a county in the United States; it is commonly referred to as a *sous-préfecture* (subprefecture). In a 1992 administrative reorganization, which for all practical purposes has yet to be fully consummated, the *arrondissement* of Kounghoul was redesignated the *arrondissement* of Maka-Yop, Maka-Yop being

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Guided by information obtained at the Kaolack office of the forest service, an initial reconnaissance visit was made to the Kounghoul area to begin planning the rural component of my fieldwork.⁷ After consulting with individuals familiar with the Kounghoul *arrondissement*, particularly the former chief of the *Centre d'Expansion Rurale* (CER)⁸ who had worked in the area for 12 years, I selected the Rural Community (*Communauté Rurale*) of Lour Escale (hereafter Lour) as the focus of my field research activities.⁹ Lour is one of six rural communities which together comprise the Kounghoul *arrondissement*, and includes 46 villages with a total population of 11,410 inhabitants according to the 1988 national census.¹⁰ With

the seat of one of the *arrondissement's* six rural communities (see footnote 9 below). For the sake of consistency, I shall refer to the *arrondissement* by its former appellation since the offices and day-to-day functions of this sub-prefecture continued to operate, at the time of my research, from the town of Kounghoul (pop. 10,000).

Rural fieldwork took place over a period of ten months, during which time I spent a total of 5 months working in the Kounghoul *arrondissement* interspersed with trips to Kaolack and Dakar for further research, consultation and interviewing.

The CER is Senegal's primary rural extension service.

In terms of Senegal's political-administrative structure the rural community (*communauté rurale*) is the penultimate territorial subdivision, generally composed of between 10 and 50 villages with total populations ranging from 2,000-5,000 inhabitants, governed by a corresponding rural council (*conseil rural*). In 1994, there were a total of 17 rural communities in Senegal. Lour was officially established as a rural community in 1974, with its seat in the village of Lour Escale. The word "Escale" is commonly used in French toponymy to indicate a "trading post," referring in this case to a location where peanut marketing transactions took place during the colonial period.

République du Sénégal 1988a. Assuming a rural population growth rate for the Kaolack region of 2.3% per annum as reported in the 1988 census, Lour had an estimated 1993 population of 12,780 inhabitants.

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the assistance of the former CER chief, I arranged to establish a base for the rural component of my fieldwork in the village of Touba Aly Mbenda (hereafter Touba¹¹), located approximately 20 kilometers north of the town of Kounghoul.

The choice of Lour was guided by several important considerations. First, information from the regional headquarters of the forest service indicates that eight of the thirty-two (25%) officially designated woodfuel production sites in operation during the nine years from 1985 to 1993 in the Kounghoul *arrondissement* are located in this rural community. Second, an internationally funded rural forestry project, PARCE,¹² was active in the zone during the 1980s in promoting reforestation practices among the local population. Therefore, research in this area offered an opportunity to investigate the project's impact on forestry-related land management activities. Third, a key informant, the former CER chief, provided me with a number of personal contacts through whom I was able to establish a base in the village of Touba. A fourth consideration, one that I regarded as critical in

¹¹ By employing this abbreviation I do not wish the reader to confuse the village of Touba Aly Mbenda with the town of Touba, the religious capital of the Mouride Islamic brotherhood, located in Senegal's Diourbel region. There is, however, an important connection between the two places since Touba Aly Mbenda was founded in 1918 by a disciple of Mouride brotherhood's founder, Cheikh Amadou Bamba Mbakké. This relationship is discussed further in Chapter 4.

¹² *Projet d'Aménagement et de Reboisement du Centre-Est* (Central-East Forests Management and Reforestation project). For details on this project see Montagne (1988) and Barrier (1989).

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facilitating my fieldwork, was the presence of an indigenous community development association based in Touba known as the Kounghoul Entente.¹³ Establishing contact with members of the Entente provided me with access to knowledgeable and dynamic residents of the local community engaged in various projects related to natural resource management. I considered this to be important in the light of certain methodological criteria concerning the conduct of field research.¹⁴ I discuss this point further in the section on research assistance later in this chapter.

The initial phases of my research program proved beneficial in terms of establishing a set of reference points for information and data collection corresponding to the multi-scale requirements of the political ecology conceptual framework. Contacts made and investigations carried out in the capital city of Dakar were particularly useful for identifying elements of the economic, social, political, and environmental variables of the study at the international and national geographic scales. Work carried out at the regional headquarters in the city of Kaolack served two important objectives. First, through a logical process of documentation review and informational interviewing, I was able to determine an appropriate location in which to conduct the local-level segment of the fieldwork. Second, work in the regional capital also

¹³ Entente, a French word meaning "agreement" or "understanding," is commonly used to refer to self-help organizations such as the numerous village development associations found throughout Senegal.
¹⁴ See Graham (1980).

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served as an important "bridge" for understanding the linkages between national and local level factors that contribute to an understanding of the overall woodfuel production system.

Information and Data Collection

In this section I discuss the specific sources of information and data I utilized during my research. I begin with a description of secondary sources consulted and continue with an explication of the primary sources of information.

Secondary sources

The majority of secondary sources consulted for this study include government reports and other official documentation not available outside of Senegal. Statistics related to woodfuel production and consumption were gleaned from annual reports and other documents obtained from the Senegalese Forest Service and the Energy Directorate of the Ministry of Industry and Commerce. Demographic statistics compiled during the latest national census (1988) were available from the Ministry of the Economy and Finance. Official legislation related to territorial administration, land tenure laws, and the environment, e.g., the national forestry codes, was consulted at the national archives and at other libraries located in Dakar. Planning documents concerning rural communities in the Kounghoul arrondissement were made available to me by the Directorate of Local Collectives at the Ministry of the Interior.

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Unpublished dissertations, theses, and other manuscripts related to research on environmental issues in Senegal were consulted during visits to a variety of university departments, libraries, and the documentation centers of international development agencies. A complete listing of the facilities visited appears in Appendix A. Consultations at these locations were useful in terms of obtaining information and results from studies conducted by Senegalese researchers that are generally unavailable elsewhere.

Complementing the information uncovered in Senegal, several weeks spent in Paris, both before and after fieldwork, led to the discovery of a wealth of helpful monographs and technical reports on land use, agriculture, woodfuel, and forestry-related topics concerning Senegal's peanut basin region. These were consulted in the documentation departments and libraries of the *Association Bois de Feu*, the *Centre Technique Forestier Tropical*, and the *Institut Géographique National*. In addition, maps and aerial photographs of the study area were obtained or consulted at the *Institut Géographique National* in Paris, and the *Service Géographique National* and the *Centre de Suivi Ecologique* in Dakar.

P r i m a r y s o u r c e s

During my first preliminary visit to Kounghoul, I was able to learn a great deal about the study area from several key informants and other persons who became part of

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my information network. Two Peace Corps volunteers stationed in Kounghoul town, who at the time of my arrival had been working in the area for sixteen months, helped to put me in touch with various persons in the community. They facilitated my introductions to the former CER chief, the head of the local forest service brigade, and the *sous-préfet*, i.e., the chief administrative officer of the *arrondissement*. In addition, numerous discussions with members of a Kounghoul-based rural credit association, personnel with an Italian non-governmental organization active in local community development projects, and with other members of the Kounghoul CER were helpful in obtaining information about the activities and personalities associated with the Kounghoul Entente.

In a series of extended visits I spent a total of five months working in the Rural Community of Lour from my base in the village of Touba. During my first stay, I employed a combination of participant observation and open-ended group interviewing techniques to achieve my initial objectives. These were to: 1) become as familiar as possible with the local area and its population; 2) allow the local people the opportunity to adjust to my presence and to explain to them the topic of my study; and 3) begin to get a picture of local natural resource use, with a special eye on how woodland resources fit into this picture. I discovered that I could learn the most by taking part in ongoing village activities such as field preparation (my work in Touba began just prior to the rainy

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season), firewood collection, visits to a nearby weekly market, and various social occasions including baptisms, funerals, weddings, and communal work efforts known locally as *santaané*.¹⁵

Informal open-ended interviews, guided by a set of key points for discussion, were held with a variety of individuals in Touba and several surrounding villages (a complete list of interviews conducted appears in Appendix B). The *pénc*, a Wolof word signifying "village meeting place," was the scene of regular opportunities to discuss a number of issues with local residents (almost always men, however). During these interviews I focused on learning about the history of settlement in the area, respective gender roles in agricultural and domestic labor, the agricultural calendar, local knowledge on the availability and use of tree resources, the history of the PARCE Forestry project, and the functioning of local institutions such as the agricultural cooperative and the rural council. I also attended two meetings of the Kounghoul Entente which allowed me to pose questions to a wider audience.

During these interview opportunities, I was able to gather a considerable amount of information in response to the specific requirements of the political ecology conceptual framework. Consequently, I learned much about the history of land use and settlement in the area, authority over land tenure arrangements, attitudes of the

Spellings for words from the Wolof language, the lingua franca of Senegal, are based on the orthography used in Fal, Santos and Doneux 1990.

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local population towards formal state institutions, and the role played by international development agencies in the natural resources sector.

During another extended stay in the Lour area I examined more specifically the issues of woodfuel production and reforestation. On several occasions I visited different sites in the rural community where charcoal production takes place, and discussed the impacts of this activity with local residents. I also visited villages in which the Touba-based community development project is involved in reforestation activities. I interviewed villagers involved in managing tree nurseries and spoke with others who have taken a particular interest in on-farm tree planting. These visits provided a clearer picture of the form and function reforestation is taking in the study area.

In order to gather information concerning the socioeconomic impact of woodfuel production on the area's residents, I designed a questionnaire for use in a household survey of woodfuel energy use (a copy of the questionnaire is found in Appendix C). The survey was conducted in a total of 90 randomly selected households in three different villages in the Lour Rural Community.

Research Assistance

As mentioned above in the discussion on field site selection, the initial phases of my work entailed several months of preliminary investigation at the national and

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regional levels prior to focusing on the rural component of the study. During this time I was able to develop an extensive network of contacts and resource persons whose assistance allowed me to work my way down the spatial hierarchy and establish a research base at the local level.

Individuals and institutions from the university, government, and development agency communities all contributed to this process. I particularly benefitted from the assistance provided by the research staff of the *Institut des Sciences de l'Environnement* (ISE) at the *Université Cheikh Anta Diop* in Dakar, and many regional-level government development agents with whom I collaborated during my previous work experience in Senegal in the 1980s. Personal introductions by these individuals to others from whom I sought information proved especially effective in terms of alleviating suspicion and gaining a degree of confidence among new contacts.

During my initial reconnaissance visit to Touba I was introduced to the community by the president of the Kounghoul Entente, whose acquaintance I had made earlier through the former CER chief. A meeting was arranged in the village at which time I was given an opportunity to explain the reason for my visit and my research interests. After a lengthy and lively discussion with those present, it was agreed that I would be welcome to base myself in Touba and to work with members of the Entente. I was then introduced to a resident of Touba - a male of my age - who was appointed by the villagers as my guide. This

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individual indeed provided me with valuable assistance throughout the rural component of the study.

Spending the first four to six weeks in the field engaged in activities to orient myself to the local area proved useful in terms of indentifying members of the community whom I eventually selected as research assistants. Four extension workers associated with the Entente agreed to assist me. Significantly, these individuals - three males and one female - were among the very few people in the Lour area who speak French. This was an important criterion in terms of helping me to cross-check and verify information I gathered while working in the Wolof language. In addition, there were other Practical considerations that contributed to my decision to select these particular individuals.

Upon reflecting on the nature of the rural fieldwork I set out to do, I deemed it more important to work with persons who had an established measure of acceptability and familiarity among the local population, and who could adequately understand the objectives of my study, than to consider recruiting less-well-known "outsider" research assistants, even if the latter might have had better formal qualifications or more professional experience. To a certain degree, I believe my association with members of the Entente helped to establish a level of trust and acceptance of my presence within the local community that could not have been possible had I decided to employ outside research assistants. Although working closely with

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a group that may be considered to be more "progressive" than the general population might introduce a predilection toward certain points of view, I believe that my interaction with other segments of the community was sufficient to temper any unintentional bias in the information and data I collected while working closely with members of the Entente.

Issues and Concerns Encountered in Research and Data Collection

Undertaking social science research in Africa, particularly in rural areas, is at once a rewarding and frustrating experience. The conscientious Westerner conducting such research will at times have to grapple with multiple epistemological, political, economic, and ethical considerations surrounding his or her very presence in the field. In addition to these issues one must also deal with concerns regarding data availability and reliability, the nature of one's relationships with local informants, public officials, and research assistants, and a host of logistical challenges that in many instances require prodigious quantities of patience, persistence, and perseverance.

Given the nature of my research topic and the considerable shortcomings in the quality of data collection, reporting, and retrieval in Senegal, I am resigned to making the inevitable caveats regarding the validity of statistics on phenomena such as energy consumption and biometric parameters of forest resources.

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It is critical to keep in mind that these statistics are generally sparse, not standardized, and often reported without reference to the methods used to collect them. Numerous other researchers and informed persons consulted in Senegal cautioned me about the dearth and lack of dependability of data in the energy and forestry sectors.

Such advice is underscored in a study commissioned for Senegal's new National Forestry Action Plan which stated that few reliable data are available on firewood and charcoal production, and that attempts to arrive at a precise estimate of such quantities are somewhat illusory.¹⁶ Regarding the validity of statistics on the country's forest resources, one quickly comes to understand that statements such as "government figures on reforested acreage exceed the total surface area of the country" are oftentimes reported only half in jest.¹⁷ It should also be noted that in much of what follows, data on woodfuel production correspond to quantities officially recorded by the forest service; they do not begin to capture the significant amounts produced illegally.

Other types of data collection problems surfaced during interviews and in the administration of the household energy survey. Depending on a particular respondent's occupation or position, e.g., government official, rural council member, or peanut farmer, information gathered from these different sources was at

⁶ République du Sénégal 1990a.

⁷ Sylva 1992: 173.

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times undoubtedly subject to strategic or calculated considerations. This was almost inevitable due to the somewhat sensitive nature of certain aspects of the research such as local land tenure conflicts or the forest service's purported collusion with charcoal producers. Much information received from government sources, particularly the forest service, seemed only to mimic current policy rhetoric in reference to developing "partnerships with the peasants" and promoting "participatory approaches" to natural resource management. In the household energy survey, the quality of some responses to the questionnaire may have been colored by what seemed to be a desire on the part of respondents to give the "right" answers.

Another element that may have affected the quality of the information I gathered was the association many villagers often assumed existed between me as a researcher and the financial and material resources available from foreign aid organizations. Therefore, cross-checking and comparison of information collected at various stages in the research process was essential in order to try to tease out some of the conflicts and contradictions of what was said from what was observed. Participant observation and repeated focused interviews were helpful in attempting to deal with some of these issues.

Finally, a few comments are necessary regarding some logistical issues confronted during rural fieldwork. As mentioned above, one of the reasons for choosing the Lour

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Rural Community had to do with the presence of several French-speaking extension agents associated with the Kounghoul Entente. This arrangement had its advantages and disadvantages. I have already noted the importance I attach to engaging local research assistants as opposed to hiring others from outside the study area. Not only were these individuals able to provide ready access to key people and places, but the fact that I could communicate with them in French offered me the opportunity to verify and cross-check information I gathered while working solely in Wolof. On the other hand, these individuals maintained certain responsibilities to the Entente that required them to be rather mobile and, therefore, oftentimes unavailable. Consequently, there were many occasions during which I had to postpone my research activities or work with other members of the community.

In working around the occasional absence of my primary assistants, I often carried out interviews with the help of the individual mentioned above whom my hosts in Touba assigned to me as a guide and companion. Although this person was of great assistance, I believe that his relatively young age of thirty years bestows upon him much less respect in the eyes of the community compared to the older extension agents I worked with. In addition, there were many occasions when my guide's eagerness to offer or interpret information during interviews interfered with the answers respondents tried to give to my questions. However, given the amount of time I spent with him, this

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individual probably became the person most accustomed to my use of the Wolof language and therefore the one best able to fine-tune my expression when necessary for the sake of clarity. In many ways his services as an assistant, and his sense of responsibility as my appointed guide, far outweighed any occasional annoyance he may have caused in terms of research protocol.

In the end, I am confident in my decision to work closely with people from the local community rather than to engage more practised assistants from the ranks of Senegal's research community. In so doing, I believe I minimized the risks involved in working with individuals from the latter community who very likely would have been considered outsiders much in the same way that I was.

Conclusion

Overall, foreign researchers will find working conditions in Senegal to be rather accommodating. Although some problems are encountered in terms of data availability and reliability, one cannot help but benefit from a comparatively well-established research infrastructure and general acceptance of the considerable expatriate community of researchers and development workers. And with practice, patience, and perseverance, one gradually learns how to negotiate the challenges of gathering useful information in the cultural context of Senegal's rural areas.

The research methods I chose to employ in my study satisfied adequately the diverse and disparate requirements

of the political ecology conceptual framework. Through a deliberate process of information gathering along a broad spatial hierarchy, anchored on one end by the offices of international aid agencies and government ministries in Dakar and on the other end by farmers fields and rural tree nurseries, I was able to collect a sufficient amount of data to build a multi-scale, multidimensional matrix of variables useful for responding to the questions posed by this study.

In the following chapter I present a general background on Senegal's forest resources, the energy sector, and the important role woodfuels play in linking these two areas together in an energy-environment nexus.

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CHAPTER THREE

OF FORESTS AND FIRES: ENERGY USE AND WOODLAND RESOURCES IN SENEGAL

In this chapter I describe the connections between energy use and the natural environment in Senegal. I begin by presenting a simplified portrait of the natural environment based on two commonly employed regionalizations of the country's major agro-ecological zones. I also describe briefly the physical composition and administrative delimitation of Senegal's forests and woodlands. In the second section of the chapter, I offer a detailed discussion of the current situation in Senegal with respect to national energy production, consumption, and conservation, with an emphasis on the dominant role played by woodfuels. I also describe briefly the structure of the woodfuel production and marketing system. In the third section of the chapter I address issues related to the environmental impact of Senegal's dependence on woodfuels.

Senegal's Natural Environments and Forest and Woodland Resources

For a country with a total area of only 196,722 square kilometers - about the size of South Dakota - Senegal has a number of diverse natural environments. These range from sparsely vegetated areas in the Senegal River valley on the border with the Republic of Mauritania in the north, to dense gallery forests of the Casamance region along the frontier with the Republics of Guinea and Guinea-Bissau 400

kilometers to the south. Average annual precipitation over this range varies from approximately 300 mm to more than 1,500 mm north to south.

Classifying Senegal's Natural Environments

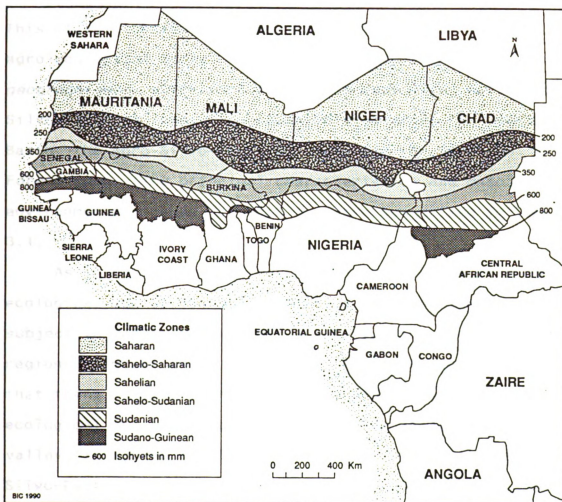
One common classification of natural environments in West Africa is based on climatic, edaphic, and vegetational characteristics used to determine areas of relative homogeneity. This results in a latitudinal arrangement of ecological zones that are distinguished by incremental changes in precipitation and dominant flora. Consequently, reference is made to a series of east-west trending belts in Senegal and other West African countries between the Sahara desert and the coastal tropical forests. This series includes, from north to south, the Sahelian zone dominated by tropical steppe vegetation of herbaceous annuals and thorny shrubs, the Sahelo-Sudanian zone of grassy savanna and scattered woody vegetation, the Sudanian zone characterized by wooded savanna or "parkland" vegetation, and the Sudano-Guinean zone noted for its denser forest formations (Figure 3.1).¹

¹ Atlas du Sénégal 1983: 19; Granger 1983: 2-11; Bank 1985.

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Source: After World Bank 1985.

Figure 3.1 - Ecological Zones of the West African Sahel

A modified system of classification is used in Senegal by government ministries and development agencies involved in natural resource management.² This system is based on a synthesis of the aforementioned latitudinal belts and the dominant agricultural and land use characteristics representative of Senegal's different geographical regions. This classification produces a map (Figure 3.2) with six agro-ecological zones, referred to as *zones éco-géographiques*, which include: the Senegal River valley, the Silvo-Pastoral zone, the Coastal Niayes zone, the Peanut Basin, the Agro-Silvo-Pastoral zone, and the Southern Forest zone. The principal characteristics and major environmental issues for each zone are summarized in Table 3.1.

As in any system of regional classification, the agro-ecological map of Senegal reflects a certain degree of subjective generalization and simplification in determining regions of meaningful uniformity. While it can be argued that there is greater homogeneity based on dominant ecological and land use criteria for the Senegal River valley (irrigated and flood recession agriculture), the Silvo-Pastoral zone (semi-nomadic transhumance), and the coastal Niayes zone (market gardening in depressions between dune formations), the remaining three zones are characterized by more varied ecological and land use patterns. Although considerable natural and human

² The system is described in République du Sénégal (1981a: 72-74) and USAID (1991: 35-37), and is updated in République du Sénégal (1993b: vol. 2, 9-13, 146).

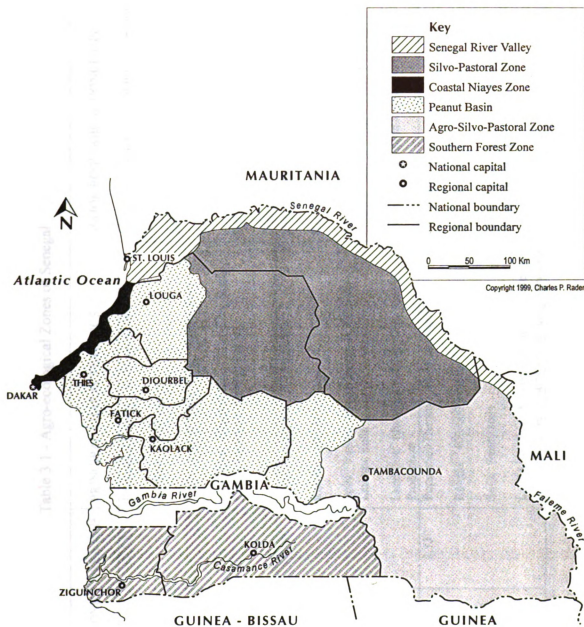
diversity exists within all six zones, there appears to be a general consensus in Senegal favoring the use of this scheme for natural resource management planning purposes. This is reflected in the fact that some of the zones, e.g., the southern Forest zone and the majority of the Peanut Basin, are delimited as much along administrative divisions as they are on ecological criteria, ostensibly facilitating data collection, longitudinal statistical analysis, and administrative aspects of resource management.³

³ DEG/Louis Berger International 1990: 10-12.

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Source: After Republique du Senegal 1993b, vol. II: 146.

Figure 3.2 - Agro-Ecological Zones of Senegal

Table 3.1 - Agro-ecological Zones of Senegal

AGRO-ECOLOGICAL ZONE	AREA KM ²	PRINCIPAL CHARACTERISTICS	MAJOR ECOLOGICAL CONCERNS
Senegal River Valley	11,500	Population Density: 10-50 pers/km ² Rainfall: < 400 mm/yr Soils: Alluvial Gleys, Sandy Upland Soils Land Use: Irrigated Rice Cultivation, Staple Crops, Livestock Raising, Fishing	Disappearance of traditional flood recession cultivation due to dam construction Recurrent drought Soil salinization Deforestation in irrigated perimeters
Silvo-Pastoral Zone	54,380	Population Density: < 10 pers/km ² Rainfall: 400-600 mm/yr Soils: Reddish-Brown Aridisols, Gravelly Lateritic Soils Land Use: Livestock Raising, Gum Arabic Production	Overgrazing Overgrazing Recurrent Drought Severe vegetation loss due to seasonal concentration of livestock near bore holes Excessive vegetation loss due to bush fires
Coastal Niayes Zone	2,130	Population Density: 10-50 pers/km ² Rainfall: 400-600 mm/yr Soils: Sandy soils Land Use: Fruit & vegetable market gardening in interdunal depressions, Phosphate production	Dune stabilization Deforestation Maintenance of groundwater aquifer for market gardening

Table 3.1 - (Con't)

Peanut Basin	49,500	Population Density: 50-100+ pers/km² (140 pers/km² maximum) Rainfall: 500-900 mm/yr Soils: Shallow, ferruginous brown & reddish-brown Land Use: Intensive peanut cultivation, staple crops, livestock raising	Human population pressure Soil degradation and salinization Disappearance of fallow cycles Deforestation
Agro-Silvo-Pastoral Zone	51,210	Population Density: < 10 pers/km² Rainfall: 700-1,200 mm/yr Soils: Shallow, lateritic Land Use: Cotton production, forest products, livestock raising, staple crops	Agricultural expansion Deforestation Encroachment upon/competition for land in and around Niokolo Koba National Park Overgrazing
Southern Forest Zone	28,000	Population Density: 10-50 pers/km² Rainfall: 1,000-1,500 mm/yr Soils: Diverse ferruginous, lateritic, and hydromorphic soils Land Use: Rain-fed rice cultivation, cotton production, forest products, fishing, livestock raising, peanut cultivation, staple crops	Extensive bush fires Deforestation Soil salinization Extensive bush fires

Source: Compiled by author after République du Sénégal 1981a & 1993b; USAID 1991; Atlas du Sénégal 1983.

Forest and Woodland Resources

The distribution and composition of Senegal's forests and woodlands are primarily a function of climatic conditions. Following the general latitudinal pattern mentioned above, woody vegetation becomes more abundant and diverse as rainfall increases from north to south. Throughout the twentieth century, however, and particularly during the last few decades, Senegal's forest resources have come under considerable pressure from the combined factors of agricultural expansion, recurrent drought, and increased demand for woodfuels. Data on deforestation in Senegal for the period 1981-1990 indicate an average annual loss in forest cover of between 52,000-80,000 hectares, or approximately 0.5% of all forested land per year.⁴

Based on the best available data, the recent evolution of forested land cover in Senegal is illustrated in Table 3.2. In 1990, forests and woodlands were estimated to cover 119,640 square kilometers, or approximately 61% of the country's total land area.⁵ These statistics, however, must be interpreted with caution since they are based essentially on uncertain assumptions used to measure deforestation rates, and in part on inexact criteria used to define terms such as "forest" and "woodland."⁶

⁴ World Resources Institute 1994: 306; République du Sénégal 1993b (vol. 2): 33.

⁵ République du Sénégal 1993b (vol. 2): 43.

⁶ Estimates of total forested area are sometimes based on administrative criteria, such as land officially gazetted as classified forests which in a few cases are no more than "forests on paper," rather than up-to-date botanical data. Variable definitions of "forest" for Senegal are discussed in World Bank (1994a: 16).

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Furthermore, due to methodological reasons that are not altogether clear, the figures reported in Table 3.2 do not take into consideration the status of forested land within the six national parks that together account for about 5% of the country's land area. There appears to be an implicit assumption in the documentation available in Senegal that forest cover in the national parks remains intact and unaffected by degradation since these areas are officially off-limits to any type of exploitation. In reality, however, knowledge about land cover change and the affects of human encroachment into the parks is limited. This is particularly the case in the remote Niokolo Koba National Park in southeastern Senegal, which alone accounts for 90 percent of the total area of all six national parks.

Table 3.2 - Recent Change in Forest Cover in Senegal

Year	Km ²	Hectares	% Total Area ^a
1980	127,225	12,722,500	65
1985	123,800	12,380,000	63
1990	119,640	11,964,000	61
2000 ^b	116,810	11,681,000	59

Source: After République du Sénégal 1993b: 43.

^a Not including approximately 1,009,450 ha. in national parks.

^b Estimate from République du Sénégal 1981a: 45.

Forests and woodlands in Senegal are classified on the basis of both phytogeographical and administrative considerations. A detailed study undertaken during the late 1970s for the 1981 Forestry Master Plan identified as many as ten different categories of woody vegetation.⁷ In an earlier, authoritative study of the country's woody vegetation, P.L. Giffard, a former conservator of forests in Senegal, employs a simplified tripartite classification scheme based on climatic divisions similar to those mentioned above, i.e., the sahelian, sudanian, and guinean domains.⁸ Acknowledging that considerable diversity exists within each division, the location and major characteristics for the three domains are summarized in Figure 3.3 and Table 3.3.

⁷ République du Sénégal 1981a: 20-23.

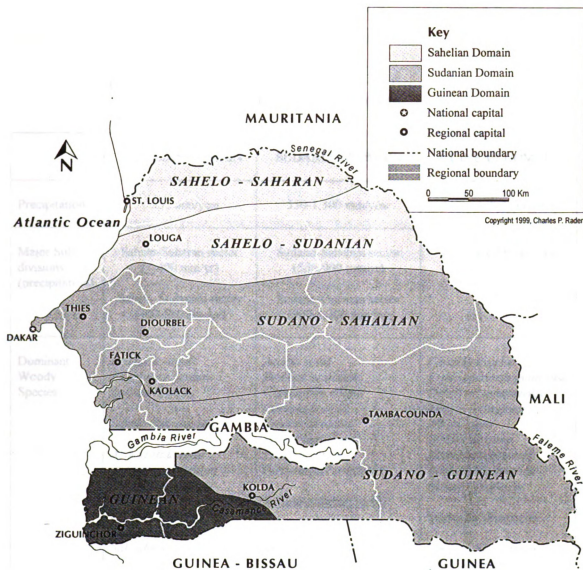
⁸ Giffard 1974.



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Source: After Giffard 1974

Figure 3.3 - Senegal's Forest Zones

Table 3.

	SAHEL
Precipitation	< 55
Major Sub-divisions (precipitation)	Sahelo-S (< 400) Sahelo-S (400-500)
Dominant Woody Species	<i>Acacia senegal</i> <i>Bauhinia r</i> <i>Lannea h</i> Sahelo-Sah <i>Acacia zaid</i> <i>Balanites a</i> <i>Calotropis</i> <i>Capparis d</i> <i>Cassia obo</i> <i>Combretum</i> <i>Salvadora</i> Sahelo-Sud <i>Acacia seye</i> <i>Boscia sen</i> <i>Calaba fa</i> <i>Commiph</i> <i>Euphorbia</i> <i>Grewia bic</i> <i>Guiera sen</i>

Source: After Gi

**Table 3.3 - Phytogeographical Classification
of Senegal's Forests**

	SAHELIAN DOMAIN	SUDANIAN DOMAIN	GUINEAN DOMAIN
Precipitation	< 550 mm/year	550-1,300 mm/year	1,300-1,700 mm/year
Major Sub-divisions (precipitation)	Sahelo-Saharan sector (< 400 mm/yr) Sahelo-Sudanian sector (400-550 mm/yr)	Sudano-Saharan sector (550-900 mm/yr) Sudano-Guinean sector (900-1,300 mm/yr)	Estuarine Mangroves
Dominant Woody Species	<i>Acacia senegal</i> <i>Bauhinia refescens</i> <i>Lannea humilis</i> <u>Sahelo-Saharan sector</u> <i>Acacia zaddiana</i> <i>Balanites aegyptica</i> <i>Calotropis procera</i> <i>Capparis decidua</i> <i>Cassia obovata</i> <i>Combretum aculeatum</i> <i>Salvadora persica</i> <u>Sahelo-Sudanian sector</u> <i>Acacia seyal</i> <i>Boscia senegalensis</i> <i>Cadaba farinosa</i> <i>Commiphora africana</i> <i>Euphorbia balsamifera</i> <i>Grewia bicolor</i> <i>Guiera senegalensis</i>	<i>Acacia seyal</i> <i>Bombax costatum</i> <i>Combretum elliotii</i> <i>Cordyla pinatta</i> <i>Entada africana</i> <i>Parkia biglobosa</i> <i>Prosopis africana</i> <i>Pterocarpus erinaceus</i> <u>Sudano-Saharan sector</u> <i>Acacia senegal</i> <i>Balanites aegyptica</i> <i>Boscia senegalensis</i> <i>Commiphora africana</i> <i>Grewia bicolor</i> <u>Sudano-Guinean sector</u> <i>Cassia sieberiana</i> <i>Daniella oliveri</i> <i>Lophira alata</i> <i>Oxythecanthus abyssinica</i> <i>Terminalia macroptera</i>	<i>Parinari excelsa</i> <i>Erythrophaeum guineense</i> <i>Detarium senegalense</i> <i>Albizia ferruginea</i> <i>Albiza zygia</i> <i>Azalia africana</i> <i>Khaya senegalensis</i> <i>Borassus aethiopum</i> <i>Elaeagnus guineensis</i> <u>Estuarine Mangroves</u> <i>Rhizophora racemosa</i> <i>Avicennia nitida</i>

Source: After Giffard 1974.

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Administratively, Senegal's forests and woodlands are divided into two principal categories: the classified and non-classified domains.⁹ Responsibility for the management of all floral and faunal resources within these domains is assumed by the state through the authority vested in the national forest service. In fact, authority over the management and exploitation of any tree-related resource extends beyond these two domains to encompass such resources as are found throughout the country on agricultural lands, "pioneer" lands, and in urban areas as defined in the national land tenure law.¹⁰ As will be discussed in the following chapters, the sweeping control over the use of tree products and woodlands exercised by the forest service is a major source of conflict between the government and the rural population.

The classified domain covers an estimated 30% of the national territory. It is comprised of 213 different parcels that together make up the *zones classées* (classified zones) category as defined in Article 6 of the national land tenure law.¹¹ Land in this category includes classified forests, special reforestation perimeters, national parks, wildlife refuges, biosphere reserves,

⁹ For a detailed description of the forest "domains" see the first post-independence forestry code (République du Sénégal 1965), especially Articles D1-10.

¹⁰ See République du Sénégal 1964.

¹¹ For a description of the classified domain, see République du Sénégal (1993b (vol. 2): 35). Article 6 of the land tenure law reads: "Classified zones are constituted by forested zones or protected zones having been classified according to the conditions set forth in the applicable regulations. These zones are administered in conformity with such regulations."

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hunting areas, and silvo-pastoral reserves. By law, virtually all commercial exploitation is prohibited in the classified domain. Exceptions are made for special hunting licenses accorded for sporting purposes, as well as for commercial woodfuel and timber production in those classified forests for which a specific management plan has been developed. According to the national forest service, 23 of the country's 164 classified forests have had a management plan at one time or another; presently, however, only a handful are actively managed according to such plans.¹²

All forests and woodlands in Senegal located outside the classified domain constitute the non-classified, or so-called "protected" domain. By definition, the non-classified domain excludes lands that have been zoned for agricultural and pastoral uses according to the national land tenure law, i.e., the *zones des terroirs*.¹³ However, given constant changes in acreage under cultivation, rates of agricultural expansion, and the dynamic nature of pastoral land use - as well as an uneven application of the national land tenure law which affects the amount of land officially accounted for in the *zones des terroirs* - it is difficult to ascertain the precise delineation and amount of land considered to be in the "protected" domain at any given time. In contrast to the classified domain, the non-classified domain is open to commercial use as authorized

¹² Sow 1992: 1.

¹³ République du Sénégal 1993b (vol. 2): 36.

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and regulated by the national forestry code.¹⁴ In the light of competition for agricultural, pastoral, and woodfuel resources, it is not surprising that conditions are ripe for conflict over the allocation and use of these resources in the non-classified domain. This situation tends to be exacerbated in many cases by what is seen as the repressive nature of forestry regulations imposed on the rural population who, in general, have little voice in how woodland resources of the "protected" domain are managed.¹⁵

Energy Production, Consumption and Conservation in Senegal

Senegal faces two major challenges related to energy use. The first is dependence on imported petroleum products used primarily in the modern sector of the economy, and the second is an overwhelming reliance on the country's forests and woodlands to supply energy used chiefly in the vast household sector.¹⁶ The latter challenge is particularly daunting given that the household sector accounts for the majority of total national energy consumption.¹⁷ This section of the chapter offers a detailed discussion of the production, consumption, and conservation of both modern and woodfuel sources of energy

¹⁴ See République du Sénégal 1965, 1974, & 1993e.

¹⁵ République du Sénégal 1993b (vol. 2): 36.

¹⁶ UNDP/World Bank 1983 & 1989; République du Sénégal 1991a.

¹⁷ The percentage of total energy consumption attributed to the household sector varies depending on whether the figures are expressed in primary (65%) or final (55%) energy terms. See UNDP/World Bank (1989: 6-7) and Lazarus et al. (1994: 32).

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used in Senegal. It also touches briefly on problems associated with the management of the country's woodfuel energy sector.

Conventional Fuels in the Energy Sector

Consistent with its meager natural resource endowment, Senegal has virtually no commercially exploitable conventional energy resources.¹⁸ A natural gas deposit at the Diam Niadio facility near Sébikotane, 30 km east of Dakar, supplies a small percentage of the country's annual consumption of this particular fuel.¹⁹ Indications of coal deposits have been registered during hydrological explorations, but none has ever been confirmed. Several experiments have been undertaken - with disappointing results - to exploit the peat resources found along the Niayes coastal zone between Dakar and St. Louis.²⁰ A small off-shore petroleum field designated as *Dôme Flore* - the subject of a protracted territorial confrontation with neighboring Guinea Bissau - lies off the southwest coast of Senegal. While it is estimated that probable reserves exceed 100 million tons, the economic viability of this site remains questionable.²¹ In short, Senegal relies heavily on imported crude oil purchased from Nigeria, Gabon, and several Persian Gulf states, which is refined

¹⁸ Considered here as "conventional energy resources" are the major fossil fuels: oil, coal, and natural gas.

¹⁹ République du Sénégal 1991a: 12.

²⁰ Sarr et al. 1990.

²¹ République du Sénégal 1991a: 12.

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Senegal's dependence on imported sources of petroleum can have a significant impact on the national economy. Although the available statistics vary widely from one source to another, the bill for imported oil during the 1980s accounted for between 10 and 60 percent of total non-energy export receipts.²³ The interannual variation in these figures is explained by fluctuations in international oil prices, currency exchange rates, world prices for Senegalese exports, and climatic conditions affecting national agricultural output.

The use of alternative, non-fossil fuels in Senegal is limited by financial and technical difficulties. The much anticipated use of hydroelectricity, based on the recent completion of the Manantali Dam in the upper Senegal River valley in neighboring Mali, remains confined to the planning stages. The tripartite Senegal River Basin Authority - comprised of Senegal, Mali, and Mauritania - continues to struggle in its effort to secure international financing to construct the generating station and to erect the transmission lines needed to reach the primary energy markets located over 700 kilometers away in western Senegal. The exploitation of Senegal's considerable solar and wind energy potential is limited to a number of small-

²² Berlureau & Berlureau 1981: 264-66.

²³ UNDP/World Bank 1989: 5; Tibesar 1991: 436; Lazarus et al. 1994: 31. Energy-related receipts are derived from the sale of refined petroleum products Senegal exports to several neighboring countries.

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scale experiments in rural areas. These produce negligible amounts of electricity and mechanical energy for lighting, food preservation, and water-pumping purposes. Residues from peanut and sugarcane processing are used by the country's major agricultural industries to generate small in-house supplies of electricity.

The use of butane, or LPG (Liquified Petroleum Gas), i.e., "bottled gas," deserves special mention. In Senegal, the supply of butane is procured through a combination of local petroleum refining and supplemental imports. As in many other developing countries, its use in Senegal is considered as a step up the "energy ladder" toward greater consumption of modern fuels typically associated with urbanization and economic development.²⁴

Recognizing the serious environmental impacts of increased urban charcoal consumption, the government of Senegal embarked upon a "butanization" campaign in the mid-1970s to promote the substitution of LPG for charcoal.²⁵ Geared primarily toward the Dakar region, the campaign includes price subsidies on gas burning stoves and LPG fuel that are justified on the basis of providing an environmental benefit, i.e., reduced deforestation, while supporting a basic need for low income urban households.²⁶ According to figures available from the energy directorate of the Ministry of Industry and Commerce, national LPG

²⁴ Leach 1992; Leach and Mearns 1988: 237-264; Cecelski et al. 1979: 23.

²⁵ UNDP/World Bank 1983: 11, 28; Laura 1990; République du Sénégal 1993a: 6-7.

²⁶ Lazarus et al. 1994: 37.

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consumption tripled from 1980 to 1990 (10,000 to 30,000 metric tons); by the early 1990s, 75% of all urban households (85% in Dakar) possessed at least one gas stove.²⁷ Elsewhere, it has been noted that households account for 90% of total LPG consumption in Senegal.²⁸

Despite the accomplishments of the butanization campaign as reflected in these statistics, the overall success of the program in terms of achieving its primary objective, i.e., reducing urban charcoal consumption through the substitution of LPG, must be considered carefully. Unfortunately, reliable time-series data that would allow a comparison of changes in per capita household LPG and charcoal consumption are not available. In addition, reports detailing the impact of LPG use on woodfuel consumption are based on unreliable data. Figures for the amount of charcoal saved on an annual basis attributable to LPG substitution range from 16,000 to 90,000 tons, or between 4-25% of total charcoal consumption in 1992.²⁹ Such a wide margin not only calls into question the validity of the data, it also leads to confusion regarding the severity of Senegal's woodfuel energy problem.

Another issue concerning LPG substitution that requires further investigation is the claim that bottled gas is overtaking charcoal as a primary household fuel.

²⁷ République du Sénégal 1993a: 7.

²⁸ Lazarus et al. 1994: 32.

²⁹ UNDP/World Bank 1989: 14; République du Sénégal 1993a: 7.

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The most recent data suggest that 41% of urban households (58% in Dakar), 3% of rural households, and 20% of all households nationwide use LPG as a primary fuel for cooking.³⁰ Based on my observations and experience in the field, however, these figures seem somewhat exaggerated. They are perhaps subject to varying interpretations between researchers and respondents as to what constitutes a "primary" fuel or a "rural" household. I would argue, as have Tibesar and White,³¹ that LPG is used principally in urban areas as a secondary or "convenience" fuel for making hot drinks, preparing quick breakfasts, and reheating leftovers, and not as a primary fuel for preparing the major meals households consume on a daily basis using woodfuels. Furthermore, LPG does not substitute well for other household energy uses such as ironing, for which most people continue to rely on charcoal.

Despite questions concerning the degree to which LPG is used as a primary fuel, other issues must be addressed if butane is to secure a more prominent position in the household energy sector. These include achieving a more reliable and regular supply to consumers, increasing incomes or continuing subsidies to help make LPG affordable for poor urban households, and strengthening the educational campaign necessary to promote wider use of LPG.

With respect to the LPG promotional campaign, research by Tibesar and White demonstrates how culturally-based

³⁰ République du Sénégal 1993a: 7.

³¹ Tibesar and White 1985: 12.

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habits of food preparation, unfamiliarity with the mechanics of gas energy use, and household financial expenditure patterns can influence consumers' decisions to switch to LPG.³² Their survey research underscores the widely shared taste preference most Senegalese have for foods prepared with woodfuels, and the apprehension some people have concerning the dangers involved in using LPG.³³ It also shows that despite evidence suggesting subsidized LPG is less expensive than charcoal per unit of useful energy delivered, households - particularly poorer ones which constitute the majority of urban residents - continue to use charcoal as a primary fuel. This is explained by the perceived lower cost of charcoal based on small daily expenditures for the fuel and the relatively affordable price of charcoal stoves, compared to the "lumpy" periodic payments required to purchase butane and the high initial investment in gas cooking equipment. Given the complexity of issues involved in this "fuelswitching" process, claims made about the successful penetration of LPG into the household energy sector, and the degree to which it substitutes for charcoal, are best viewed with guarded optimism.

Woodfuels in the Energy Sector

The numerous problems associated with the use of modern fuels notwithstanding, Senegal's most pressing

³² Tibesar and White 1990: 39-44.

³³ Stories appear often in the Senegalese press about asphyxiation and explosions resulting from household accidents involving LPG.

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energy-related concern remains the predominant consumption of woodfuels in both rural and urban areas. The impact of this woodfuel dependence on Senegal's natural environment, and the respective interests of urban and rural populations regarding access to woodland resources, are at the center of some of the country's most intractable ecological, social, economic, and political problems.

In contrast with other African countries, the proportion of total national energy consumption in Senegal attributed to woodfuels is relatively low. The latest estimates indicate a downward trend in which the percentage share of woodfuels has declined from approximately 65% to 55% during the 1980s (Table 3.4). Consequently, Senegal is less dependent on woodfuels than countries such as Niger, Tanzania, and Mali, where comparable percentages range from 88% to 97% of total energy consumption, but more dependent than countries such as Côte d'Ivoire, Congo and Zambia, where similar figures range from 31% to 46%.³⁴ Obviously, these statistics reflect in part the natural resource endowments and relative economic conditions in the respective countries.

³⁴ Tibesar 1991: 433; Armitage and Schramm 1989: 140-41.

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**Table 3.4 - Woodfuels and Petroleum-based Energy
in Senegal in the 1980s**

	Percent of total national energy consumption		
	1981	1986	1988
Woodfuels	65	60	55
Petroleum Products ^a	35	40	45

Source: UNDP/World Bank 1989: 6-7; République du Sénégal 1991a: 6-8.

^a Includes oil, gasoline, diesel, kerosene, and LPG (including use of such fuels to generate electricity).

Although the trends observed during the 1980s can be seen as a positive change in the fuelswitching process, it is important to recall that consumption of woodfuels in absolute terms continues to grow at a significant pace. Data for the period 1987-1992 indicate that total woodfuel consumption (firewood and charcoal) increased by 37% from approximately 3.2 to 4.4 million cubic meters of wood equivalent.³⁵ In addition, one should note that an increased percentage share of petroleum products in the national energy picture does not necessarily translate into major fuelswitching changes in the household or artisanal sectors. For example, a considerable amount (10%) of petroleum consumption is accounted for by the aviation sector alone, reflecting Senegal's location as an important hub for air transportation in West Africa.³⁶

Dependence on woodfuels in Senegal is most pronounced when one considers their use in the household sector.

³⁵ République du Sénégal 1993a: 5
³⁶ Lazarus et al. 1994: 31-32.

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Overall, in 1990, woodfuels accounted for an estimated 85% of all energy consumed by Senegalese households nationwide.³⁷ When examined on the basis of location, woodfuels account for approximately 89% and 96% of total household energy consumption in urban and rural areas respectively.³⁸ An important distinction with respect to this rural-urban dichotomy is revealed when considering the form in which woodfuels are consumed. Whereas in urban areas the proportion of woodfuel energy consumed as charcoal is 91% and that of firewood is 9%, the corresponding figures for rural consumption are 8% and 92% respectively.³⁹

These differences in rural and urban woodfuel consumption patterns have important environmental ramifications due to the nature of the charcoal-making process. Although charcoal is a more efficient fuel than firewood in terms of energy content per unit weight and is cheaper to transport over longer distances than bulky firewood, approximately half of the original heat energy contained in raw wood is lost in the charcoal conversion process.⁴⁰ The net effect of this loss is reflected in the quantity of resources required to obtain equal amounts of useful energy: i.e., urban residents who use charcoal consume anywhere from two to three times as much raw wood

³⁷ République du Sénégal 1993b (vol. 2): 15.

³⁸ République du Sénégal 1993b (vol. 2): 44.

³⁹ According to G. Madon as cited in Ribot (1993: 561).

⁴⁰ Earl 1975: 26-28; Poulsen 1978: 15. The actual amount of heat energy lost in making charcoal depends on several factors, including the species of wood used, its moisture content, and the specific carbonization technique employed.

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as rural villagers who use firewood. For example, household surveys in Senegal indicate that average annual per capita woodfuel consumption (measured in terms of oil-equivalent primary energy, i.e., the energy in raw wood prior to burning or carbonization) for urban dwellers is approximately 250 kg, while that of rural residents is only 120 kg.⁴¹ Consequently, it is evident that urban domestic energy consumption, at least on a per capita basis, places greater demands on the natural resource base than does rural energy consumption.

Quantitative changes in woodfuel consumption in Senegal for the period 1937-1992 can be gleaned from the official woodfuel production statistics illustrated in Figure 3.4.⁴² Generally speaking, these statistics show relatively flat levels of commercial firewood production and a steady increase in charcoal production over time. The appreciable increase in both firewood and charcoal production for the period 1940-47 is attributed to the suspension of coal and petroleum imports in Senegal during World War II. During this period, most transportation and

⁴¹ République du Sénégal 1987a (vol. 1): 3. Data reported in the Senegal Forestry Action Plan (République du Sénégal 1993b (vol. 2): 44) differ slightly - 218 kg for urban and 122 kg for rural residents - from the earlier figures.

⁴² It is important to note that a considerable discrepancy exists between the data on official production and actual consumption of woodfuels in Senegal. For example, by extrapolating data on per capita consumption to total urban charcoal demand, one finds that official production figures account for less than half of total charcoal consumption. It is widely accepted that a large share of charcoal consumed in urban areas is produced clandestinely, and thereby is not reflected in official production statistics. See République du Sénégal (1993a: 2)

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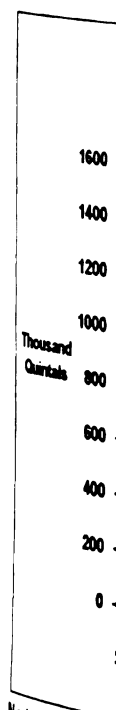
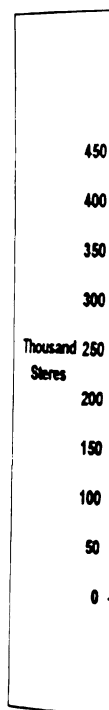
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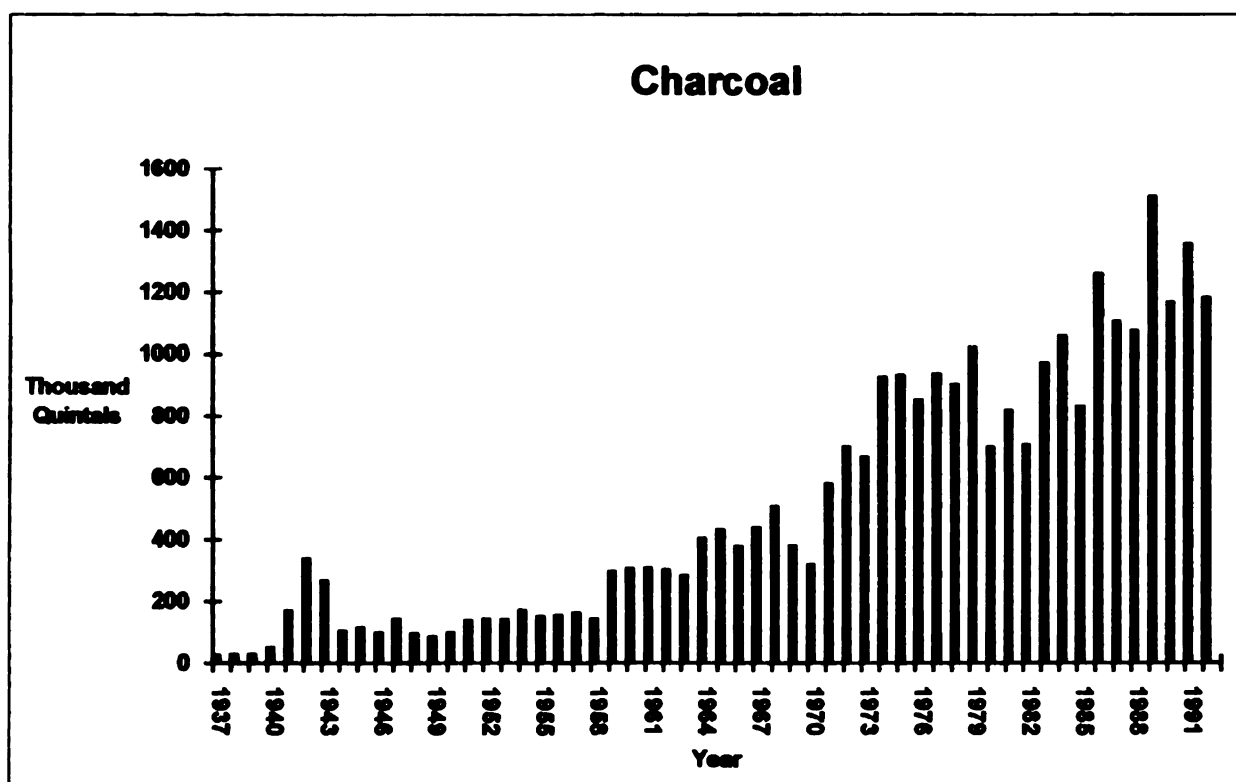
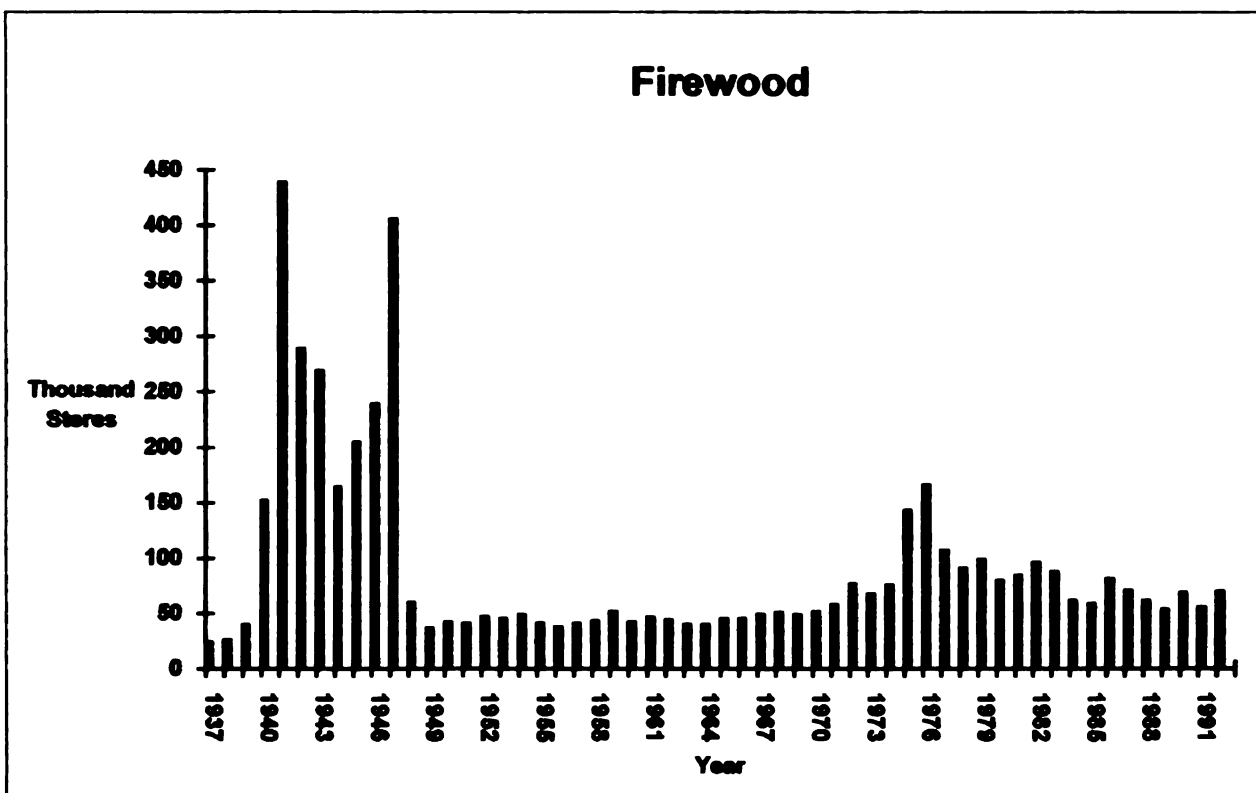
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industrial energy needs were met exclusively by woodfuels.⁴³ The data in Figure 3.4 illustrate well the decline in importance of commercial firewood production and the concomitant switch to charcoal as nearby forest and woodland resources were depleted in and around Senegal's major towns. The increase in charcoal production also reflects urban population growth and the slow pace of fuelswitching from traditional to modern fuels.

⁴³ Giffard 1974: 211.



Note: Stere
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Note: Stere = 1 cubic meter stacked wood; Quintal = 100 kg.
 Source: Compiled by author from Forest Service reports.

Figure 3.4 - Official Firewood and
Charcoal Production, 1937-1992

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The quantitative changes in woodfuel production over time have been accompanied by changes in the spatial pattern of production. Again, this is best illustrated using data on official charcoal production recorded by the Senegalese forest service (Table 3.5 and Figure 3.5). Both the table and the map reveal a dramatic shift in the location of charcoal production over a period of three decades. In 1961, 94% of the country's charcoal was produced in the central Peanut Basin and less than 1% in the eastern and southern forests. By 1990, the amounts produced in these two regions were essentially the reverse, with 94% of production taking place in the eastern and southern forests and only 4% in the Peanut Basin. At the level of individual administrative regions, the change in the production figures for Senegal's two most important woodfuel zones is equally dramatic. For example, in 1961, the Kaolack region (formerly called the Sine-Saloum) accounted for 69% of total charcoal production, while the Tambacounda region (formerly Senegal-Oriental) contributed a paltry 0.03%; in 1990, these figures were 3% and 81% respectively.

Table 3.5 - Regional Distribution of Official Charcoal Production, 1961-1990

	St. Louis	Thies	Diourbel	Louga	Kaolack	Fatick	Tambacounda	Ziguinchor	Kolda
Percent of Official National Charcoal Production									
1961	5	22	3	**	69	**	<1	1	**
1970	10	6	2	**	48	**	29	5	**
1980	30	4	0	7	13	**	13	33	**
1990	2	0	0	1	3	0	81	1	12

Source: Compiled by author from Senegalese Forest Service data.

** Due to changes in Senegal's administrative boundaries during the period 1961-1990, the data collection units for this table are not constant over time. The changes occurred as follows: until 1976, the present regions of Diourbel and Louga together formed the Region of Diourbel; until 1984, the present regions of Kaolack and Fatick together constituted the Region of Sine-Saloum; also until 1984, the present regions of Ziguinchor and Kolda together formed the Region of Casamance.

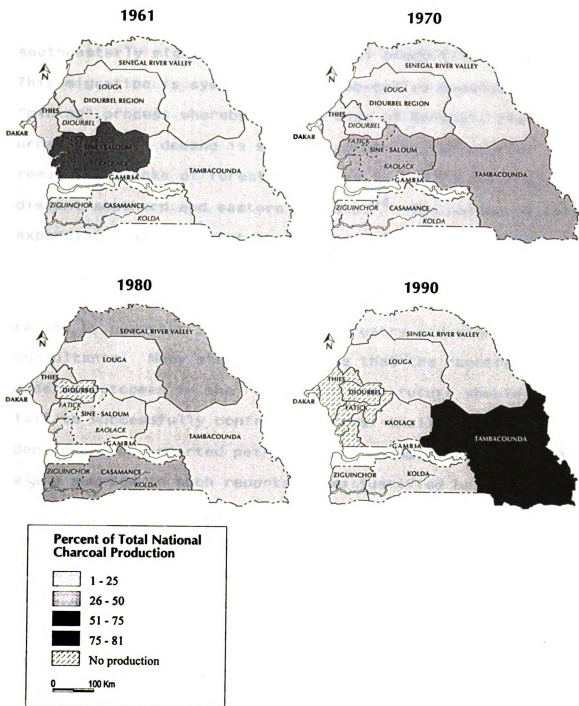


Figure 3.5 - Change in Location of Charcoal Production, 1961 - 1990

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The observed change in the spatial pattern of woodfuel production is indicative of what can be described as the southeasterly migration of a charcoal production "front". This migration is symbolic of the so-called woodfuel "mining" process whereby, in the case of Senegal, rising urban charcoal demand is met by exploiting the country's remaining stocks of forest resources in the increasingly distant southern and eastern forests.⁴⁴ The notion of this expanding charcoal front is discussed further in Chapter 6.

Over the last ten to fifteen years, concerns about the worsening situation in Senegal's energy sector have been raised by numerous international forestry and energy consultants. Many studies conclude that the country faces drastic outcomes in the relatively near future should it fail to successfully confront the dual challenges of dependence on imported petroleum and biomass energy.⁴⁵ The alarm sounded in such reports seems justified based on the country's sluggish economic performance and its relatively ineffectual attempts to curb the growth in woodfuel consumption and to better manage its forest resources.

The ominous conclusions drawn by outside consultants are depicted in the woodfuel supply and demand scenarios

⁴⁴ For an explanation of the concept of woodfuel mining, see Anderson and Fishwick (1984: 17-19) and Whitney et al. (1987: 332). On the question of access to forest resources in southeastern Senegal, future research should consider the impact improvements currently being made to the main Tambacounda-Kédougou road might have on the exploitation of these resources, or to the potential importation of charcoal from the neighboring Republic of Guinea.

⁴⁵ Chatain 1988; Di-Meo, Jambes and Guerrero 1985; République du Sénégal 1990a; UNDP/World Bank 1983 & 1989; World Bank 1994a.

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presented in the 1981 Forestry Master Plan and expanded upon in the 1983 report of the joint United Nations Development Program/World Bank Energy Sector Management Assistance Program (ESMAP).⁴⁶ Table 3.6 summarizes these scenarios for the period from 1981 to 2016.⁴⁷ According to these estimates, which assume unconstrained demand for woodfuels based on projected population growth and supplies based on the mean annual increment of biomass growth in commercially accessible woodlands, Senegal can expect to see total demand exceed available supply by the turn of the century.

⁴⁶ République du Sénégal 1981a & 1981b; UNDP/World Bank 1983.

⁴⁷ Note that Table 3.6 incorporates a discrepancy found in the UNDP/World Bank 1983 report which claims to have acquired its figures from the original 1981 Forestry Master Plan. The data reported in the Master Plan indicate slightly less somber deficits for 2001 and 2016.

Table

Year	Run	Area
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1981	33	
1991	35	
2001	36	
2016	35	

1981	330	
2001	420	
2016	470	

Source: Ré
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Table 3.6 - Woodfuel Supply and Demand Scenarios^a

Year	Rural Areas	Urban Areas	Total Demand	Estimated Supply	Demand/Supply(%)
(firewood & charcoal in thousands of m ³ roundwood equivalents)					
1981	3300	1255	4555	7161	64%
1991	3500	1930	5430	n.a.	----
2001	3680	2820	6500	6300	103%
2016	3545	4595	8140	5300	154%

1981	3300	1300	4600	7200	64%
2001	4200	3000	7200	6300	114%
2016	4700	5400	10100	5300	191%

Source: République du Sénégal 1981a and UNDP/World Bank 1983.

^a The first set of figures are from the Forestry Master Plan (République du Sénégal 1981a: 39, 78, 131), and the second set from the 1983 ESMAP Report (UNDP/World Bank 1983: 23), which cites the Master Plan as its source for these data.

Although the data reported in Table 3.6 are commonly accepted and frequently used in many studies and projects in the woodfuels sector, one would do well to consider more closely some of the assumptions upon which the scenarios are based. As mentioned in Chapter 1, Cline-Cole and colleagues argue that the often-assumed direct relationship between population growth and woodfuel demand may, in reality, be far more complicated.⁴⁸ These authors claim that the commonly accepted "orthodoxy" of a linear population growth-woodfuel consumption relationship fails to adequately take into account factors such as variation

⁴⁸ Cline-Cole et al. 1990: 514-521; see also Mearns 1995: 104-05.

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in household (i.e., consuming unit) size and composition, urbanization patterns, culturally determined cooking practices, availability of alternative energy sources, and market mechanisms that can ultimately influence total woodfuel consumption. On the supply side, one could argue that depending upon the criteria used to define "accessible" woodland, the quantity of available resources is subject to profound recalculation given possible changes in transportation infrastructure, woodfuel harvesting techniques, and land use zoning policy. Obviously, important climatic factors such as rainfall patterns will also affect production potential. In any case, the complexity of the inherently dynamic nature of woodfuel supply and demand is sufficient cause for using caution when interpreting scenarios such as those mentioned above.⁴⁹ It also bolsters the argument that a more inclusive, comprehensive framework is needed in the analysis of energy-environment problems.

In light of the portentous outlook for Senegal's energy sector, a variety of measures have been initiated in an attempt to control the undesirable environmental consequences of continued woodfuel "mining" such as increased deforestation, soil erosion, stream sedimentation, etc., and to improve household energy security. These initiatives reflect the fundamental economic, environmental, and social elements of the

⁴⁹ See Dewees (1989) for an insightful reexamination of the dynamics of woodfuel supply and demand.

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country's national energy policy which are summarized as follows:

- 1) improve the conditions of energy supply and consumption in as economically rational a way as possible...
- 2) encourage the rational exploitation of rural areas in which woodfuel production takes place in order to protect the environment...
- 3) provide the urban and rural poor with better access to affordable and reliable sources of energy.⁵⁰

Specific interventions undertaken to meet these policy goals are divided into three primary strategies, namely, fuelswitching, demand reduction, and supply enhancement.⁵¹ Senegal's butanization campaign is the prime example of the fuelswitching approach. As mentioned above, for the last twenty years this campaign has attempted to provide an alternative supply of affordable and reliable energy for Senegal's urban poor.

Several government and foreign development agencies have undertaken efforts to reduce total woodfuel demand by enhancing the efficiency of woodfuel consumption. These efforts mostly involve the design and promotion of so-called improved cookstoves for use in both urban and rural settings.⁵² Stove design is focused on maximizing the heat energy transferred to the cooking vessel while minimizing heat loss due to dissipation. Improved firewood-burning stoves used in rural areas are typically made from locally available clay, sand, and other materials. They are

⁵⁰ République du Sénégal 1991a: 3.

⁵¹ For a general overview of these approaches see Sow (1990: 115-172), Munslow et al. (1988: 120-141), and Leach and Mearns (1988: 237-264).

⁵² Madon et al. 1982; Dieng et al. 1984; Chatain 1988.

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Charcoal-burning metal stoves are a commercial artisanal product intended for use by urban residents whose household energy consumption is tied to the monetized charcoal market. In general, charcoal cookstoves have proved more successful than the firewood stoves in terms of user acceptance. While the former are relatively fuel efficient and economical to use, experience with the latter indicates that users perceive fewer benefits in terms of savings of time and labor in firewood collection. Although cookstove programs have been viewed as an important element of Senegal's energy policy, the overall results so far have not had a significant impact on reducing woodfuel consumption.

Improving the efficiency of the charcoal-making process is a supply enhancement strategy in which significant research and promotional effort have been invested. The centerpiece of this approach is the development of a more efficient stacking and burning technique known as the *Meule Casamançaise* (Casamance charcoal kiln). In controlled laboratory tests, the Casamance kiln is reported to improve carbonization efficiency by up to 50%.⁵³ However, attempts to promote its use have been thwarted by financial, technical, and

⁵³ République du Sénégal 1990a: 33.

cultural difficulties. Consequently, use of this technique is extremely limited in the major charcoal producing areas.

Other attempts to enhance the supply of woodfuels have been carried out through a variety of reforestation strategies in many regions of Senegal. These range from large-scale peri-urban plantations to small-scale village woodlots. Unfortunately, difficult lessons have been learned through these efforts to produce woodfuel as a separate crop. Large scale plantations have been plagued by financial and technical problems related primarily to overestimates of the growth rates of exotic tree species planted in this Sahelian environment.⁵⁴ While village woodlot projects have proven successful in some cases, success and sustainability have been the exception and not the rule. Technical difficulties coupled with unevenly distributed costs and benefits among participants have frequently led to project demise. Indeed, successful small-scale woodlot projects have been those which focus on more lucrative fruit orchard and Eucalyptus building-pole production, or on protective functions such as anti-erosion windbreaks, which in effect contribute relatively little to the enhancement of woodfuel supply.⁵⁵ Lai, highlighting the difficulties with reforestation approaches, states that even if accelerated rates of plantation establishment and declining rates of per capita woodfuel consumption could be

⁵⁴ Freeman and Resch 1985/86.

⁵⁵ For example, see Harmand (1988).

achieved, plantations would meet only 4% and 6% of total woodfuel demand in 2000 and 2016 respectively.⁵⁶

Improved management of the country's remaining natural forests and woodlands is yet another way in which Senegal is trying to achieve its energy planning goals. Some consider this approach to have a better chance of succeeding compared to earlier attempts at demand reduction and supply enhancement, particularly if emphasis is placed on a more decentralized strategy involving the active participation of local populations.⁵⁷ Improved forest management seeks to preserve and protect the natural productivity of woodland ecosystems while simultaneously assuring that local resource needs are met. It is considered a more holistic approach to managing trees as an integral part of a larger agricultural production system, rather than as a unique "monocrop" as is typically the case in many woodlot development schemes. Examples of improved management techniques include careful extraction of high-value tree species as opposed to clear-cutting practices, better control of bush fires to avoid excessive loss of biomass when this technique is used as a land management tool, and developing more ecologically sound rotation practices in areas where commercial woodfuel production takes place.

Attempts over the past two decades to address the problems in Senegal's woodfuel energy sector have met with

⁵⁶ Lai 1985/86: 99.

⁵⁷ Guèye and Laban 1992; République du Sénégal 1993d.

mixed results in some cases, such as the improved stoves program, and led to disappointing failure in others, such as the establishment of large-scale woodfuel plantations.⁵⁸ Many efforts have been stymied by overwhelming financial, technical, cultural, and environmental difficulties. Experience to date with efforts to promote greater community participation in improved forest management is still too brief to attempt any serious evaluation of this particular approach. Nevertheless, it has become increasingly clear that the search for solutions to Senegal's woodfuel dependence problem must go beyond singular fuelswitching, demand reduction, and supply enhancement strategies. Actors in both government and development agency circles are beginning to pay attention to the more systemic problems in this sector, including those of weak management and supervision of the woodfuel production and marketing systems, the absence of a long-term planning perspective, and the heretofore disparate fashion in which forestry and other land use problems have been tackled. Efforts to review and redress the institutional problems of managing the woodfuels sector are starting to receive the kind of consideration that in the past was reserved only for technical silvicultural interventions.

⁵⁸ The most glaring example being the peri-urban woodfuel plantation project planned to supply Dakar from the Bandia classified forest in the Thiès region. See Freeman and Resch (1985/86).

Managing Woodfuel Resources

Responsibility for managing the woodfuels sector in Senegal is shared between two government agencies: the forest service - *Direction des Eaux, Forêts, Chasse et Conservation des Sols* - which operates under the tutelage of the Ministry for the Protection of Nature, and the energy directorate - *Direction de l'Energie, des Mines et de la Géologie* - which is housed in the Ministry of Industry, Commerce, and Handicrafts. The role of the forest service in managing the sector is, however, considerably more involved than that of the energy directorate. Through its Office of Forest Production, the forest service oversees all aspects of commercial woodfuel production, from the designation of production zones and the allocation of quotas to producer cooperatives, to the supervision of woodfuel marketing and the collection of all licensing fees, taxes, and royalties.⁵⁹

The energy directorate is less involved in the production end of the woodfuels sector. Its activities are instead focused on woodfuel retailing and end-use consumption issues, such as monitoring market prices and supplies and promoting the use of improved stoves and fuelswitching technologies. Although linkages between the forest service and the energy directorate have been relatively weak in the past, a woodfuels monitoring board staffed by representatives from both agencies was created

⁵⁹ Sow 1992.

in 1992 to improve communication and data collection activities.⁶⁰

Another important player in the woodfuels sector is the cooperative movement that produces the bulk of commercial firewood and charcoal marketed in Senegal. Members of the national forest products cooperatives - the *Union Nationale des Coopératives Forestières du Sénégal* - constitute a potent force in the lucrative woodfuels trade.⁶¹ Less a movement of well organized cooperatives than an loose association of charcoal merchants dominated by a small number of financially and politically powerful individuals, the forest products cooperatives are considered by some analysts as being more interested in short-term profit than in long-term sustainable production.⁶²

Numerous problems are encountered in the management of the woodfuels sector. These include, among others, qualitative and quantitative deficiencies related to staff and equipment that plague the forest service, lingering uncertainties about the implementation of Senegal's new forestry code, antagonistic relationships between agents of the forest service and rural populations, the circumvention of charcoal production rules and regulations by the producer cooperatives - which is often compounded by the complicity of the forest service, and the confusion

⁶⁰ République du Sénégal 1992a: 6-7.

⁶¹ See Ribot (1990) for a thorough study of the cooperatives and the role they play in the woodfuels market.

⁶² Diédhiou 1987: 24; Laura and Dianka 1992: 7.

surrounding the respective roles of local government and the forest service concerning the future of natural resource management for woodfuel production.⁶³

In this section of the chapter I have touched upon the considerable technical, financial, institutional and cultural problems that have plagued efforts to resolve Senegal's predicament in the energy sector. It is evident that the complexity of the problem requires a sophisticated yet feasible response that takes into account the myriad challenges of meeting a growing population's demand for affordable supplies of energy in an environmentally, politically, and socially acceptable way. The nature of these challenges and the obstacles to overcoming them will be addressed in greater detail in the chapters that follow.

Woodfuel Dependence and the Environment

As mentioned both in the present chapter and in the discussion in Chapter 1, problems in Senegal's energy sector are inextricably linked to concerns regarding the state of the natural environment. This linkage will remain prominent as long as the country's economic outlook remains dismal and dependence on woodfuels shows little sign of abating. Hence, it is important to recall that the "energy problem" in Senegal is effectively an energy-environment problem. In addition to factors such as agricultural expansion and recurrent drought, practices and policies

⁶³ By "local government" I am referring to Senegal's Rural Councils. The Rural Councils, and perspectives on the roles they play in natural resource management, are discussed in greater detail in later chapters.

employed in the exploitation of natural resources for woodfuel production will affect the degree to which future environmental degradation occurs. In this final section of the chapter, I discuss several concerns related to woodfuel dependence and environmental degradation.

Impacts on the Environment

Although both subsistence collection and commercial production of woodfuels leave their mark on the landscape, it is commonly accepted that commercial production plays the greater role in contributing to environmental degradation. This is particularly the case in areas where the demands on local woodland resources, especially those resulting from charcoal-making activity, are compounded by other pressures such as cattle grazing, extensive bush fires, and land clearance for agriculture.

Examples of environmental degradation attributable to the activities mentioned above include increased soil erosion, the decline of biomass productivity and biodiversity, and the potential for increased deforestation to contribute to climate change at both micro- and macro-scales. For instance, problems of soil erosion due to the loss of protective tree cover are noted in areas where charcoal production has occurred in the Senegal River valley.⁶⁴ The significant decline in natural stands of *Acacia nilotica*, var. *tomentosa*, a preferred charcoal-making species, contributes to increased aeolian soil

⁶⁴ Giffard 1974: 215-217; Gritzner 1988: 80; Harmand 1988: 5.

erosion and the consequent siltation of this region's important irrigation systems. Removal of the protective tree cover also contributes to an increase in the erosive potential of precipitation and a reduction in the accumulation of decaying organic matter that enhances soil nutrient content, fertility, and water absorption capacity, resulting in a positive feedback mechanism that can lead to decreased biomass productivity.

Changes in biomass productivity and species composition due in part to local subsistence and commercial woodfuel production have been noted in the central region of Fatick (part of the former Sine-Saloum region), on what are some of the most densely populated and intensively cultivated lands in Senegal. Grennier, citing a survey conducted by a United Nations Food and Agriculture Organization-sponsored reforestation project, points to the difficulty local villagers experience in finding sufficient quantities of preferred firewood tree species including the renowned *Acacia albida*, symbol of this region's traditionally stable agro-silvo-pastoral land use system.⁶⁵ Research conducted in and around the *Delta du Saloum* national park by Lykke provides evidence of degradation of the savanna vegetation as indicated by changes in local species composition.⁶⁶ She notes that in areas of high human impact, formerly abundant woody tree species have

⁶⁵ Grenier 1988: 33; see also Lericollais 1972.

⁶⁶ Lykke 1994: 51-52.

been replaced by a variety of shrubby Combretaceae species characteristic of secondary vegetation growth.

Stable tree cover contributes to moderating local microclimatic conditions. This includes regulating relative humidity levels and evapotranspiration rates, and moderating and deflecting potentially erosive winds.⁶⁷ Increased deforestation can result in the reduction of these microclimatic benefits and, although the linkages are still not fully understood, contribute to the wider phenomena of regional and global climate change via fluctuations in levels of atmospheric carbon dioxide.⁶⁸ Given Senegal's location in the drought-prone Sahelian region, it would indeed seem prudent to assure the maintenance of the microclimatic benefits provided by trees.

Conclusion

The discussion in this chapter has provided a backdrop for examining more closely the relationship between energy and environment in Senegal. At the national level, I have noted how the country is destined to continue to rely on its remaining forests and woodlands to supply the population with affordable sources of energy for the foreseeable future. This dependence on woodfuel energy is accompanied, however, with concern for the potential risk of increased environmental degradation at the local level. In particular, it is uncertain whether the country will

⁶⁷ Maydell 1990: 70-71.

⁶⁸ Rosillo-Calle and Hall 1992.

succeed in meeting the energy requirements of a growing urban population without further jeopardizing the well-being of its rural population and the natural resource base upon which all Senegalese depend.

In a broader context, the discussion in this chapter also sheds light on the complex and diverse nature of issues surrounding the energy-environment nexus in Senegal. Such issues include, among others, highly variable and often precarious ecological circumstances of geographic location, an elaborate and complicated administrative arrangement for managing forest resources, dependence on woodfuels that is due in large part to macro-economic constraints, sociocultural circumstances of fuel preference and energy consumption behavior, and difficult challenges to energy and environment policy making. As will be discussed in greater detail in Chapters 5 and 6 of the dissertation, application of a political ecology framework to the analysis of energy-environment relationships provides an effective vehicle for thorough identification of issues and processes that affect the outcome of human use of natural resources.

The broad outline of energy-environment relationships sketched in this chapter presents a point of departure for a more focused examination of these relationships in a specific geographical context. In the next chapter, I describe the evolution of land use over the past century in a region of Senegal that has undergone significant environmental transformation due to successive waves of

agricultural expansion and woodfuel production. The discussion will concentrate on the past, present, and future challenges Senegal has faced and will continue to face in terms of establishing sound energy production and natural resource management practices.

CHAPTER FOUR

AN HISTORICAL PERSPECTIVE ON LAND USE IN THE SOUTHEASTERN PEANUT BASIN

In this chapter I present a generalized history of twentieth-century human occupation and agricultural expansion in the part of the Kaolack region in which I conducted my research. I describe social and cultural characteristics of the region's population germane to the discussion of natural resource management and environmental degradation that appears in the following chapters of the dissertation. This examination of historical land use dynamics in the southeastern Peanut Basin helps us to better understand current conditions and future concerns regarding natural resource management in the region.

Population Migration and Agricultural Expansion in the *Terres Neuves*

Human settlement in the southeastern Peanut Basin is intimately related to aspects of colonial economic history, religious association, and changing demographic factors. The history of population migration and agricultural expansion in this part of Senegal during the twentieth century reflects a process through which considerable territory in the so-called *Terres Neuves* (New Lands), located south and east of the country's traditional agricultural hearth, was brought under the plow.

Numerous observers describe land settlement in this region in terms of a combination of mutually reinforcing

demographic push and pull factors.¹ Relatively high population density, reduced fallow periods, declining soil fertility, and diminished agricultural productivity in the northern and western sections of the "old" Peanut Basin, centered on the present-day regions of Louga, Thiès and Diourbel, are among the push factors that gave rise to peasant migrations from the hearth area to the interior. Pull factors that account for movements into the *Terres Neuves* include sparsely populated tracts of relatively fertile land, official colonial policy designed to expand commercial peanut production, and, during the 1970s, an experimental government-sponsored population resettlement project.

The *Terres Neuves* constitute an important transition zone between the major agricultural and pastoral regions of Senegal. Although references in the literature defining the geographic location of the *Terres Neuves* tend to vary depending on the focus and date of study, this zone essentially forms a northwest-southeast trending corridor separating the Peanut Basin and the Ferlo, the latter being the sparsely inhabited semi-arid pastoral domain of northeastern Senegal. Generally speaking, the *Terres Neuves* extend from the south-central Louga and eastern Diourbel regions, through the northeastern tip of the Fatick region, and into the eastern Kaolack and western Tambacounda regions (see Figure 2.1 in Chapter 2).

¹ On the *Terres Neuves*, see: Copans 1980, Diop 1981, Dubois 1975, Garenne & Lombard 1991, N'Doye 1974, Pélissier 1966, Rocheteau 1975 & 1979, and Trincaz 1979.

Lands to the west and south of this transition zone, the "old" Peanut Basin, are the realm of Wolof and Serer farmers. Some of Senegal's highest rural population densities are found in this area, reaching over 140 persons/km² in parts of the Diourbel region.² The pastoral domain north and east of the transition zone is home to the Fulbe, Senegal's semi-nomadic pastoralists. Population density in this section of the Ferlo is approximately 15 persons/km². In the transition zone proper, where Wolof farmers have expanded cultivation onto lands formerly used only by Fulbe pastoralists, population density ranges from 30-60 persons/km².

The French geographer Paul Pélissier describes the migration process into the transition zone that began around the turn of the twentieth century as "*la marche vers l'est*" (the march to the east).³ He points to three primary and interrelated factors to explain the course of human occupation in the *Terres Neuves*: 1) the establishment of the Islamic Mouride brotherhood and its well-organized penchant for agricultural colonization; 2) the successful promotion of commercial peanut production during the colonial period; and 3) the penetration of transportation and communication networks into the interior of Senegal, particularly the construction of the Dakar-Niger railroad in the first quarter of this century. Examination of these

² Population density figures are based on 1988 national census data from République du Sénégal 1989: 3.

³ Pélissier 1966: 302-321. See also: Sy (1969: Chapter 8) and Cruise O'Brien (1971: Chapter 9) on the "Rush to the Interior."

three factors sheds considerable light on the evolution of human settlement and land use practices in the study area.

The Mouride brotherhood is a Sufi sect of Islam, founded in Senegal in the last decade of the nineteenth century by the Muslim cleric Cheikh Amadou Bamba Mbacké (1850-1927).⁴ The leadership and holy shrines of the brotherhood are based in the town of Touba, located in the Diourbel region.⁵ The Mouride order occupies a prominent position in the religious, social, and economic affairs of the country. Although it is not the largest of Senegal's Islamic brotherhoods in terms of number of adherents - that distinction belonging to the Tijani brotherhood - it is arguably the most politically and economically influential. Its membership is composed of representatives of many of Senegal's diverse ethnic groups, with the overwhelming majority being Wolof.

The emerging Mouride brotherhood played many significant roles in the early years of the colonial period. It constituted an important focus of resistance to French rule, offered an alternative social structure to peasants living under what remained of Senegal's

⁴ The Mouride brotherhood and its founder are the subjects of numerous scholarly investigations. Included among the most important works are: Behrman 1970, Copans 1980, Coulon 1981, Cruise O'Brien 1971 & 1975, Dumont 1974, Marty 1913, and Sy 1969.

⁵ As mentioned in Chapter 2, I do not wish the reader to confuse Touba, the capital of the Mouride brotherhood, with Touba Aly Mbenda, the village in which I was based during my rural fieldwork. Recall, however, the important connection based on the fact that Touba Aly Mbenda was founded by a disciple of Cheikh Amadou Bamba Mbacké, and that strong socio-religious ties continue to exist between the two places.

aristocratic pre-colonial kingdoms, and served as a vehicle for the spread of Islamic teachings among the rural population. Amadou Bamba's charismatic leadership and initially anti-French attitudes eventually led him to be exiled by the colonial administration on several occasions, including seven years in Gabon (1895-1902) and another four in Mauritania (1903-1907).⁶

The adversarial relationship between Amadou Bamba and the French underwent a transformation to a more collaborative association in the period before and after World War I. This accommodation was based on the realization by the French that Amadou Bamba's immediate preoccupations were more religious and spiritual in nature than they were inherently political, and that cooperation with the Cheikh⁷ could prove to be an effective way to mobilize peasant labor for colonial economic purposes. As relations between the two sides improved, and as Amadou Bamba's stature as a religious figure among the rural masses solidified, the Cheikh adopted a policy of "positive neutrality" vis-à-vis French occupation.⁸ The most important outcome of this detente is arguably the cooperation that ensued between the Mouride leadership, i.e., the *marabouts*,⁹ and French colonial agents with regard to expanding peanut production for export.

⁶ Colvin 1981: 30.

⁷ "Cheikh" is synonymous with *marabout* (see footnote 19 in this chapter), i.e., a religious leader. It is also commonly used as a proper name.

⁸ Diop 1981: 324-25.

⁹ *Marabout* is the French translation of the Arabic term used to denote a Muslim scholar. In contemporary usage,

Given the limitations placed on agricultural intensification in much of Senegal, i.e., difficulty in improving yields due to climatic, edaphic, and technical factors, efforts to increase peanut production have typically relied on expanding the area under cultivation. From the French point of view, authority to regulate land use in the colonial territories was the purview of the colonial government, and a formal decree establishing state control over "vacant" lands in all of French West Africa was promulgated in 1904.¹⁰ As the French came to appreciate the contribution Amadou Bamba's increasingly numerous followers could make to agricultural production and economic development in the colony, they saw to it that the Mourides were encouraged to extend their area of influence over as much territory as possible. Consequently, the colonial government granted them access to forested lands that were then cleared for agriculture, and provided credit and marketing support for the commercialization of peanuts.

Thus began a long period of favorable state disposition toward Mouride land acquisition that lasted for over fifty years and propelled the brotherhood's members to establish new agricultural settlements throughout much of the *Terres Neuves*.¹¹ This was accomplished by organizing

the term refers to any Muslim cleric regardless of his scholarly achievement.

¹⁰ Gouvernement de l'Afrique Occidentale Française 1904.

¹¹ The Mourides continue to wield considerable influence when it comes to acquiring land from the state. See, for example, the reference later in this chapter concerning the

the *marabouts*' disciples into pioneer settler groups, called *daaras*, whose members labored to bring much of the *Terres Neuves* under cultivation.¹² Discipline, a religiously inspired work ethic, and an intense sense of community are hallmarks of the *daaras*. Disciples working in the service of their *marabout* for several years would, at the end of this period, be granted some land upon which they could settle permanently and maintain use rights to cultivate for their own account.

It was during this period, from about the turn of the century through the 1960s, that numerous villages in the study area were founded. For example, Cruise O'Brien, citing a 1966-67 report of the Senegalese Land Management Service (*Service de l'Aménagement de Territoire*), notes the fairly steady increase in the number of Mouride villages established in the *arrondissements* of Kounghoul, Nganda, and Malème-Hoddar, all located in central section of the *Terres Neuves* corridor (see Table 4.1).¹³

recent allocation to the Mourides of land within the Mbégué silvo-pastoral reserve.

¹² The term *daara* is often translated as a Koranic school; other interpretations consider it as a cooperative work-group. Among the Mourides, the *daara*, as a closed-knit group of religious disciples, plays a key role in agricultural expansion by forming groups of settlers who work to bring more land into production. For a further explanation of *daaras*, see Cruise O'Brien (1971, 1975: 66-68) and Sy (1969).

¹³ Cruise O'Brien 1971: 195, footnote 2.

Table 4.1 - Mouride Expansion in the
Southeast *Terres Neuves*^a

Years	Number of Villages Settled
1890-99	8
1900-09	4
1910-19	8
1920-29	11
1930-39	18
1940-49	20
1950-59	27
1960-69	17

Source: Cruise O'Brien 1971: 195.

^a Villages settled in *arrondissements* of Kounghoul, Nganda, and Malème-Hoddar, located in the present-day Kaffrine Department.

Migration into and settlement of the *Terres Neuves*, together with the expansion of the peanut trade, were facilitated by improved transportation linkages and infrastructure development. The most significant development was the construction of the Dakar-Niger railroad, built over the seventeen-year period from 1906 to 1923. Migrating Wolof-Mouride peanut farmers followed in the wake of the railroad's construction as this progressed toward the east. By 1910, the line emerged from the eastern margins of the old Peanut Basin at the town of Guinguineo, from which a spur line was later built to the Saloum River at Kaolack. Continuing to open up the hinterland of interior Senegal and beyond, the railroad reached Birkelane in 1912, Kaffrine and Kounghoul in 1914, and Tambacounda in 1915.¹⁴ As Pélissier notes, with each

¹⁴ Pélissier 1966: 304.

advance of the railroad the disciples of Amadou Bamba "did not hesitate to strike out into the tall bush of the southern Ferlo east and north of the railroad."¹⁵

Determining the placement of this important transportation corridor, which formed the main conduit for agricultural expansion into the *Terres Neuves*, was by no means a random process. Once beyond the town of Diourbel, the railroad traces a northwest-southeast trending arc that conveniently skirts the drier, less productive lands of the Ferlo in favor of more promising agricultural potential to the south. The southern extension of the arc, however, is circumscribed by the proximity of the Gambia River which, during the colonial period, was in territory under British control. The French thus built the railroad through the most promising territory it could, maximizing the extent of the potential trade area while being certain to avoid passing too close to possible transshipment points whence one could take advantage of cheaper river transport that would have ultimately benefitted a rival colonial power. This strategy, attributed to the then Governor General of French West Africa, was explained as follows in 1903:

"From Diourbel, it is recommended that [the line] break toward the south in such a manner as to traverse the arable lands north of The Gambia, and it is advisable that [the line] approach the [Gambia] river up to a point that would maximize our economic return without coming under the direct influence of the navigable waterway."¹⁶

¹⁵ Pélissier 1966: 305.

¹⁶ Cited in Dupon (1964: 179). The original reads: "*A partir de Djourbel [sic], il semble indiqué de s'infléchir vers le Sud de façon à traverser les régions cultivables qui s'étendent au Nord de la Gambie et il conviendra de*

The preeminent role played by the construction of the Dakar-Niger notwithstanding, there were other important infrastructure developments associated with the opening of the *Terres Neuves*. As mentioned previously in this chapter, securing an adequate supply of water in this region is problematic. With the railroad came the sinking of relatively deep wells at each station along the line and, later, at more populated points in the bush as well. Station stops became important trading posts where Lebanese and Syrian merchants established themselves as the middlemen of the peanut trade. Today, these locations are the major towns along this communications corridor. In addition, with the arrival of the Mouride pioneers who colonized lands north and south of the railroad, a network of rudimentary rural roads developed linking production fields with market towns. Several of these original tracks are now important, although still unpaved, secondary roads that connect villages south of the Ferlo and north of The Gambia with the railroad and the paved National Route No. 1 which runs parallel to it.

Environmental Implications of Mouride Expansionism in the *Terres Neuves*

The favorable attitudes and policies of the French colonial government toward Mouride colonization began to

chercher à se rapprocher de cette rivière jusqu'à la distance toutefois qui apparaîtra comme devant être maintenue pour que le rendement économique de la future ligne projetée ne soit pas directement influencé par le voisinage de cette voie navigable."

change somewhat after World War II. From the late 1940s and early 1950s, agronomists, foresters, and administrators started to look more closely at the environmental and socioeconomic impacts of Mouride migration into the *Terres Neuves*. Although economic priorities remained focused on the expansion of commercial peanut production, concerns were being raised about the effects of speculative peanut farming on soil conditions, the destruction of forested lands, and the impact that agricultural expansion into the Ferlo perimeter was having on Fulbe pastoralists.

Farming practices among the Wolof who took part in the "march to the east" are often criticized for their unsustainable qualities. The primary explanation given for this is that the Wolof-Mouride agricultural system is based on a strategy of short-term profit maximization that gives little consideration to factors of long-term environmental stability. Agricultural extensification is the norm among Wolof farmers who have traditionally displayed a considerable degree of mobility, both seasonal and permanent.¹⁷ Lake and Touré, citing Pélissier, discuss this mobility in terms of a Wolof "expansionism" remarkable for its lack of interest in soil conservation techniques or other innovations that could lead to more intensive forms of cultivation.¹⁸

This dynamic is clearly represented in Wolof settlement of the *Terres Neuves*. Beyond their concern with

¹⁷ Pélissier 1966: 178-80.

¹⁸ Lake and Touré 1985: 72.

religious proselytization, Mouride *marabouts* who established *daaras* throughout the eastern frontier also sought to maximize profits from peanut farming. In addition, given the arrangements between religious leaders and their disciples, under which the latter would eventually acquire land for their own account, the *marabouts* needed to constantly consider their eventual move into new areas where they could replicate the colonization process.¹⁹ For example, the *marabout* who founded Touba Aly Mbenda established a string of *daaras* which eventually became permanently settled villages in what is today the Lour Rural Community.²⁰ Cruise O'Brien offers some insight into the environmental ramifications of this system of agricultural expansion:

"Trees, which have a long-term value in water-retention and soil preservation, are sacrificed to extend the cultivable area, while fallow periods and crop rotation (with millet) are disregarded in favour of annually repeated peanut cultivation. The disciple settlers, despite their long-run interest in the preservation of land which must eventually devolve to them, are willing in the short run to comply with these practices. The result, on soils which are already fragile and far from ideal for commercial agriculture, is at worst a mining of agrarian resources, the creation in certain localities of something approaching dust-bowl conditions. Mouride villagers, once they leave the saintly settlements, do their best to restore the soil, and (contrary to a prevalent view) are probably no less efficient farmers than most others in Senegal.^[21] But the movement of pioneer settlement itself has been accompanied by considerable soil erosion: the Western Ferlo indeed now enjoys a certain notoriety among ecologists as a case where the supply of an infra-structure [sic] for

¹⁹ Diop 1981: 312.

²⁰ Personal communication, interview no. 45.

²¹ By "leav[ing] the saintly settlements," Cruise O'Brien is referring to the end of a disciple's initial obligation to his *marabout*, and not a major spatial relocation.

agriculture in a pastoral zone has brought about an extension of the desert."²²

Cruise O'Brien's portrait of "dust-bowl conditions" and allusion to "desertification" must be understood in the context of his research. Conducted during the 1960s in the Mouride heartland of the Diourbel region, O'Brien's work focused on pioneer villages located in the northwesternmost part of the *Terres Neuves* corridor. Certainly, it is this area that has witnessed the most serious problems associated with population pressure, the disappearance of fallow rotations, nearly total deforestation, and severe soil erosion.²³ This description would not, however, be apt in the case of the southeast extension of the *Terres Neuves*. Although land degradation processes are evident in the more southerly zone, so far they have not resulted in the dramatic conditions to which Cruise O'Brien referred in the case of the Diourbel area.

Among colonial foresters the Mouride Wolofs gained a reputation as the perpetrators of massive forest destruction. Commenting on the construction of the Dakar-Niger railroad between the towns of Diourbel and Tambacounda, P.L. Giffard, the former conservator of forests, noted that "each time a station was opened along the route, the Mourides established a village and proceeded to attack the forest."²⁴ P. Foury, Giffard's predecessor, decried the Wolof propensity to clear almost all trees from

²² Cruise O'Brien 1975: 80.

²³ See Rodale Institute (1989) and Copans (1980: 60).

²⁴ Giffard 1974: 108. The original reads: "Chaque fois qu'une station était ouverte, les mourides implantaient un village puis ils se lançaient à l'assaut de la forêt."

their fields.²⁵ And there is this observation from the 1930s on Mouride expansion into Fulbe pastoral lands along the Ferlo perimeter:

"At sunrise, the *talibés* [disciples] place themselves in line and begin to cut down the trees and clear the ground with frenetic zeal. Usually the Fulani [Fulbe] immediately leave their villages and move off. The Mourides advance, already they have cut down all the trees, even the useful ones: dye trees, calabash (sic) trees, baobabs, etc."²⁶

Such remarks are echoed in a more recent study in which a Wolof farmer, responding to a question seeking his opinion of trees on agricultural land, said: "A good farmer does not have trees on his fields [because shade is bad for the growth of peanuts]."²⁷

Part of the colonial response to concerns about deforestation due to agricultural expansion by Mouride Wolofs was the establishment of a series of classified zones across the *Terres Neuves* region to which access would be limited. This project involved the creation of two types of protected areas: silvo-pastoral reserves and classified forests, the latter known as *savanne sur rail* (rail-side savannas).²⁸ Thirteen zones, two silvo-pastoral reserves and eleven classified forests, were established between 1938 and 1956 by the forest service in what is today the Department of Kaffrine.²⁹ The main objectives of this legal maneuver were to protect the productive capacity of Fulbe grazing lands from excessive encroachment by Wolof

²⁵ Foury 1953: 14.

²⁶ J. Belvert, cited in Cruise O'Brien 1971: 197.

²⁷ Busacker et al. 1990: 107.

²⁸ Giffard 1974: 108.

²⁹ République du Sénégal 1991c: 38.

farmers and, in the case of the rail-side savannas, to secure a reliable fuel reserve for locomotives plying the Dakar-Niger railroad.

The creation of these classified areas ushered in an era of strict control by the forest service over access to land and forest resources. With time, however, a combination of need, greed, and political influence among Wolof peanut farmers and the Mouride leadership would prevail in overcoming official barriers to gaining access to these resources. As will be discussed in Chapter 6, confrontational attitudes that developed between forestry agents and local populations, together with the deterioration in the capacity of the forest service to manage protected areas adequately, eventually undermined the original objective of establishing the classified areas, i.e., to counter environmental degradation associated with Mouride expansion into the *Terres Neuves*.

Given that the agro-pastoral transition zone along the southern margins of the Ferlo is critically important to the Fulbe for sustaining their herds, the prospects for conflict with Wolof farmers in this area are seemingly inevitable. The antagonisms and competition that have existed and continue to exist between Wolof farmers and Fulbe herders are persistent problems affecting land use planning and resource management in the *Terres Neuves*. Most studies on this subject conclude that national economic priorities and the interests of Wolof farmers have always taken precedence over those of the Fulbe herders and

long-term environmental protection.³⁰ The economic benefits of expanding the peanut monoculture system through mobilization of Mouride Wolof labor and sedentarization of the semi-nomadic Fulbe, who are often considered to be less productive, uncooperative, and untaxable land users, help to explain policy decisions that are usually prejudicial to the pastoralists.

Occasionally, and perhaps only superficially, the plight of the Fulbe receives some attention. In addition to restricting access to land in classified zones, both colonial and post-colonial governments intervened in other ways at various points in time to counter the perceived threat of Mouride expansion onto the grazing lands of Fulbe pastoralists.

An early attempt to stem the tide of Mouride Wolof migration into the *Terres Neuves* was undertaken by French colonial officers in the 1930s. As Dubois reports, the then *commandants de cercle* of Sine-Saloum³¹ devised a plan for the organized transmigration of Serer farmers from the densely populated villages around Fatick to new settlements created along a road cleared north of the town of Kaffrine.³² The strategy was two-fold: relieve population

³⁰ Ba 1986: 162-170; Freudenberger and Freudenberger 1993; Grenier 1960; Monteil 1950; Ware 1979; and Weicker 1993.

³¹ *Cercle* refers to an administrative subdivision of the colonial period whose chief officer was the *commandant de cercle*. The *cercle de Sine-Saloum* corresponds to the present-day regions of Fatick and Kaolack. Sine, a precolonial kingdom with its capital at Diakhao located north of the town of Fatick, is the cultural hearth of the Serer ethnic group (see Gravrand 1983).

³² Dubois 1975: 86.

pressures on lands in the Sine area west of Kaolack, and establish a buffer against Mouride Wolof expansion into the Ferlo perimeter. The Serer were chosen for their farming prowess which the French believed would assure sustainable use of land on the drier margins of the *Terres Neuves*. The Serer, agro-silvo-pastoralists par excellence, are renowned for their skills in integrated land use management and a spiritual attachment to their ancestral lands.³³ Unlike the Wolof, the Serer tend to be far less mobile and, during the colonial period, were less inclined to become followers of Amadou Bamba's religious movement.

Acclaimed Serer land use practices include the maintenance of millet-peanut-fallow rotations, well supervised integration of livestock in a spatially constrained farming system, and intercropping of millet and peanuts with the leguminous woody species *Acacia albida*. The special characteristics of *A. albida*, known as *Kad* in Wolof and *Sas* in Serer, make it a valuable and carefully protected tree in the Serer farming system.³⁴ Its unique quality of leaf loss during the rainy season reduces competition with crops for sunlight, water, and soil nutrients. *A. albida* also has the ability to fix atmospheric nitrogen and recycle other important soil nutrients, thereby helping to maintain soil fertility and improve crop yields. In addition to these biological

³³ Lericollais 1970, 1972, 1990.
³⁴ Giffard 1974.

functions, *A. albida* is an important source of firewood and fodder.

The attempt to interpose Serer farming settlements between the Wolof and Fulbe was initiated in 1934. Colonial officers of the Sine-Saloum *cercle* directed the construction of a road from Kaffrine to Colobane, the digging of wells to supply water, the distribution of seeds and first-year foodstuffs, and the transportation of the migrants themselves from Fatick. This massive effort was accomplished through the auspices of the *Société de Prévoyance du Sine-Saloum*, a colonial parastatal organization that was the precursor to Senegal's agricultural cooperative movement.³⁵ The first villages occupied by the Serer in the resettlement zone were seen by the *commandant de cercle* as "constituting a kind of barrage against the flow of Mourides coming from the region of Baol [i.e., Diourbel] who would ravage the forests of the N'Doucoumane."³⁶

The resettlement strategy ultimately met with mixed results, and its effect on stemming the tide of Mouride migration was certainly limited. By the late 1930s, the total number of Serer brought to this small parcel of the *Terres Neuves* reached approximately 3,000.³⁷ However, with the opening of hostilities in Europe during World War II,

³⁵ Dubois 1975: 87.

³⁶ Dubois 1975: 87. N'Doucoumane was a canton in the Sine-Saloum *cercle* during the colonial period, located in the area of the present-day *arrondissement* of Malem-Hodar, just southeast of the Serer resettlement zone.

³⁷ Dubois 1975: 88.

the colonial government focused its attention and resources on the war effort and abandoned its investment in roads, wells, and transmigration for another day. This externally imposed set-back, together with harsh living conditions in the new villages and a strong motivation on the part of Serer migrants to return to the Sine - from which it has been suggested many were forcibly removed³⁸ - resulted in a partial abandonment of the resettlement zone.

At the end of the war, however, efforts to improve and modernize agricultural practices in this area did resume. These included the establishment of a major agricultural research station at Boulel, near the site of the first resettlement villages, and an attempt to encourage further in-migration as a countermeasure against Mouride expansion, again on the part of the Serer and, this time around, the Bambara from neighboring French Sudan (Mali).³⁹

After independence in 1960, the Senegalese government attempted a similar yet far more ambitious resettlement operation. The project was launched in the early 1970s with financial assistance from the World Bank. Christened the *Société des Terres Neuves* (STN), this parastatal organization's mandate was to develop a broad swath of the eastern extension of the *Terres Neuves*, from the *arrondissement* of Kounghoul to territory deep within the Tambacounda region.⁴⁰

³⁸ Dubois 1975: 88.

³⁹ Pélissier 1966; Foury 1953; Dubois 1975.

⁴⁰ Garenne and Lombard 1991; Trincaz 1979; Dubois 1975.

As with the colonial resettlement project of the 1930s, the STN's objectives were to relieve population pressures in the old Peanut Basin and promote agricultural diversification and intensification in sparsely populated frontier locations. A major effort was made to encourage cotton production given the slightly more favorable soil and rainfall conditions in this section of the *Terres Neuves*. According to Dubois, nearly 300 Serer families were moved from the Fatick area to new settlements south of the town of Koumpentoum between 1972 and 1975.⁴¹ Once again there was a conscious effort to engage Serer farmers and avoid encouraging Wolof Mourides to take part in this migration project. The enormous costs associated with this large-scale transmigration effort, together with problems of project management, put an end to the official life of the program only a few years after it began.

Today, the population of this section of the *Terres Neuves* reflects the ethnic mixing engendered by colonial transmigration and agricultural extension programs. Nevertheless, a Wolof Mouride majority remains the dominant presence in a region that boasts increased land degradation after 60 years of speculative peanut production, enduring farmer-herder conflict, and the continued "attack" on its remaining woodland resources. A recent example of this latter point is represented by the declassification in 1991 of 45,000 hectares in the Mbégué silvo-pastoral reserve (total area 73,000 ha) which were allocated to the leader

⁴¹ Dubois 1975: 117.

of the Mouride brotherhood for expanded agricultural production.⁴²

Conclusion

Located along the country's agro-pastoral frontier and endowed with significant transportation infrastructure, the southeastern Peanut Basin occupies an important position in Senegal's rural-based economy. As discussed in this chapter, the region is a transition zone between the sparsely populated semi-desert Ferlo and the better watered areas of south-central Senegal and the Gambia River basin. Given its relatively good soils, agricultural potential, and open spaces, the eastern extension of the *Terres Neuves* has been an important agricultural area for the better part of a century. Despite environmental challenges such as highly variable precipitation and problematic water supply, the region has accommodated successive waves of migrants from the degraded hearth of the Peanut Basin in northwestern Senegal.

Human settlement and agricultural expansion in the *Terres Neuves* are closely related to Senegal's colonial peanut-based economy, the emergence of the Mouride Islamic brotherhood, and infrastructure developments that facilitated colonization of the area. In many respects, these factors have combined to recreate the expansive land use system typical of the Wolof Mouride heartland in the Louga and Diourbel regions.

⁴² Freudenberger 1991; World Bank 1994a: 1.

The discussion in this chapter on the settlement history of the *Terres Neuves* and the environmental consequences of Mouride expansionism illustrates the applicability of the political ecology framework used in this study. As mentioned in Chapter 1, the examination of contemporary human-environment relationships is bolstered when placed in historical perspective. In the present example, it is important to recognize that current land use patterns and natural resource management practices in the southeastern Peanut Basin reflect in large part the history of economic, social, and political forces that over time have shaped the regional landscape. The multidimensional characteristic of political ecology analysis captures these important considerations, in both historical as well as contemporary perspectives.

In addition to its multidimensional feature, the multi-scalar quality of the political ecology framework is also evident when one considers the historical context of land use and resource management in the study area. As illustrated in the preceding sections of this chapter, international (i.e., colonial), national (post-independence state resettlement policy), and local (Mouride in-migrant communities) influences have all contributed to shaping the present-day regional landscape. Recognition of this complex historical account helps to inform the search for solutions to the problems associated with Senegal's current energy-environment dilemma.

To understand more clearly the challenges today's residents of the southeastern Peanut Basin face, one must first identify the pertinent variables related to the management of the natural environment. In the next chapter, I present these variables with respect to forest resources for sustainable woodfuel production. Later, in Chapter 6, I illustrate several ways in which an understanding of the interrelationships between these variables contributes to a more informed appreciation of the complex nature of Senegal's woodfuel situation.

CHAPTER FIVE

MULTIPLE DIMENSIONS OF THE ENERGY-ENVIRONMENT NEXUS

In this chapter, I present the spectrum of variables identified during my research as significant to the analysis of natural resource management for woodfuel production in Senegal. The following discussion therefore corresponds to the categorization phase of the political ecology approach described in Chapter 1.

Discussion of the variables is organized according to the four principal categories - environmental, economic, social, and political - of the political ecology conceptual framework. These categories constitute the cardinal points of a framework within which the multidimensional problem of managing Senegal's woodland resources for national energy supply can be analyzed. Constituent elements of the four principal components are identified and considered in terms of their representation at international, national and local scales (see Table 5.1). The categorization phase informs the more synthetic discussion, presented in Chapter 6, of ways in which these variables interact, both within and between various geographical scales and throughout different points in time, that helps to shed light on the complex relationship between woodfuel energy dependence and local environmental conditions in Senegal.

Table 5.1 - Multiple Dimensions of the Energy-Environment Nexus in Senegal

SCALE	ENVIRONMENTAL	ECONOMIC	SOCIAL	POLITICAL
International	Tropical Deforestation	Market Reform	Empowerment	Democratization
	Biodiversity	Economic Liberalization	Indigenous Technical Knowledge	Foreign Development Assistance
	Sustainability	Privatization	Popular Participation	Private Property Rights
National	Global Climate Change			Government Downsizing
	PDDF & PAFS ^a	Structural Adjustment	Population Growth	Decentralization
	CONSERE ^b	Currency Devaluation	Rural-Urban Migration	Land Tenure Law
Local	Charcoal Front	Stumpage Fees	Household Energy Consumption Behavior	Forest Code Reform
	Desertification	Woodfuel Prices	Peasant Associations	
		Energy Subsidies		
Local	Rainfall Variability	Household Resource Allocation	Gender Issues	Rural Councils
	Water Availability	Access to Capital & Credit	Religion	Local Elites
	Soil Erosion	Access to Markets	Environmental Philosophy	Local Land Tenure Arrangements
	Termites		Education	<i>Responsibilisation</i>
	Fallow Regeneration		Social Organization	
	Bush Fire			

^a Master Plan for Forestry Development (République du Sénégal 1981a) & National Forestry Action Plan (République du Sénégal 1993b).

^b Superior Council for Natural Resources and the Environment. See World Bank (1994).

The Environmental Dimension

Natural resource management problems in Senegal are representative of a number of pressing global environmental concerns. These include global climate change, tropical deforestation, air and water pollution, and losses in biological diversity at the genetic, species, and ecosystem levels. These and other environmental problems received widespread international attention at the 1992 United Nations Conference on Environment and Development.¹

At the global level, attempts to find ways of coping with the perceived threats to the world's natural systems are expressed in recent international accords such as the U.N. Framework Convention on Climate Change, the Convention on International Trade in Endangered Species of Flora and Fauna, and the U.N. Convention on Biological Diversity.²

In the forestry sector, international concern over rapid rates of tropical deforestation and for finding ways to promote more sustainable use of the world's forest resources is expressed in the 1985 Tropical Forestry Action Plan, a joint program of the United Nations Food and Agriculture Organization (UNFAO), the World Bank, and the United Nations Development Programme (UNDP).³ As part of this multilateral environmental program, the FAO plays the lead role in orienting and assisting individual governments

¹ See UNCED 1991.

² For a detailed explanation of these international environmental conventions see World Resources Institute (1994).

³ The UNFAO Tropical Forestry Action Plan is discussed in World Resources Institute (1994) and Lynch (1990).

with the development of national strategies designed to meet internationally defined goals and objectives for forest management.

International agendas have a strong influence on the establishment of environmental policies and programs at the national level. The planning process alluded to above is one way in which this influence manifests itself in individual countries. Through the elaboration of a variety of planning documents, many developing nations are able to achieve recognition and, ultimately, financial assistance from the international community for their stated commitment to address environmental issues of global importance.

In Senegal, this process is reflected in a range of environment-related planning documents prepared over the last decade. These include the National Plan for Desertification Control, the National Energy Plan, and the National Plan for the Integrated Development of the Silvo-Pastoral Zone. In 1993, Senegal demonstrated its concern for improved management in the forestry sector and its adherence to the principles of the FAO Tropical Forestry Action Plan by adopting a National Forestry Action Plan (PAFS).⁴

The PAFS represents a significant revision of the previous Master Plan for Forestry Development (PDDF), completed as recently as 1981.⁵ In the event that the

⁴ République du Sénégal 1993b.

⁵ République du Sénégal 1981a.

ideas, strategies, and projects outlined in the PAFS become more widely disseminated, better understood, and, ultimately, successfully implemented by forest service agents and others involved in promoting rural development, the plan has the potential to affect natural resource management at the national and local levels in a positive way. Currently, however, it is much too early to tell whether this potential will be realized.

Compelling criticisms of the multiple environmental plans adopted recently in Senegal include lack of coordination and redundant mandates among the diverse array of agencies involved in their implementation. These concerns are particularly troubling in light of the relatively weak institutional and financial structures that are required to translate strategy into action. In an effort to provide better planning, coordination, and monitoring of the country's diverse environmental programs, a government coordinating council was created to take charge of the environment portfolio.

The Superior Council on Natural Resources and the Environment (CONSERE), formed in August of 1993, held a national conference in early 1995 to reexamine and refine Senegal's environmental agenda. The Council's short-term goal is to elaborate a National Environmental Action Plan that incorporates environmental concerns into overall national development planning.⁶ The creation of CONSERE

⁶ Wal Fadjri 1995; World Bank 1994a: 43-44. The French acronym stands for *Conseil Supérieur des Ressources Naturelles et de l'Environnement*.

and its call for a national conference are strong indicators of the increasing importance the government of Senegal now attaches to natural resource management issues. The influence of actors at the global level in promoting these developments, however, must not be overlooked.

The current situation regarding charcoal production and consumption is another important environmental issue that now receives considerable attention at the national level. Continued dependence on charcoal as the primary household fuel in urban areas together with changes observed in the location of charcoal production raise concern about the management of the remaining major stocks of forest resources in southeastern Senegal. Recent improvements to the main road between the towns of Tambacounda and Kédougou, the latter on the Senegal-Guinea frontier, may, in addition to improving transportation conditions, facilitate access to forest resources for clandestine charcoal production. The notion of an accelerated southeasterly expansion of the charcoal production front leads some of Senegal's partners in the donor community to insist on knowing what the government plans to do about "rationalizing" the country's charcoal production and marketing system.⁷

⁷ At the International Roundtable on the Senegal Forestry Action Plan (PAFS), held in Dakar in October, 1993, several foreign delegations pressed representatives of the Senegalese government for details on how they intend to address problems in the woodfuel sector, raising the possibility that their support of the forestry plan may be contingent on resolution of some of the more thorny issues related to charcoal production and marketing.

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It is at the local level that the outward signs of environmental degradation and change are most readily observed. Proximate causes of degradation and change in a given locale can be explained by a combination of systemic natural conditions and anthropogenic factors related to the use of the natural environment. In the Kounghoul *arrondissement* and the Lour Rural Community, the dominant natural factors affecting local conditions include high rainfall variability, problematic subsurface water availability, soil nutrient depletion and potential for soil erosion, and the widespread presence of termites that thwart new tree growth. Varying combinations of these factors influence the productive potential of natural and planted vegetation in the area.

Human use of the environment also plays an important role in affecting conditions of local biological productivity. For example, anthropogenic factors such as the use of bush fire as a land management tool, animal herding practices, and the nature of local farming systems all influence the quality and quantity of woody vegetation in the study area. In dryland Africa, fallow rotation practices are of great importance with respect to the potential for natural vegetation regeneration.⁸ For example, it has been noted that where agricultural expansion has not impinged upon those areas of Senegal's classified forests formerly managed to supply woodfuel for

⁸ Adesina 1990; Chidumayo 1988; Ohler 1985.

the railroad, successful regeneration of the natural woody vegetation took place over a fifteen-year period.⁹

This promising observation notwithstanding, one must recall that more favorable rainfall conditions and lower population pressure prevailed in the immediate post-World War II period when exploitation of classified forests for the railroad ceased. Given contemporary problems of variable rainfall, susceptibility to drought, and increased population pressures, the local population's ability to maintain satisfactory fallow practices is now somewhat diminished.¹⁰ This situation has brought about initiatives to promote rural forestry and integrated land use management practices designed to restore the integrity of local ecological conditions.¹¹ An example of one such initiative in the Lour area is the recent, albeit limited, incorporation of *Acacia holosericea* on farmers' fields for the purposes of soil protection and restoration. This species is noted for its effectiveness in reducing aeolian soil erosion when used as a component in planted windbreaks.¹²

⁹ Gueye 1987: 28.

¹⁰ Evidence of reduction in fallow practices due to these factors for Senegal's Peanut Basin is discussed in Rodale Institute (1989: 23-30); see also Lericollais (1990: 163).

¹¹ Gueye and Laban 1992; van den Breemer et al. 1993. "Rural forestry," after Niang (1992: 9), is defined as "the ensemble of activities undertaken to encourage the rural population to invest actively and voluntarily in reforestation with the aim of conserving the productivity of local land resources" [my translation]; the term is used in order to distinguish small-scale initiatives from large-scale forestry operations (e.g., commercial plantations).

¹² Montagne 1988: 25; National Academy of Sciences 1980: 39.

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The Economic Dimension

In the 1990s, we are witnessing unprecedented international recognition of the linkages between economic development and protection of the natural environment. In 1992, the World Bank took pains to inform the international community that divergent perspectives on economic development on the one hand, and environmental management on the other, represent a "false dichotomy" between "complementary aspects of the same agenda."¹³ Issues and concerns raised on the international environmental agenda must, therefore, have their counterparts on the international economic agenda. Currently fashionable trends in international economic circles include greater reliance on market reforms, economic liberalization, and privatization of state-owned enterprises.

In Senegal, leverage exercised by international economic organizations plays a significant role in government decision making with respect to the national economy. Given its relatively poor financial position, due in part to declining export revenues from peanuts and phosphates and weak performance in the domestic industrial sector, the Senegalese state is increasingly dependent on foreign development assistance just to manage day-to-day affairs of running the country. To date, this situation has resulted in the imposition of stringent economic reforms under a structural adjustment program and a 50%

¹³ World Bank 1992: 25; Schramm and Warford 1989.

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currency devaluation at the behest of the International Monetary Fund (IMF) and the French government.

In the forestry and woodfuel sectors, such internationally imposed measures will presumably force the Senegalese state to consider more closely additional reforms that it would otherwise try to avoid, for political reasons, when pressured by members of the foreign donor and environmental communities. Economic factors subject to reexamination include stumpage fees, taxes, and royalties associated with the commercial exploitation of forested lands, retail charcoal pricing, and price subsidies to alternative forms of energy such as natural gas.¹⁴

Economic factors identified at the local level are related primarily to household investment behavior, generation of investment capital, and access to forest products markets. One of the most interesting facets of household (and group) investment behavior relates to whether decisions are made from a short- or long-term perspective. This is illustrated by examining local tree planting preferences in several villages in the Lour Rural Community.¹⁵ The extreme rarity of *Bombax costatum*, a species traditionally favored for roofing material, has created a local market for *Eucalyptus camaldulensis* as an acceptable substitute. This eucalyptus species is highly regarded for its fast growth, straight poles, and coppice

¹⁴ See Diédiou (1989), Laura and Dianka (1992), Tibesar (1991), and Tibesar and White (1990).

¹⁵ Information on these practices obtained during interview nos. 57, 59, 63, & 74.

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capability; it is also an excellent component in field boundary windbreaks to reduce soil erosion.¹⁶

In villages I visited, the production of *E. camaldulensis* is geared far more toward short-term economic considerations, i.e., the marketing of building poles, than it is toward combined economic and long-term environmental protection purposes. Most of the eucalyptus plantings I observed are located in small woodlots close to village settlements where they are more easily cared for; few are planted as windbreaks along field boundaries. It appears that the labor demands required to obtain the environmental protection benefits of planting *E. camaldulensis*, e.g., careful watering and protection from grazing animals, restrict the role of this species to an economically productive one.

Scarcity of capital and credit in rural Senegal stymies all types of investment in economically productive and environmentally protective activities. Limited financial resources pose serious challenges to most individual farmers, households, and the larger cooperative development associations to which many villagers belong. In this period of state disengagement from the rural economy, much of Senegal's population is becoming increasingly dependent on foreign sources of direct financial assistance. For example, the Kounghoul Entente alone has established contacts with over twelve foreign non-governmental organizations on whom it relies for

¹⁶ Weber 1986; Maydell 1990.

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project funding, both for initial start-up and recurrent operating expenditures. Although there may be many positive aspects to such grassroots development cooperation, chronic dependence on foreign funding can compromise the integrity, sustainability, and, ultimately, the independence of indigenous village associations.

Under the aegis of Senegal's decentralization policies, discussed below in the section on the political dimension, rural communities are expected to benefit from economic opportunities that will ostensibly accompany their new responsibilities in the realm of natural resource management. However, for those local communities interested in entering the potentially profitable woodfuels business, many will find substantial obstacles to gaining access to this market.¹⁷ Assuming that local enterprises succeed in finding economically efficient ways to produce commercial firewood or charcoal, they will still have to overcome existing social and political barriers to the wider national market that is strictly controlled by powerful members of the National Union of Forest Products Cooperatives.

The Social Dimension

In addition to the global environmental agenda marked by concerns with climate change, tropical deforestation, and biological diversity, a number of social issues currently rank high on the international human development

¹⁷ Ribot 1990.

agenda. Themes of human resource development, women's empowerment, indigenous technical knowledge, popular participation, and community involvement have made their way into discussions and debates that are intimately related to issues in the environmental arena.¹⁸ Whether or not the dissemination and understanding of such themes have advanced beyond the point of development rhetoric, it is certain that they are beginning to reverberate in the natural resources field at national and local levels. In Senegal, international development assistance agencies, non-governmental organizations, and regional and local level extension agents are becoming particularly well versed in the current discourse on human resource development and popular participation.¹⁹

Social factors at the national level associated with the energy-environment nexus touch upon aspects of demography, household woodfuel consumption behavior, and associational movements in civil society that focus on environmental and rural development issues. Senegal's national population growth rate of 2.7% per annum, urbanization rate of 39%, and sustained rural-urban migration patterns are all closely linked to the pressures placed on the natural environment.²⁰ Rapid urbanization and low household incomes reinforce the dominant position

¹⁸ Cernea 1985; Chambers 1983; Landell-Mills 1992; World Bank 1989.

¹⁹ See ENDA (1992) and République du Sénégal (1992c).

²⁰ Demographic figures based on 1988 national census (République du Sénégal 1988d).

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of charcoal in domestic energy consumption.²¹ As the proportion of woodfuel energy consumed in the form of charcoal steadily eclipses that of firewood, the pressures on remaining forested lands to meet urban energy demand will inevitably increase.²²

Closely related to these demographic variables is the type of woodfuel consumption behavior practiced by the majority of households in Senegal. Cultural factors, expenditure patterns, and alternative fuel prices combine to reinforce charcoal's place as the urban fuel of choice. As a matter of convenience in cramped quarters, and of taste preference with regard to Senegalese cuisine, charcoal remains a highly desired cooking fuel in urban households. Spending patterns among the urban poor, typified by small daily allocations to meet basic needs, reveal the difficulty most households have in affording larger lump-sum payments required to switch to the most plausible alternative to charcoal, i.e., natural gas.²³

With respect to the rural population, which bears a significant share of the environmental costs associated with urban woodfuel consumption, many local development associations and advocacy groups have been organized to voice their concerns over economic and environmental conditions. One example of these self-help community organizations is the Kounghoul Entente, introduced in

²¹ World Bank 1994a: 23.

²² See discussion in Chapter 3 on firewood/charcoal-rural/urban energy dynamics.

²³ Tibesar and White 1985: 15.

Chapter 2. The creation of these associational movements has taken place primarily as a response to the state's inability to provide essential services in the countryside. They are indicative of the initiative now evident among rural populations to try to take greater control of their own economic destiny.

The Entente movement in Senegal is currently comprised of ten regionally-based development associations with over 6,000 members in more than 200 villages. The Ententes are linked together by a coordinating body - the Inter-Entente - which is a non-governmental organization (NGO) officially recognized by the state. In turn, the Inter-Entente is a constituent member of the Senegalese Federation of Non-Governmental Organizations (FONGS), which has become the major forum for the promotion of peasant interests in Senegal.²⁴ To further these interests and to press for a greater voice for rural communities in matters that directly affect them, the national leadership of FONGS recently established a tripartite partnership between the Federation, the local World Bank mission, and the government of Senegal known as the Senegalese Association for Small-Scale Community Development Projects (ASPRODEB).²⁵ As with the government-sponsored Forestry

²⁴ The acronym stands for *Fédération des Organisations Non-Gouvernementales du Sénégal*; a sister organization, made up of national and international NGOs, is known as CONGAD - *Conseil des Organisations Non Gouvernementales d'Appui au Développement*.

²⁵ Ndiaye 1995. The acronym ASPRODEB stands for the *Association Sénégalaise pour la Promotion des petits projets de Développement à la Base*.

Action Plan mentioned above, the degree to which these associational movements can succeed in putting rural interests on the national planning agenda remains to be seen. They do, however, represent a significant effort in the direction of organized grassroots promotion.

The complexities of rural Senegalese society are reflected in the number of diverse factors that affect the management of locally-based natural resources. In general terms, these factors are associated with phenomena such as gender, religion, environmental philosophy, education, and social organization.

The international call for greater recognition of the importance of women's productive and reproductive roles in society has set the pace for consideration of this important issue at national and local levels. The second United Nations Conference on Women held in Kenya in 1985 helped to focus international attention on women's issues, with particular emphasis on African women. In Senegal, one of the guiding principles of the National Forestry Action Plan is the improvement of conditions under which rural women live and work.²⁶ Given the predominant role women play in rural woodfuel supply, it is critical to incorporate their perspectives, recommendations, and participation in any effort to address this resource management issue. This is a particularly challenging prospect in a cultural context in which men still dominate almost every facet of rural life.

²⁶ République du Sénégal 1993b (vol. 2): 106.

As mentioned in Chapter 4, the impress of Islam by way of the Mouride brotherhood is clearly reflected in the historical experience of human settlement and agricultural expansion in the study area. The religious imprint on local society remains strong not only in spiritual terms, but in economic and political terms as well. Programs and projects designed to address environmental issues in this rural area must take into consideration the important roles the local Mouride leadership plays in the areas of agriculture, land distribution, and the organization of labor.²⁷

A corollary issue closely tied to religion is the question of local perceptions of the environment, or what one might call a land ethic. Despite the Mouride Wolof zeal for "attacking the forest"²⁸ in the process of agricultural extensification, which may seem somewhat misguided in comparison to the more conservative environmental attitudes and skilled land use techniques of the Serer, the fact that Islam accords a particular reverence for natural phenomena invites closer examination of the philosophical aspects of human-environment interactions in this stronghold of the faithful. Koranic references to the sanctity of the natural environment, such as the following, might be useful in ethical considerations of the energy-environment dilemma:

"Have you considered the fire you kindle? Was it you who made the tree to grow or are We the source of its

²⁷ Colvin 1983.

²⁸ See footnote 24 in Chapter 4.

being? We devised it to be a point of recollection and to provide solace for those who pass through desert ways. Praise, then, each of you the Name of your great Lord" (Surah 56, *Al-Waqi'ah*).²⁹

A preliminary report to the interministerial commission on the National Forestry Action Plan expounded upon this very issue, posing the question as to whether the powerful influence of Senegal's *marabouts* could be used to rally support not only for expanded peanut production but for sustainable natural resource management as well.³⁰

Educational attainment among the Senegalese rural population is another important factor with respect to managing the natural environment at the local level. Both the opportunity and the desire for formal schooling, i.e., government-sponsored, French-language education, in the Lour Rural Community are somewhat limited. The dominant voice of local *marabouts* has effectively squelched the expansion of state-sponsored secular education in the area.³¹ Formal educational experience is for the most part restricted to attendance at Koranic school for varying periods of time among different segments of the population. Nevertheless, exposure to new skills, knowledge, and techniques, whether through formal or non-formal modes of education, will certainly be an important element in the future economic and social development of the area. Acquiring skills and knowledge in the fields of improved farming methods, reforestation techniques, accounting, and political leadership will be critical if the population of

²⁹ Cited in Cragg (1988: 94).

³⁰ République du Sénégal 1990a: 56.

³¹ Interview no. 45.

this area is to succeed in adapting to the changing parameters of rural development in Senegal.

A final social factor to consider relates to social structure in rural African society. Foreign development specialists often approach rural Africa from a perspective that considers peasant society to exemplify some degree of social homogeneity, solidarity, and/or communitarianism. Such assumptions of indigenous sociocultural conditions, however, are usually based on perceptions which one Senegalese social forester, Amsatou Niang, describes as the belief in the "myth of the rural collective."³² Niang argues that the perception of inherent solidarity and communitarianism tends to overlook the fact that rural African society is often highly stratified by age, gender, class, caste, and religious affiliation, leading to a varied and complex set of interests and needs. The complex social heterogeneity found in rural Senegal must be taken into consideration when examining the local aspects of the country's energy-environment predicament, particularly in terms of who reaps the benefits and who endures the costs of exploiting natural resources.

The Political and Institutional Dimension

The wave of democratization spreading over many parts of the world dominates the international political scene of the late twentieth century. In Africa, the post-cold war period has witnessed an unprecedented surge in efforts to

³² Niang 1992: 21.

promote political liberalization and multiparty democracy.³³ Senegal's relative success in its experiment with democracy, together with its evolving policy of administrative decentralization as discussed below, provide a backdrop to examine how change in the international political situation affects developments in the arena of local-level natural resource management. Other political issues at the international level that influence national and local events include changes in the direction and magnitude of foreign aid flows, increased attention to the promotion of private property rights, and the streamlining of government bureaucracy.

National level political factors of direct consequence to woodfuel energy production and environmental protection in Senegal include state policy on administrative decentralization, the perennial debate regarding the interpretation and application of national land tenure laws, and the recently concluded revision of the national forestry code and proposed institutional reforms in the national forest service.

Since independence from France in 1960, the Senegalese government has forged slowly ahead in its attempt to transform the centralized unitary state it inherited from the colonial power into a more decentralized bureaucratic structure operating within a representative democracy.³⁴ Efforts in this domain continue with the hopeful

³³ Sklar & Strege 1992; Kraus 1991.

³⁴ Gellar 1990.

expectation that allowing local populations greater jurisdiction over their own affairs will contribute to expanding popular participation in sustainable natural resource management. As will be discussed in Chapter 6, various factors make this strategy highly problematic.

Land tenure arrangements in Senegal differ widely between regions. Such variation is the result of what are essentially parallel systems of control over rights to land based on a division between long-standing indigenous arrangements on the one hand, and contemporary administrative and territorial legislation on the other. Pursuant to the national land tenure law of 1964, ninety-five percent of all land in Senegal is "nationalized," i.e., held by the state in order to assure its rational exploitation as determined by overall national development planning.³⁵ However, the 1964 law notwithstanding, actual land tenure practices in Senegal are extremely complex and firmly rooted in the historical experience of Senegal's various ethnic groups.³⁶ Although an official apparatus is in place that attributes certain powers in land allocation to administrative bodies such as local rural councils, this does not necessarily replace nor diminish the power of

³⁵ For a detailed treatment of this landmark piece of legislation, *Loi no. 64-46 du 17 juin 1964 relative au domaine national*, see Caverivière & Debène (1988).

³⁶ The history of land tenure in Senegal is extremely complex. For insight into the systems that have been practised by the Wolof ethnic group see, among others, Diop (1968 & 1981), M.M. Niang (1975, 1979 & 1982), and Le Roy and Niang 1969.

traditional institutions to exercise control over land tenure decisions.

Senegal's forest service occupies a pivotal position with respect to all aspects of the exploitation, conservation, and restoration of the country's woodland resources. Legislation that created the forest service, dating from the 1930s, reflects the colonial objective of "wise management" of forested lands in former French West Africa.³⁷ The primary characteristics of the legislation can be summarized as follows: forested lands are delimited into classified and protected zones; the forest service is vested with broad powers to regulate all uses of forests; and, a legal distinction is to be made between forest products subject to customary subsistence use and those that are allowed to be exploited commercially.³⁸

Given the current status of Senegal's forested lands, characterized as degraded to varying degrees depending on location, much criticism has been levied upon the forest service for its shortcomings and failure to better manage these important resources. Explanations for this situation include lack of sufficient financial and material resources, susceptibility to corruption and collusion with commercial forestry enterprises, and the development over time of adversarial and even hostile relationships with the rural population.³⁹

³⁷ Elbow and Rochegude 1990.

³⁸ Bertrand 1985: 31-32.

³⁹ Buttoud 1995.

Consequently, efforts have been made over the last decade to reform the forest service. A major outcome of this process was the government's adoption in 1993 of a revised national forest code.⁴⁰ Despite this long-awaited and much debated new code, concrete changes cannot be expected to take effect overnight. Moreover, many active in rural advocacy organizations believe that the new code does little to address the problems local populations experience in managing woodland resources.⁴¹

At the local level, important political factors center around questions related to representative government and decision making authority, land tenure arrangements, and the role local populations play in managing their own economic and environmental affairs. For the purposes of this discussion, the question of representative government encompasses the function of Senegal's rural councils. As mentioned in Chapter 2, rural councils constitute a governing body of locally elected officials for the Rural Community administrative subdivision. Their mandate covers responsibilities in three main areas: 1) allocation of land among members of the local population, 2) land use zoning and the regulation of use rights to natural resources, and 3) the identification, funding, and supervision of capital investments financed from the rural community budget.⁴²

In reality, the ability of most rural councils to carry out this mandate is subject to a variety of factors

⁴⁰ Dieng et al. 1993.

⁴¹ Ribot 1995.

⁴² République du Sénégal 1991b.

that, under prevailing local conditions, explains the significant discrepancy between theory and practice. For example, although they ostensibly oversee questions concerning local land tenure, the action many rural councils take on this matter is, in effect, only symbolic. For the most part, other influential actors at the local level are found to have much greater authority in decisions related to the disposition of land resources, reflecting the parallel systems of land tenure that exist throughout much of the country.

At the local level, a key element of national decentralization policy is manifest under the rubric of *responsabilisation*. The notion of *responsabilisation*, i.e., transfer of responsibility, refers to the increased role local communities are to play in managing their own affairs as the state pursues a policy of bureaucratic disengagement. It is in this spirit that local populations are expected to undertake for themselves many land use planning and management tasks hitherto in the purview of the state. These tasks are to be carried out by local institutions employing participatory planning processes in which all members of the community have an opportunity to take part. In light of some of the local-level social and economic variables mentioned above, a transfer of responsibility that is shared equitably among all segments of the rural population, not to mention between the rural and urban populations, is likely confront a number of significant challenges.

Conclusion

The suite of variables and their constituent elements described in this chapter represent the principal components of the political ecology analytical framework presented in Chapter 1. In the following chapter, I demonstrate how interrelationships between these environmental, economic, social, and political variables at different spatial scales and points in time, help to shed light on the environmental and socioeconomic outcomes of woodfuel energy production in one Rural Community in Senegal.

CHAPTER SIX

TOWARDS A SYNTHESIS OF ENERGY-ENVIRONMENT RELATIONSHIPS IN THE RURAL COMMUNITY OF LOUR ESCALE

In this chapter, I consider a number of relationships between elements of the environmental, economic, social, and political variables identified in Chapter 5. In so doing, I draw attention to some of the associations among the principal components of this analysis that inform the connection between national woodfuel energy dependence and local environmental conditions in the Lour Rural Community. The aim here is to demonstrate how information and data collected during my research help to shed light on the problems associated with woodfuel-related land use in the study area.

In the process phase of the political ecology approach, one can explore numerous combinations and permutations in the relationships between variables identified during the categorization phase. Within the scope of the present study, however, only a select sample of these can be addressed in sufficient detail. Consequently, I concentrate here on issues related to the importance now attached to local community participation in managing natural resources in the study area. Discussion on this theme addresses the research questions posed in Chapter 1 concerning the scope for participatory approaches to contribute to a resolution of Senegal's woodfuel energy problem.

I begin the chapter with a brief description of the physical landscape in the Lour Rural Community. As I illustrate below, prevailing environmental conditions pose a number of challenges to successful management of woodland resources for energy production and other tree-related products and services. In the following section of the chapter, I discuss both historical and contemporary aspects of woodfuel production in the Kaolack region and Lour Rural Community. This second section sets the stage for an examination in the final part of the chapter of issues surrounding local community participation in the management of the area's woodland resources.

Environmental Conditions in the Lour Rural Community

The Lour Rural Community and Kounghoul *Arrondissement* of which it is a part are located in the eastern half of the Kaffrine Department, the largest of the three administrative departments that comprise the Kaolack region. The landscape in this area is typical of the monotonous plain that dominates the western half of Senegal north of The Gambia. This is a region of extremely low relief, where elevation ranges between only 20-50 meters above sea level.

As defined in Chapter 3, the study area is located squarely within the Sudanian climatic zone and the southeastern section of Senegal's Peanut Basin agro-ecological zone. Average annual precipitation recorded at the town of Kounghoul for the thirty-year period 1961-1991

is 685 mm (27 in.), and falls on an average of 45 days per year (see Figure 6.1).¹ Rainfall occurs primarily during a three-month period from July to September, although occasional early rains fall in June and late rains usually extend into October.

According to Giffard's classification, the area is located in a transition zone between sudano-sahelian and sudano-guinean vegetation types and is characteristic of a dry wooded savanna.² Ferruginous tropical soils (Alfisols) dominate this part of the Peanut Basin.³ Known locally as *deck-dior* soils, these soils cover 82% of the surface area in the Lour Rural Community.⁴ Although soils in the southeastern Peanut Basin are generally more fertile than those in the central and northwestern sections, due mostly to the maintenance of longer fallow periods associated with relatively lower population densities, they have become increasingly subject to wind and water erosion.⁵

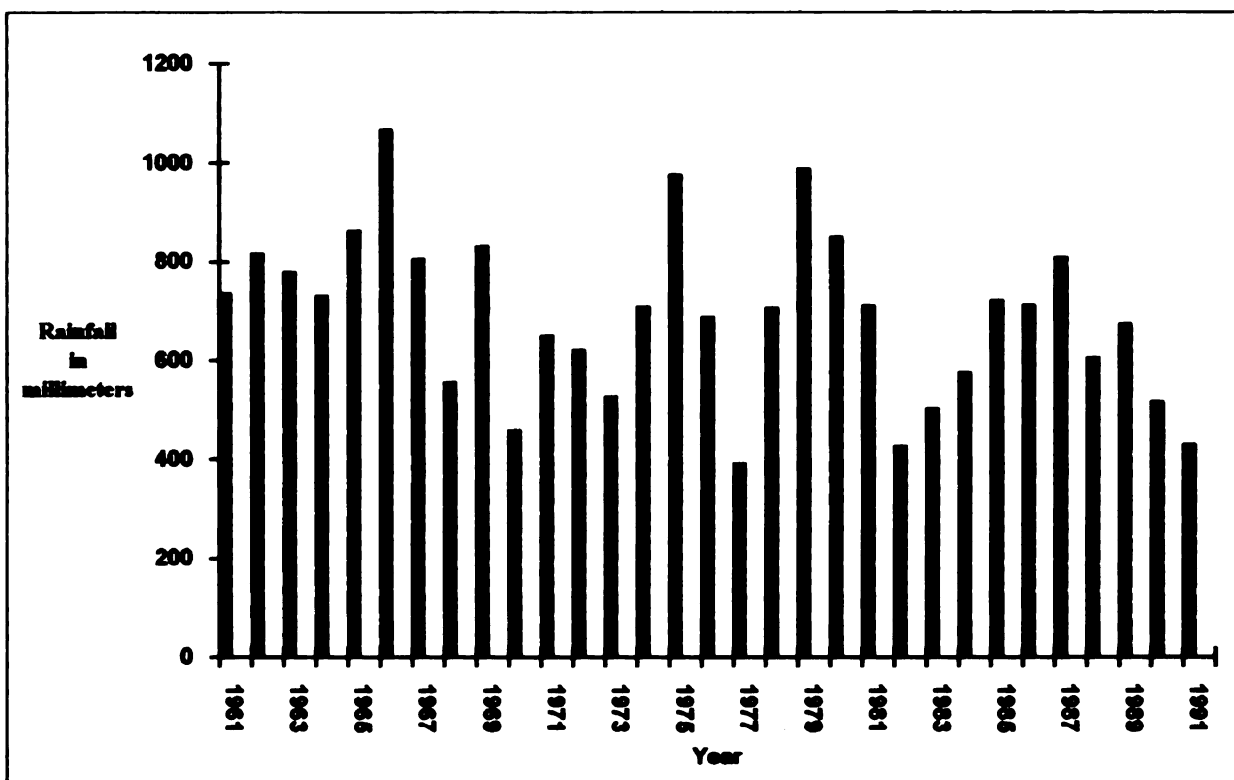
¹ Data obtained from records at the National Meteorological Directorate (DMN) field station in Koungheul.

² Giffard 1974: 104. See Table 3.3 and Figure 3.3 in Chapter 3.

³ Steila 1976: 141-43; Gritzner 1988: 22, 24.

⁴ République du Sénégal 1988c: 1.

⁵ Rodale Institute 1989: 36-43.



Source: National Meteorological Directorate (DMN), Kougheul Field Station.

Figure 6.1 - Total Annual Rainfall at Kougheul, 1961-1991

Surface water availability in the region is highly seasonal. Localized depressions and intermittent stream floodplains maintain surface water for several weeks during the rainy season. Throughout the remainder of the year, however, the area's water supply is restricted to wells sunk deep into the sub-surface aquifer.⁶ The difficulties associated with obtaining adequate year-round water supply limit considerably the agricultural, pastoral, and silvicultural productivity of the area.

Woodfuel Production in the Kaolack Region

In this section I discuss the context in which woodfuel production has taken place over time in the Kaolack region and the Lour Rural Community. Both commercial charcoal production for the urban markets of western Senegal and firewood collection for local rural households are examined.

With regard to charcoal production, data available from forest service records reveal a precipitous decline in this activity over the last decade. This decline, in turn, suggests the migration through the area of what can be described as Senegal's charcoal production "front," representing the progressive southeastward extension of woodland exploitation to satisfy household energy demand in the country's major cities and towns.⁷ This charcoal

⁶ Depths range from 50-150 meters (République du Sénégal 1987c: 2).

⁷ Despite the difficulties of exploiting the increasingly distant and less accessible woodlands of eastern and southern Senegal, which Giffard (1974: 217) once considered an unlikely scenario, recent evidence clearly indicates

production dynamic, coupled with the process of agricultural expansion discussed in Chapter 4, constrains the local population's ability to satisfy its own energy needs. With respect to local firewood supply, data presented here from a household energy survey I conducted point to incipient woodland degradation in the study area.

Commercial Charcoal Production

Investigation of the commercial production of woodfuels to supply urban centers in western Senegal reveals that forest resources in the Kaolack region have been subject to exploitation for many decades. Recently, most of this activity has been concentrated in the eastern part of the region in and around the study area. In the following paragraphs, I place this activity in historical perspective, illustrating the consequences of long-standing commercial charcoal production for current local woodfuel supply.

As mentioned in Chapter 4, colonial-era construction of the Dakar-Niger railroad and attempts to protect the Ferlo pastoral region from Wolof-Mouride encroachment gave rise to a series of official land classifications intended to conserve woodland resources. Nowhere was this more significant than in the forests of what is now the Kaffrine Department. Thirteen classified areas gazetted between the

that this is now taking place (see République du Sénégal 1993a: 3). A similar occurrence of the charcoal "front" phenomenon is noted for the area surrounding Kano, Nigeria, by Cline-Cole et al. (1990: 524).

late-1930s and the mid-1950s cover one-fifth of department's nearly 1.2 million hectares (see Table 6.1).

**Table 6.1 - Classified Forests and Silvo-pastoral Reserves,
Department of Kaffrine**

Forest/ Reserve	Date Classified	Area in Hectares ^a	Classification Type ^b
Birkelane	1941	8,100 (2,500)	Rail-side savanna
Delby	1938	7,000 (2,000)	Rail-side savanna
Kaffrine	1944	700	Rail-side savanna
Kassas	1952	12,150 (2,000) (1,500)	Rail-side savanna
Koumpentoum	1950	4,000	Rail-side savanna
Koungheul	1951	1,400	Sudanian Savanna
Maka-Yop	1940	20,000	Rail-side savanna
Malem-Hodar	1941	5,000	Rail-side savanna
Mbégué	1951	73,000 (45,000)	Silvo-Pastoral Reserve
Ndankou	1952	3,000	Sudanian Savanna
Sagna	1948	3,900	Rail-side savanna
Saloum	1956	95,000	Silvo-Pastoral Reserve
Pathé Thiangaye	1951	8,000	Sudanian Savanna
Total		241,250	

Source: République du Sénégal 1991c: 38.

^a Figures in parentheses represent portions of the respective classified areas that are under management contracts, usually to Mouride marabouts, for peanut cultivation.

^b Classifications according to Giffard (1974).

Despite these early protection measures, subsequent human population pressure, agricultural expansion, and commercial woodfuel production for a growing urban population have taken their toll on the area's forests. As a result, woodfuel production in the central Peanut Basin has progressively declined over the last several decades.

Official data on charcoal output show that the Basin's share of national production dropped from 94% in 1961, to only 4% in 1990. The production data for individual administrative regions in the Peanut Basin are given below in Table 6.2.

Table 6.2 - Official Charcoal Production in the Central Peanut Basin, 1961-1990

Region	Percent Share of National Production			
	1961	1970	1980	1990
Diourbel	3	2	0	0
Louga ^a	-	-	7	1
Sine-Saloum ^b	69	48	13	-
Fatick	-	-	-	0
Kaolack	-	-	-	3
Thiès	22	6	4	0
Total	94	56	24	4

Source: Forest Service Data compiled by author.

^a Louga was created as a separate region in 1976; prior to this date it was a department in the Diourbel region.

^b In 1984 the former Sine-Saloum region was divided to form the regions of Fatick and Kaolack.

Clearly, the Sine-Saloum/Kaolack region has consistently accounted for the major share of charcoal produced in the Peanut Basin. Since disaggregated data for the earlier time periods are not available, it is difficult to illustrate precisely the amounts produced in the constituent areas of "Sine" and "Saloum" which, after the redrawing of administrative boundaries in 1984, became the regions of Fatick and Kaolack respectively. It is reasonable to assume, however, that over the years the

majority of charcoal came from the less densely populated woodlands of the Kaffrine department. Much of the western and southern Sine-Saloum, i.e., the present-day Fatick region and the Kaolack and Nioro du Rip departments of the Kaolack region, have long been densely settled areas of peanut cultivation with fewer commercially exploitable woodland resources.

Recent data support the position of the Kaffrine department as the primary woodfuel producing area in the Kaolack region. Forest service reports on charcoal production since 1985 - after the new administrative regions were established - offer a clear picture not only of the importance of the Kaffrine department, but also of the Kounghoul *arrondissement* within it. For the nine charcoaling seasons from 1985 to 1993, a total of 129 official production sites, known as *chantiers*, were assigned to charcoal cooperatives licensed to operate in the Kaolack region. Of these, at least 87 (67%) were located in the Kounghoul *arrondissement* (Table 6.3). The distribution of production sites by rural community within the Kounghoul *arrondissement* is given in Table 6.4.

**Table 6.3 - Charcoal Production
in the Kaolack Region, 1985-1993^a**

<i>Chantiers</i> by Arrondissement, Kaffrine Department					
Year	Birkelane	Koungheul	Malem Hodar	Not Spec. ^b	Total
Number of <i>Chantiers</i> Assigned (% of total)					
1985	0 (0)	9 (69)	0 (0)	4 (31)	13 (100)
1986	0 (0)	9 (69)	0 (0)	4 (31)	13 (100)
1987	1 (5)	9 (45)	0 (0)	10 (50)	20 (100)
1988	1 (6)	7 (44)	0 (0)	8 (50)	16 (100)
1989	0 (0)	9 (82)	0 (0)	2 (18)	11 (100)
1990	1 (11)	5 (56)	0 (0)	3 (33)	9 (100)
1991	1 (9)	8 (73)	0 (0)	2 (18)	11 (100)
1992	0 (0)	14 (78)	1 (6)	3 (16)	18 (100)
1993	0 (0)	15 (83)	2 (11)	1 (6)	18 (100)
Total	4 (3)	87 (67)	3 (2)	35 (27)	129 (99) ^c

Source: Forest Service Annual Reports for Kaolack Region and author's field checks.

^a Data prior to 1985 not reported by production site location.

^b Not Specified: Due mostly to poor record keeping, the precise locations for 27% of all chantiers assigned from 1985-1993 could not be verified.

^c Does not equal 100% due to rounding.

**Table 6.4 - Charcoal Production Sites in Kounghoul
Arrondissement, 1985-1993**

Rural Community	Nearest Village	# Chantiers Assigned	% Total Arrond.^a	% Total Region^b
Gainthe Pathé	Khaye Boubou	3		
	Ndiolkhoss	4		
	Ngouye Diery	6		
	<u>Thiobe</u>	<u>8</u>		
	Sub-total	21	24%	16%
Kounghoul	Arafat Mbayene	2		
	Darou Thiekene	1		
	Douba Lampour	2		
	Miname	4		
	<u>Missirah</u>	<u>1</u>		
	Sub-total	10	12%	8%
Lour Escale	Affé	3		
	Koura Mouride	1		
	Lour	1		
	Ndiayene Lour	1		
	Niolé	1		
	Nioro Kéba	1		
	Touba Thiarène	10		
	<u>Yeti-Khaye</u>	<u>2</u>		
	Sub-total	20	23%	15%
Maka Yop	Coly	3		
	Fass Thialène	1		
	Méo Ndiobene	2		
	Nguérane	3		
	<u>Touba Wendou Aere</u>	<u>4</u>		
	Sub-total	13	15%	10%
Ribot Escale	Koung Koung	6		
	Poubard	2		
	<u>Taw Fekhe</u>	<u>1</u>		
	Sub-total	9	10%	7%
Saly Escale	Keur Bara	2		
	Keur Mandoumbé	2		
	Keur Socé	1		
	Koyé Bouré	1		
	Makhama	4		
	Mousdalifa	2		
	<u>Yeve Bouré</u>	<u>2</u>		
	Sub-total	14	16%	11%
Totals		87	100%	67%

Source: Forest Service Annual Reports for Kaolack Region.

^a Percent of total chantiers in Kounghoul Arrondissement.

^b Percent of total chantiers in Kaolack Region.

Chantiers are the designated sites where forest products cooperatives are authorized to make charcoal. In theory, production takes place in areas under the careful supervision of the forest service and is guided by sound ecological and silvicultural criteria. There are indications, however, that *chantier* designation is instead based primarily on logistical criteria that result in repeated selection of the same site year after year.⁸ This increases the risk that certain areas will be overexploited, which in turn exacerbates conditions with respect to local firewood collection. For example, information obtained from discussions with forest service agents, members of forest products cooperatives, and area villagers suggest that *chantier* locations are chosen to accommodate easy access for the cooperatives and proximity to forest service stations. In the case of the Lour Rural Community, data from the household woodfuel energy survey presented below support this contention.

As suggested above, the eastern part of the Kaolack region is witnessing the passage of Senegal's charcoal production front. This spatial progression is represented by the declining importance of charcoal production in the Kaffrine department, and its concomitant increase in the Tambacounda and Kolda regions to the east and south. Part of the drop-off in production is explained by deliberate government intervention, reflected in a 1987 policy that

⁸ République du Sénégal 1994: 14-15; personal communication, interview no. 71.

limits the marketing of commercially produced charcoal in several regions of the country.⁹

In the Kaolack region, this policy led to the so-called *domiciliation* ("confinement") of charcoal production. Essentially, the policy states that, henceforth, charcoal produced in the Kaolack region can be sold only in markets within the region itself; it may no longer be "exported" to markets in other parts of the country, particularly Dakar. Motivation for the policy, according to statements in forest service annual reports, stems from a concern that woodlands in the Kaolack region are overexploited, that too many forest products cooperatives operate in the area, and that action is necessary to protect the productive potential of the region's remaining woodlands.¹⁰ As noted in Table 6.5, application of the policy reduced the allocation of official charcoal production quotas to the Kaolack region from over 300,000 quintals in 1987 to about 70,000 quintals in 1988.

⁹ République du Sénégal 1993a: 3; République du Sénégal 1991c: 78.

¹⁰ République du Sénégal 1987b: 68.

Table 6.5 - Official Charcoal Production Quotas,
Kaolack Region, 1981-1993^a

Year	Quintals ^b
1981	120,000
1982	(no data)
1983	227,000
1984 ^c	259,000
1985	242,000
1986	351,000
1987	304,000
1988	70,000
1989	50,000
1990	45,000
1991	61,000
1992	63,000
1993	50,000

Source: Forest Service Annual Reports for Kaolack Region compiled by author.

^a These figures indicate quantities allocated for production by the Forest Service, but do not necessarily reflect the amounts actually produced.

^b 1 quintal = 100 kg.

^c Data prior to 1984 are given for former administrative region of the Sine-Saloum, and thereafter for the region of Kaolack.

Forest products cooperatives operating in the Kaolack region were dismayed by the new confinement policy.

Remarks made in forest service annual reports indicate a lack of compliance among the registered cooperatives with this and other new regulatory measures such as increased royalties, taxes, and fees.¹¹ Presidents of the cooperatives consider the new policy as an attempt to squelch their business activity.

¹¹ République du Sénégal 1988b, 1989, 1990b; also, personal communications from interview nos. 23, 27, 32, 42, & 66.

In the face of diminishing charcoal quota allocations, the cooperatives' recourse is either to compete with their counterparts in the Tambacounda and Kolda regions or to continue producing charcoal illegally, i.e., in excess of the official quotas, in the Kaolack region. Given current government policy emphasizing participatory natural resource management at the local level, discussed later in this chapter, attempts by the forest products cooperatives to continue illegal production may prove to be a source of increased conflict between the cooperatives, rural population, and government agencies such as the forest service.

Local Firewood Collection

Woodland resources in the Lour Rural Community are subject to a variety of pressures. The quality and quantity of available resources, as well as the degree to which woodland degradation occurs, are a function of both natural and human factors. Natural factors include rainfall variability and drought, water table fluctuations, soil conditions, bush fires (often associated with human activity), and termite infestation. Human factors include land clearance for agriculture, livestock grazing, woodcutting for construction and toolmaking purposes, and firewood collection and charcoal production.

Assigning accurate quantitative weights to the different factors that contribute to woodland degradation is beyond the scope of this study. Nevertheless, observations and data from the field indicate that

commercial charcoal production is regarded by many among the local population as a contributing factor to woodland degradation and to increased difficulty in meeting household energy needs.

In this section I discuss several concerns regarding woodland resources in the Lour Rural Community based on interviews and survey data on women's views of the local woodfuel situation. Women are able to provide particularly good information about changes taking place in the natural landscape. Given their near total dependence on woodfuel energy, they have intimate knowledge about the status of tree-related resources in the area.

Discussion of women's perceptions of the woodfuel situation in the Lour Rural Community first requires a statement recognizing the multiple rigors of rural life in this part of Senegal. As explained in Chapter 4, compared to the more precarious environmental situation in the western areas of the "old" Peanut Basin, the environmental and socioeconomic consequences of woodfuel production in the southeastern Peanut Basin are only now becoming apparent. As a consequence of the relatively abundant yet dwindling woodland resources available in the latter region, which includes the Lour Rural Community, assuring an adequate supply of firewood is often acknowledged as a somewhat less severe problem compared to other demands on household labor. This is reflected in the responses women offered when asked to describe their most difficult domestic chores (see Table 6.6).

**Table 6.6 - Women's Perceptions on Household Labor Tasks
in the Lour Rural Community**

	Order of Difficulty According to Respondent			
Task	First	Second	Third	Total
Number of Responses (% of Survey)				
Millet Processing ^a				
- threshing	43 (48)	22 (25)	15 (17)	80 (90)
- pounding	3 (3)	13 (15)	13 (15)	29 (33)
- grinding	3 (3)	11 (12)	9 (10)	23 (26)
Hauling Water	36 (40)	23 (26)	9 (10)	68 (76)
Firewood Collection	2 (2)	6 (7)	21 (24)	29 (33)
Cooking	2 (2)	7 (8)	16 (18)	25 (28)
Laundry	- (-)	7 (8)	6 (7)	13 (15)

Source: Author's Household Energy Survey, 1993.

^a Women's responses for millet processing reflect the various stages of preparation.

The data in Table 6.6 indicate that various aspects of food processing and water provision are more demanding tasks than assuring an adequate supply of firewood. Ninety percent of the women surveyed place millet threshing among the top three most difficult household tasks (48% as the most difficult), and 76% percent mentioned water supply within the top three tasks (40% as the most difficult). Although one-third of the women surveyed noted firewood collection among the top three most difficult tasks, only 2% viewed it as being the most difficult chore they perform.

The data reported in Table 6.6 reflect both the nature of rural labor in and the physical geography of the Lour Rural Community. Since it occurs daily and demands considerable physical effort, it is not surprising that food processing registers high on the list of difficult household chores. Hauling water is also a daily task during most of the year, and it too requires substantial physical energy.¹² As mentioned earlier, water supply is one of the Rural Community's most pressing problems.

Despite the fact that firewood collection does not rank highest on the list of women's travail, 95% of those surveyed responded positively when asked whether they experience difficulties with firewood supply. The existence of a firewood collection problem, therefore,

¹² Water collection tasks are slightly mitigated during the brief rainy season given greater access to surface water and catchment of supplemental water from roof-top runoff. At most other times, however, women haul water manually with ropes and buckets from rather deep wells.

appears to be a matter of relative difficulty when compared to other domestic chores. For example, unlike food processing and water supply, firewood collection is not part of the daily routine for most households.¹³ The nature of the problems women encounter in firewood collection are summarized below in Table 6.7.

¹³ Data from the household survey indicate that, on average, women in the Lour Rural Community collect firewood by headload approximately every third day (n=55). Those women indicating access to animal-drawn carts (n=43) report collecting firewood twice a month on average. It should be noted that collection with carts is often a supplement to, not a substitute for, headload collection. Of the 43 women reporting animal-cart collection, 20 (47%) also collect firewood by headload while 23 (53%) report using only cart collection.

**Table 6.7 - Difficulties in Firewood Supply
Reported by Women in the Lour Rural Community**

Type of Difficulty	Village			Total
	Lour (n=30)	Touba (n=29)	Thiarène (n=30)	
	# of women reporting (%)			
Distance to Supply Area	27 (90)	24 (83)	24 (80)	75 (84)
Deforestation Caused by Charcoal Production	18 (60)	1 (3)	0 (0)	19 (21)
Fatigue	0 (0)	13 (45)	4 (13)	17 (19)
Lack of Transport ^a to Supply Area	4 (13)	3 (10)	9 (30)	16 (18)
Disappearance of Preferred Tree Species	2 (7)	3 (10)	1 (3)	6 (7)
High Purchase Price	1 (3)	0 (0)	0 (0)	1 (1)
Wet Wood in Rainy Season	1 (3)	0 (0)	0 (0)	1 (1)

Source: Author's Household Energy Survey, 1993.

^a This is a reference to animal-drawn carts. The response is similar to that of "Distance to Supply Area" noted above.

The data in Table 6.7 suggest the lack of satisfactory woodfuel supply in proximity to household locations. An overwhelming majority of all respondents (84%) in the villages surveyed report distance to collection site as a problem. In addition, 18% of all respondents mention "lack of transport" - a reference to the desire for access to animal-drawn carts - which further suggests that distance

to collection site is a problem. Although greater distance to firewood collection sites is often attributed as a sign of deforestation due to excessive commercial woodfuel production,¹⁴ one should remember that other factors, such as land clearance for farming and local firewood collection itself, can also contribute to a decline in the availability of nearby trees.

A relationship between distance to firewood collection site and commercial woodfuel production is nevertheless suggested when data in Table 6.7 are considered on the basis of village location. For example, responses obtained in the village of Lour Escalé, where problems of distance to supply area and deforestation attributed to nearby charcoal production were reported by 90% and 60%, respectively, of those surveyed, correspond with the frequent assignment in recent years of charcoal *chantiers* near the village.¹⁵

Solutions proposed by women to alleviate firewood collection problems also support a connection between difficulty in supply and nearby charcoal production. As noted below in Table 6.8, 77% and 64% of the women surveyed in the villages of Lour Escalé and Thiarène suggest limiting or prohibiting charcoal production in their respective areas. The vicinity of Thiarène, it should be

¹⁴ See Eckholm et al. (1984) and Agarwal (1986).

¹⁵ See Table 6.5. Chantier sites within the vicinity of Lour Escalé include: Affé, Lour, Ndiayene Lour, and Yeti-Khaye. Note that fewer charcoal *chantiers* have been assigned in the vicinity of Touba Aly Mbenda.

noted, has also been the site of much repeated charcoal production activity since the mid-1980s.¹⁶

**Table 6.8 - Solutions to Firewood Supply Difficulties
Recommended by Women in the Lour Rural Community**

Recommended Solution	Village			
	Lour (n=30)	Touba (n=29)	Thiarène (n=30)	Total (n=89)
	# of women reporting (%)			
Limit or Prohibit Charcoal Production	23 (77)	14 (48)	19 (63)	56 (63)
Acquire Means of Transport to Supply Area	5 (17)	13 (45)	21 (70)	39 (44)
Establish Household Woodlot (Reforestation)	4 (13)	3 (10)	1 (3)	8 (9)
Have Men Help with Firewood Collection	1 (3)	2 (7)	4 (13)	7 (8)
Switch to Using Butane	3 (10)	0 (0)	0 (0)	3 (3)
More Frequent Rotation of Charcoal Production Sites	0 (0)	2 (7)	0 (0)	2 (2)
Use Improved Woodstoves	0 (0)	1 (3)	0 (0)	1 (1)
Purchase Firewood	1 (3)	0 (0)	0 (0)	1 (1)

Source: Author's Household Energy Survey, 1993.

In addition to overcoming distance, other signs of difficulty in firewood collection are apparent in the Lour Rural Community. Survey data from the villages of Lour,

¹⁶ See Table 6.5.

Touba, and Thiarène indicate that households are beginning to turn to the purchase of firewood and the allocation of male labor (and the access to animal-drawn carts which men control) in order to make up for shortages in locally available firewood resources. Sixty-nine percent of all households report occasional purchase of firewood, and 26% say that male labor contributes toward firewood collection (see Table 6.9).

Table 6.9 - Changes in Firewood Supply
Reported by Women in the Lour Rural Community

Reported Change	Village			
	Lour (n=30)	Touba (n=29)	Thiarène (n=30)	Total (n=89)
	# of women reporting (%)			
Occasional Purchase of Firewood	27 (90)	19 (66)	15 (50)	61 (69)
Allocation of Male Labor	6 (20)	14 (48)	3 (10)	23 (26)

Source: Author's Household Energy Survey, 1993.

While in the field, I personally participated in several forays with men using animal-drawn carts to collect firewood in the areas surrounding the village of Touba. During these trips I witnessed considerable cutting of live wood as opposed to the collection of dead wood. Villagers point out that finding an adequate supply of preferred dead wood has become more difficult due to the repeated presence

of charcoal producers in the area.¹⁷ With increasing distances to wooded areas and problems of allocating sufficient female labor to firewood collection now observed in the Lour Rural Community, it is reasonable to assume that one will continue to see more firewood purchases and more frequent use of male labor in firewood collection.

Problems of assuring satisfactory quantities of woodfuel are accompanied by reductions in the quality of locally available woodland resources in the Lour Rural Community. Changes in the composition and prevalence of certain woody species are also signs of woodland degradation. Discussions with local residents on this subject indicate the disappearance of highly valued, formerly abundant tree species.¹⁸ These include a decline in the availability of a species known locally as *Ir* (*Prosopis africana*), appreciated by local blacksmiths for its quality charcoal, and the rarity of *Garabe Laobe* (*Bombax costatum*), valued for in toolmaking and construction.

Further insight into qualitative changes in woodland resources can be gleaned from information on tree species used for firewood in the area's households. Table 6.10 summarizes responses women offered when asked about the species they prefer to use as firewood.

¹⁷ Interview nos. 56, 57, 59, & 72. Recall that lower moisture content in wood makes for easier carbonization.

¹⁸ Interview nos. 59, 63, & 74.

**Table 6.10 - Preferred Tree Species for Firewood
Reported by Women in the Lour Rural Community**

Species ^a	Order of Preference					Total
	1st	2nd	3rd	4th	5th	
Number of Responses (% of Survey)						
Ratt	54 (61)	25 (28)	5 (6)	0 (0)	0 (0)	85 (96)
Géej	14 (16)	17 (19)	15 (17)	4 (4)	3 (3)	53 (60)
Ween	11 (12)	8 (9)	16 (18)	10 (11)	2 (2)	47 (53)
Dimb	10 (11)	14 (16)	13 (15)	4 (4)	3 (3)	44 (49)
Nger	0 (0)	18 (20)	6 (7)	3 (3)	1 (1)	28 (31)
Kel	0 (0)	4 (4)	7 (8)	4 (4)	0 (0)	15 (17)
Sam	0 (0)	2 (2)	2 (2)	2 (2)	2 (2)	8 (9)
Tap	0 (0)	1 (1)	3 (3)	0 (0)	0 (0)	4 (4)

Source: Author's Household Energy Survey, 1993.

^a Species names given in Wolof; botanical equivalents are:

Ratt	<i>Combretum glutinosum</i>	Nger	<i>Guiera senegalensis</i>
Géej	<i>Anogeissus leiocarpus</i>	Kel	<i>Grewia bicolor</i>
Ween	<i>Pterocarpus erinaceus</i>	Sam	<i>Acacia macrostachya</i>
Dimb	<i>Cordyla pinnata</i>	Tap	<i>Combretum nigricans</i>

Of the species listed in Table 6.10, the first three - *Combretum glutinosum*, *Anogeissus leiocarpus*, and *Pterocarpus erinaceus* - are noted by Maydell as being particularly good woodfuels: the latter two are especially

suited for charcoal production.¹⁹ Although there is little evidence at present to suggest that charcoal production has adversely affected women's ability to find sufficient quantities of *Anogeissus leiocarpus* and *Pterocarpus erinaceus* (only 7% of all women surveyed mentioned having difficulty finding preferred species (see Table 6.7)), one cannot disregard the possibility that competition for these species might lead to dependence on inferior firewood species sometime in the future.²⁰

The preference noted for *Combretum glutinosum* deserves special mention. As noted in Table 6.10, 96% of survey respondents cite this species among their top five preferred woodfuels; 61% rank it in first position. Although Maydell gives this shrub a high rating for use as firewood, others describe it as an invasive species associated with degraded woodland conditions.²¹ When asked why they prefer *C. glutinosum*, most women do remark that it ignites easily and burns well. However, the popularity of *C. glutinosum* for use as firewood might also be explained by its wide availability as a rapidly growing invasive species.

¹⁹ Maydell 1990. Suitability for charcoal production is determined primarily by calorific value of carbonized wood.

²⁰ Although my survey data indicate no evidence of decline in the preferred woodfuel species, it is worth noting that Montagne (1988: 9) - a former technical advisor to the PARCE project - cites the diminution of *Pterocarpus erinaceus* in the nearby major charcoal-producing region of Tambacounda.

²¹ See Maydell (1990), Lykke (1994: 51-52) and Grenier (1988: 33).

According to the data presented above, together with information gleaned from interviews with members of the local population, there are clear signs that assuring adequate supplies of firewood and other tree-related resources is becoming increasingly difficult in the Lour Rural Community.²² The incipient monetization of firewood supply, changes in labor allocation to firewood collection, and disappearance of preferred tree species noted here are all indicative of similar consequences that attended woodland degradation in other parts of the Peanut Basin.²³

Woodfuels, Resource Management, and Community Participation: Interrelationships in the Energy-Environment Nexus

For the eastern Kaolack region and the Lour Rural Community, the discussion so far in this chapter illustrates both the environmental challenges to natural resource management and the intensity with which the area's resources have been exploited to satisfy national energy demand. In this final section, I examine the context within which the local population is being called upon to take greater responsibility for overall management of the area's natural resources, and the implications this call has for woodfuel energy production. I endeavor to demonstrate a number of obstacles likely to be confronted by attempts to improve natural resource management through more formal local community involvement.

²² Interview nos. 64, 69, & 70.

²³ See Grenier 1988; also on the signs of degraded conditions in firewood supply see Agarwal 1986 and Hoskins 1979.

As noted in Chapter 5, numerous - although not new - trends in international development thinking currently favor community-based initiatives as the best way to both protect natural resources and promote economic development at the local level. These trends reflect ideas about popular participation, empowerment, and reliance on indigenous technical knowledge in the sociocultural realm, and democratization, property rights, and government decentralization in the political sphere (see Table 5.1). A major part of the focus on community-based initiatives seeks to promote decentralization of authority and responsibility for natural resource management to regional and local organizations and institutions.²⁴

In Senegal, many external actors are engaged in the planning, funding, and execution of development policies and projects designed to support local community participation. However, transcending the rhetoric of participation as promoted by international agencies and the national government, in order to achieve the practice of participation in the fields and forests of rural Senegal, will first require that attention be paid to a number of unresolved issues.

Observations from my research offer a glimpse into the kinds of problems that impede the transformation of decentralization as theorized at the international and national levels into effective practice at the local level. These include weaknesses in local institutions, a

²⁴ Associates in Rural Development 1992: 8.

sociocultural foundation not entirely conducive to the participatory paradigm, the presence of powerful elites with vested interests to protect, and difficulties in resolving land tenure conflicts under the auspices of sometimes weak and often conflicting forms of local governance. These issues illustrate some of the interrelationships at work between economic, social, and political variables that influence management of natural resources in the energy-environment nexus.

Sociocultural Dissonance in Community Participation

In the Chapter 5 discussion outlining elements of the social variable at different scales of analysis, I noted the attention gender issues receive in economic development and environmental conservation circles among international organizations. I also stated how this concern is reflected in various ways at the national level, with an example in Senegal being the incorporation of specific language related to women as important resource managers in the recently revised National Forestry Action Plan. As the data presented in the previous section of this chapter amply illustrate, gender issues are central to the discussion of rural woodfuel supply.

Clearly, women bear the brunt of the burden of diminishing firewood supply and increasing woodland degradation. This is evident in terms of the additional labor they must allocate to satisfying household energy requirements. However, despite the attention now focused on gender, empowerment, and women's participation at

national and international levels, local circumstances often dictate that women's concerns receive only incidental consideration.

At no time is the rhetoric of local community participation more suspect than when it comes to the role of women. Only a few days in the Lour Rural Community are needed to convince even the most casual observer of the inferior social position women occupy in this area. Men dominate almost every facet of rural life including the productive resources of land, agricultural technology, and capital. Although women are keen to participate in the projects of village development associations such as the Kounghoul Entente, their voice in these most progressive of Senegal's rural institutions is still often limited due to prevailing sociocultural conditions.

For example, although women dominate, numerically speaking, the ranks of the Kounghoul Entente by a margin of two-to-one, their attendance at the three monthly Entente meetings I attended while in the field never accounted for more than twenty-five percent of those present.²⁵ As these seemingly interminable sessions stretch into the late afternoons, the number of women present steadily dwindles as they must inevitably return home to attend to household chores. At other times, such as the smaller "committee" meetings I attended in the village of Touba, gatherings

²⁵ According to its development committee secretary, the Kounghoul Entente counted 656 female and 318 male members in 1993. Attendance at monthly meetings is from my informal survey of males and females present.

were held late in the evening when women have a brief respite from their incessant travail. No matter when or where these gatherings are held, women seldom assert themselves or voice their concerns in front of the men who preside over these meetings. Similar experiences are reported for another village development association in the neighboring Kounghoul Rural Community. As Blundo notes, although association meetings are ostensibly open forums where everyone is free to contribute their opinion, in reality "these meetings reaffirm the existing social hierarchy...[in which] discussion would seem to concern the men only".²⁶

Reconciling the low social position women occupy in rural Senegal with the high expectations for their participation in decentralized natural resource management envisioned by national and international development agencies is certain to pose a significant challenge.²⁷ This situation clearly illustrates the dissonance in the way some of the social variables identified in Chapter 5 are manifest at different points along the local-global continuum.

²⁶ Blundo 1994: 108.

²⁷ A cartoon appearing in an Oxfam (UK) publication speaks in an eloquent and amusing way to this issue. In it is depicted a burly charcoal maker with hatchet in hand peering over his shoulder at a group of women working assiduously at planting trees. The caption has the charcoal maker saying: "See, [woodfuel supply] isn't difficult...Women take care of the planting, and I take care of the rest" (Oxfam 1993).

In addition to addressing the issue of gender inequality, improvements to woodland resource management in the Lour Rural Community will certainly require an effort to strengthen skills, knowledge, and attitudes about forestry management. As described in Chapter 4, compared to their proven prowess in clearing land for agricultural colonization, the population in the study area has little practical experience either with natural woodland management or with reforestation. Today, however, training and skills development are more important than ever. This is especially so given opportunities that are expected to derive from changes in the national forest code that call for increased local involvement in the management and exploitation of woodland resources.

Several aspects of Senegal's revised forest code deserve special mention at this point. Enacted into law in February 1993, the new code contains provisions that confer upon local populations unprecedented opportunities, rights, and responsibilities - under the auspices of the rural councils - for the commercial exploitation of forest resources.²⁸ As summarized by van den Breemer and colleagues, the main changes in the new code that directly affect local communities include:

²⁸ For the text of the new forest code see République du Sénégal (1993e); see also Dieng et al. (1993). On the implications for Rural Community participation, see Ribot (1995c: 1594-95).

- 1) recognition of individual property rights in planted trees and products deriving from them (excluding rights to the land on which the trees are grown);
- 2) delegation of authority to local communities - subject to forest service-approved management plans - to manage forested lands under state control, including the authority to sell production rights to third parties to harvest local forest resources (for charcoal production, for example) or to engage in this opportunity themselves;
- 3) obligations on all forest users (i.e., commercial and subsistence) to manage resources sustainably through mandatory participation in reforestation, and:
- 4) the payment to local communities of a portion of the national forestry fund.²⁹

Consequently, Senegal's rural communities will have a legally recognized stake in the management of local forest resources, something that hitherto was the exclusive purview of the national forest service. As with the overall decentralization enterprise itself, however, there is a wide gap between theory and practice regarding the effective implementation of these new reforms.³⁰

In the Lour Rural Community, the legacy of the internationally-funded Central-East Forests Management and Reforestation Project (PARCE) does not bode well for the future prospects of popular participation in woodland management.³¹ After promoting reforestation programs during most of the 1980s, the lasting impact of the project amounts to little more than a few remaining project-trained

²⁹ van den Breemer et al. 1995: 107.

³⁰ See Ribot 1995c.

³¹ See footnote 12 in Chapter 2. *Projet d'Aménagement et de Reboisement du Centre-Est* (Central-East Forests Management and Reforestation Project).

nursery managers who claim that it is difficult to get people interested in planting trees.³² According to one international consultant, PARCE succeeded in training several people to manage a few small tree nurseries, but it did not achieve the more elaborate goal of promoting integrated land use management, i.e., agro-sylvo-pastoralism.³³ The latter goal seems to have faded with the withdrawal of project funding in the late 1980s.³⁴

Despite the international development community's newfound interest in tapping people's store of knowledge and awareness about local environmental conditions, i.e., in "indigenous technical knowledge," it is important to realize that not all local groups have adequate experience and/or "technical knowledge" about reforestation and natural forest management. Such is the case in the Lour Rural Community, where successful tree planting is subject to a number of constraints related to the semi-arid environment and the population's general lack of silvicultural experience.

For example, tree species found most frequently in the Kounghoul Entente's nurseries, including *Acacia senegal*,

³² From discussions during visits to all of the PARCE-trained nursery managers in the Lour Rural Community, they note that the population's interest in reforestation is limited mostly to planting backyard fruit trees or small groves of eucalyptus (Interview nos. 57, 59, 63 & 74).

³³ Montagne 1988: 21.

³⁴ This evaluation is confirmed by the president of the Kounghoul Entente, who indicated to me that the PARCE project "trained a 'few' nursery managers and sent an extension agent around from time to time, but never did much in the way of establishing a larger project in the area" (Interview no. 47).

Azadaractica indica, *Eucalyptus camaldulensis*, and *Prosopis africana*, although adapted to drought conditions, have not succeeded very well when transplanted to farmers' fields.³⁵ The problem seems to be one related more to poor site selection and lack of proper care of seedlings than it is to poor species selection. The site selection issue reflects in part the land tenure arrangements in the villages where the Entente tries to promote reforestation.

According to one tree nursery manager, site selection depends on identifying a landholder in the community who is willing to extend use rights to the Entente.³⁶ It appears that much land suitable for reforestation in the study area, e.g., in shallow depressions and along seasonally flooded streams, is off-limits to the Entente. One reason for this is that tree planting represents a long-term use of increasingly scarce land resources. Those who control access to land are more apt to provide temporary use rights to the Entente for seasonal millet production than they are for a multi-year use such as planting trees.

In terms of addressing the technical aspects of silviculture, the Senegalese forest service purports to be engaged in a campaign to help villagers better manage woodland resources. Building its widely touted "partnership with peasants," however, will require substantial effort on the part of the forest service to

³⁵ Interview nos. 60, 66, & 74.

³⁶ Interview no. 63.

earn the trust of local populations.³⁷ This will be difficult for a variety of historical and contemporary reasons, including the government's generally poor record of providing effective rural extension services, and the traditionally antagonistic relationship between villagers and government agents.³⁸ Since the early colonial period in francophone Africa, the somewhat draconian authority with which forest services have operated has done little to endear their agents to the rural population.³⁹ Experiences some villagers in the Lour Rural Community have had with the forest service illustrate these points.

In Senegal, the sweeping control over forested lands exercised by the forest service is a major source of conflict between the rural population and the government. In an interview in which I was able to ask about this relationship, a villager in the Lour Rural Community made this telling comment about the forest service: "we have no respect for these 'hommes de loi'" (lawmen).⁴⁰ Others often describe their experience with forest service agents in terms of being constantly fined for some minor infraction of the forest code, rather than encouraged to acquire and practice productive or protective silvicultural

³⁷ Building "partnerships with peasants" is a current refrain in the discussions on decentralized natural resource management (Interview nos. 12, 17, & 33).

³⁸ On the problems of Senegal's rural extension services, see Ba (1985), Gellar et al. (1980), Jones (1985), Kane (1988), and Moulton (1977).

³⁹ Clement & Strasfogel 1986: 91-2; Buttoud 1995: 40-46.

⁴⁰ Interview no. 70. The reference here to the "law" (i.e., "the state") is one example of the distinctions made between traditional/indigenous and contemporary/externally-related (i.e., colonial-inherited) institutions.

techniques.⁴¹ For many, the relationship is one of intimidation, reinforced by the paramilitary appearance and behavior of forest service personnel.⁴²

Such experiences with the forest service shape the views many villagers have regarding official state institutions in general, which are based in large part on a history of repression and domination rather than on cooperation and partnership. Settling old antagonisms between villagers and government agents, and improving the quality and availability of extension services, will be essential ingredients in helping local communities to deal successfully with the challenges of taking on greater responsibility for natural resource management.

This discussion here has highlighted a number of interrelationships among social, environmental-technical, and political components of the energy-environment situation that inform the local outcome of woodfuel production and the prospects for future improvements in resource management. Again, important connections among these components are evident along the local-global

⁴¹ Interview nos. 57, 70, & 74. Similar views held by villagers in other parts of Senegal are reported by van den Breemer et al. (1995: 101-102).

⁴² Indeed, it is easy to comprehend why forest service personnel are often seen as a threatening presence. On several occasions in the villages of the Lour Rural Community, I observed uniformed forest service agents prominently sporting their side-arms. Such scenes reflect the commentary of a representative from the Ministry of Women's Affairs at the international conference on the PAFS: "the presence of uniformed forest service agents in the field often has a threatening psychological impact on the rural population" (Field notes from roundtable meeting, 10/21/93). Also on the subject of villager-forest agent relationships, see Wiersum & Lekanne dit Deprez (1995).

continuum. For example, one observes how environmental and socioeconomic outcomes of woodfuel production in the Lour Rural Community, i.e., fewer trees and more difficult firewood supply conditions, result from decisions made to exploit local resources by forces exogenous to the local community.

Institutional Dissonance in Community Participation

In Chapter 1, I stated that the existence of functional institutions is considered to be an important element of decentralized natural resource management.⁴³ In Senegal, the local institutional context is complex, based on overlapping and often conflicting modern and traditional structures. In the Lour Rural Community, these dual structures are represented by the central government-established Rural Council and the indigenous Mouride-Wolof religious institution respectively.⁴⁴ A number of factors help to explain why rural councils tend not to operate as the autonomous, representative, and independent units of decentralized local government they were intended to be, and why the indigenous Mouride institution tends to maintain firm control over local affairs, thereby effectively attenuating full community participation as envisioned by actors at the national and international levels.

⁴³ Minis et al. 1989.

⁴⁴ For more on the legislation establishing the Rural Councils and Rural Communities, *Loi no. 72-25 du 19 avril 1972 relative aux communautés rurales*, see République du Sénégal (1991b).

First, there is the fundamental question concerning representation. According to the legislation that created Senegal's rural councils, the council president is also the official local representative of the sub-prefect, i.e., the centrally-appointed chief administrative officer of the *arrondissement* (the next level up the territorial hierarchy).⁴⁵ This raises the interesting question of exactly who represents whom via the institution of the rural council: Does the council, through its president, represent the wishes of the people of the rural community to the central government, or is the rural council president in effect the local spokesperson for the central government, via the sub-prefect, in affairs concerning the rural population?

A basic assumption about Senegal's rural councils is that they function as a body of popularly elected representatives who serve the member villages of the rural community. In reality, however, the position of rural councillor has less to do with representative governance than it does with political patronage. For example, election to this office does not begin with an individual announcement of candidacy or a petition of one's constituency for a place on the ballot.⁴⁶ Instead, "candidates" are appointed by local political party

⁴⁵ See Article 53 in République du Sénégal (1991b).

⁴⁶ It should be noted here that a rural councillor's constituency is in effect the entire population of the rural community. There are no village, ward, or other types of subdivision within the rural community for the purposes of selecting rural councillors.

officials to electoral lists based on party affiliation. Since electors are not permitted to vote a split ballot, appointment to the party list essentially guarantees a place on the rural council.

Since effective multiparty politics is a recent phenomenon in Senegal, it is not surprising that rural councils are dominated by the *Parti Socialiste*, the party in power since independence. In a study on the management of political power in Senegal's rural communities, Bellot notes that at the time of his work the *Parti Socialiste* controlled every rural council in the country.⁴⁷ He goes on to say that the state (i.e., the party in power) has in effect succeeded in overlaying its internal structure upon that of the territorial administrative structure, which in essence means that the rural community has become the basic unit of the *Parti Socialiste*. Bellot thus questions whether local power and authority reflect democratic forces at the local level, or if they are instead a manifestation of political control by higher echelons of the party hierarchy. The Lour Rural Council, composed of 18 councillors representing 11 of the rural community's 46 villages, appears to symbolize the latter case.

In interviews I conducted in several villages in the Lour Rural Community, there appeared to be a general consensus that the rural council is essentially comprised

⁴⁷ Bellot 1988: 16. In fact, Senegal's opposition parties tend to bypass the rural elections and concentrate their efforts at the national level, thereby guaranteeing the *Parti Socialiste* a solid lock on the rural councils (see Andriamirado 1990).

of the political cronies of the local *Parti Socialiste* leader.⁴⁸ For example, in addition to being one of the wealthiest landholders in the rural community, the current president of the rural council is in fact the local party chief. Residents of the rural community have indicated their dissatisfaction with the way the council is managed, particularly with respect to issues of land allocation and handling of the rural community's budget.⁴⁹ As Landell-Mills suggests, some of Africa's failed attempts to achieve accountable government at the local level have resulted in a more "top-down form of centralised democracy."⁵⁰ Considering the opinions of some members of the local population, one is led to question whether this has not become the case for the Lour Rural Council.

Ambiguity surrounding the question of representation on rural councils is complicated by the significant powers that are reserved for the sub-prefect. For example, all decisions taken by the rural council are ultimately subject to approval by the sub-prefect, who also has the power to suspend or dissolve councils under his jurisdiction.⁵¹ These powers are justified in terms of the roles the sub-prefect plays as facilitator, advisor, and supervising authority vis-à-vis the rural council. Abelin remarks, however, that this arrangement implies that the rural council essentially has two heads, one elected (the

⁴⁸ Interviews nos. 56, 58 & 61.

⁴⁹ République du Sénégal 1988b.

⁵⁰ Landell-Mills 1992: 567.

⁵¹ See Article 53 in République du Sénégal (1991b).

president) and one appointed (the sub-prefect).⁵² This in turn supports Gellar's contention that although in theory the rural councils have "broad powers" to administer local affairs, in practice the central state maintains control over these affairs through the office of the sub-prefect.⁵³

The broad powers maintained by sub-prefects derive in large part from the general background profile of the average rural councillor in Senegal. The latter is usually illiterate, lacks formal administrative and financial management experience, and is otherwise poorly qualified to interpret and convey policies and laws concerning the affairs of state. In fact, previous research indicates that most rural councillors in Senegal lack the experience and skills one would expect as basic requirements for the job.⁵⁴ In canvassing the Lour Rural Council, I found that none of its members has any formal French-language education. This is not surprising given the prevailing sociocultural and religious attitudes in this part of the country that do not recognize formal, Western-style education as being particularly desirable.⁵⁵

Obviously, such circumstances are problematic when it comes to local administration, which includes the

⁵² Abelin 1979: 523-24.

⁵³ Gellar 1990: 140.

⁵⁴ Vengroff & Johnston 1989; Bellot 1988.

⁵⁵ In the Lour Rural Community there is only one primary school, which has only two classrooms, for an estimated school-age population of 4,000 pupils (République du Sénégal 1988c). The lack of scholastic infrastructure reflects the strong influence of local religious leaders who generally disdain formal education, seeing it as an unwelcome cultural influence on the community.

management of natural resources. Since formal government operates primarily through French language media, most rural councillors rely on translations of official information either through local-language radio broadcasts or their contacts with the sub-prefect - both of which, incidentally, are instruments of central authority. For example, many councillors are unaware of important changes in the new forestry code (discussed above) intended to increase local options for woodland management.⁵⁶ It is somewhat surprising that the new code, which on a symbolic level means so much to the government in terms of maintaining positive rapport with the international donor community, remains a virtual mystery to many rural council members.⁵⁷

Despite problems of representation, qualifications, and accountability, no single aspect of the rural council's mandate is more contentious than that of land management. This is due to the often ignored prerogative the council has to decide on matters of local land tenure. According to the 1964 National Land Law and the 1972 Rural Community Law, rural councils have the authority to manage, under the supervision of the central state, all non-classified rural lands.⁵⁸ It is at this juncture, however, where the split between contemporary and traditional institutions is most evident. Since land represents the most important resource

⁵⁶ See Dieng et al. 1993.

⁵⁷ Interview nos. 48, 58, 61, & 73.

⁵⁸ Described in Article 9 of *Loi no. 64-46 du 17 juin 1964 relative au domaine national*; see République du Sénégal (1964).

at the disposal of the rural population, this issue is of critical importance with respect to policy changes that envision the rural councils taking the lead in promoting community-based natural resource management.⁵⁹

Indigenous institutions play a far more significant role in managing local land matters than does the rural council. As noted in Chapter 4, the Mouride brotherhood, in response to commercial opportunities created by the French during the first half of the twentieth century, was at the forefront of expanding agricultural production onto the eastern and southern margins of the Peanut Basin. Today, in the Lour Rural Community, descendants of religious elite maraboutic founding families and their disciples are among some of the largest landholders in the area.⁶⁰ Use rights to large tracts of land are controlled by and passed down to younger generations in these extended families. It is this traditional system of land tenure that holds sway in the rural community, and that would most likely continue to do so despite the allocation to rural councils of rights under the new forest code to manage local woodland resources.

The foregoing discussion on local government institutions highlights some of the barriers to effective local participation in natural resource management in the Lour Rural Community. To summarize, the main problems include the ambiguity of bicephalous executive leadership

⁵⁹ République du Sénégal 1993d.

⁶⁰ Interview nos. 46 & 53.

and inadequate managerial experience with respect to the rural councils, and the clash of customary and contemporary land tenure arrangements.

Conclusion

In this chapter I have brought together observations, information, and data on a number of variables concerning the energy-environment situation in one Rural Community in Senegal in an attempt to arrive at a better understanding of this complex human-environment problem. The discussion has spanned a number of issues that touch upon different dimensions of the problem.

Although the synthesis of data and information shows that a combination of different factors helps to explain the outcome of exploiting woodland resources for domestic energy production, it is clear that some components carry more weight than others. For example, the political ecology approach employed here brings to the fore important revelations about power relationships, expressed at different geographic scales among various groups and individuals, that affect efforts to better manage natural resources. This is an important demonstration of how the political ecology framework can help bolster our understanding of local environmental issues by placing them within the broader context of circumstances related to national and global-level political economy.

In this chapter, the role that power relationships play in determining numerous aspects of the energy-

environment situation in Senegal has been illustrated in several ways. For example, mention has been made of the influence international institutions exercise over national environmental policy making such as the National Forestry Action Plan. At the national level, the discussion surrounding parallel customary and contemporary forms of governance - particularly with respect to authority over the administration of the rural communities - illustrates the complicated nature of negotiating land tenure and resource management issues. Regarding the scope for effective local participation in natural resource management, intricate relationships among the rural population in general, and the religious, landed, male-dominated foci of power in particular, raise perplexing questions about the ultimate outcome of renewed emphasis on the bottom-up approach to development.

Beyond recognizing the important role played by power relationships, the synthesis of disparate yet related dimensions of the energy-environment situation also underscores the value of examining human-environment problems from an integrated, holistic perspective supported by the political ecology approach. If nothing else, this study demonstrates that there exists no single technical solution to the overall problem of dwindling woodfuel supply and rising energy demand in Senegal. The disappointing results associated with expensive large-scale efforts such as woodfuel plantations, subsidies to butane gas, cookstove dissemination, and "rural forestry"

interventions can be explained in part by the failure to examine sufficiently the multitude of other factors related to woodfuel energy use.

As illustrated in this and earlier chapters, the search for answers to the country's energy-environment problem must take into consideration a broader range of issues. These include, among others, household behavior regarding energy consumption and economic decision making, historical aspects of land use practice and attitudes toward the environment, relationships between government agencies and the rural population, and a host of sociocultural conditions at the local level. In this chapter, the discussion on decentralization and local participation in natural resource management demonstrates the important roles these factors play in affecting the prospects for successful improvement in the energy-environment situation.

Although it remains unclear at present just how the local population will respond to the call for community-based natural resource management, the road ahead is certainly paved with numerous challenges. These include overcoming difficulties in translating internationally inspired ideals of gender empowerment, popular participation, democratization, and property rights - via nationally supported policies of decentralization and forest code reform - into effective measures for better resource management that are applicable given the social,

cultural, political, and environmental conditions at the local level.

In the concluding chapter, I highlight the findings of this study with respect to overall environmental management for woodfuel production in Senegal. I also consider the utility of the political ecology conceptual framework for analysis of this, and other human-environment problems.

CHAPTER SEVEN

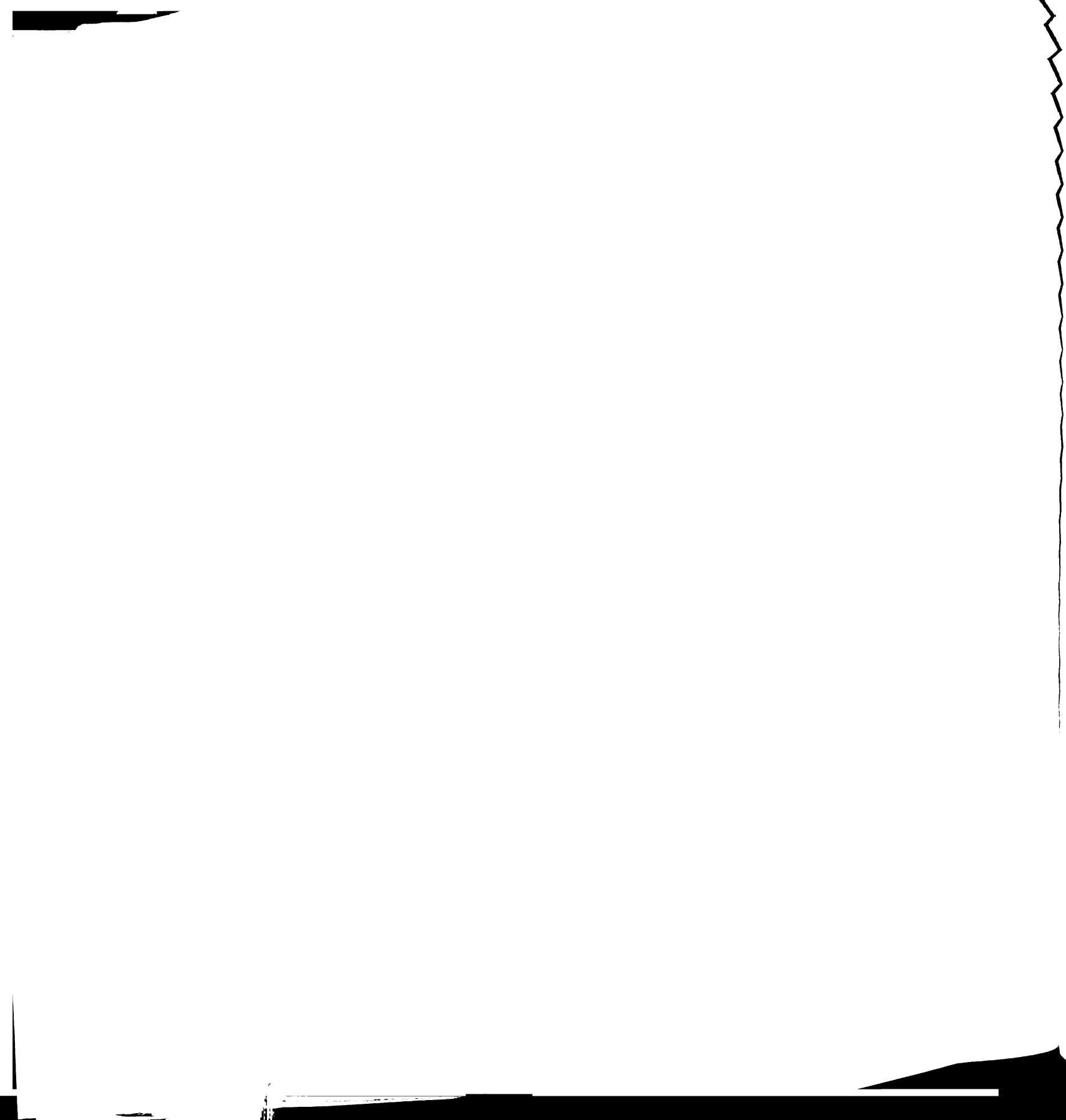
POLITICAL ECOLOGY AND HUMAN-ENVIRONMENT RELATIONSHIPS: LESSONS FROM SENEGAL'S WOODFUEL ENERGY DILEMMA

Geography is steeped in its role as a pluralistic and holistic discipline.....The academy seeks good synthesis, and while geography has no monopoly on this, as many of our colleagues from other fields have reminded us, it has unusual qualifications.

(Turner, 1989)

In the preceding four chapters of this study, I have charted the major stations of the energy-environment situation in Senegal. Chapter 3 introduced the connections between woodfuel energy consumption and the natural environment, focusing on ecological and administrative issues related to woodlands and their management. Chapter 4 offered an historical overview of land use in the study area, portraying the specific socioeconomic conditions under which the natural resource base has been exploited over time. Chapters 5 and 6 dealt, respectively, with the categorization and processing of an array of variables that show how energy and environment are linked in a multifaceted web of interrelationships at various spatial scales and throughout different points in time.

In this concluding chapter, I consider the findings of this study with respect to the environmental and socioeconomic consequences of woodfuel energy dependence in Senegal. I underscore the key points from the analysis that help to inform efforts to resolve this problem, and discuss the findings in the light of theoretical



considerations mentioned in Chapter 1. I also evaluate the utility of the political ecology conceptual framework as employed in this study, in addition to its general applicability to other analyses of human-environment relationships.

Discussion of the Findings

Findings from this study reinforce the contention put forward elsewhere that, in general, negative environmental consequences of "woodfuel problems" are not due solely to a gap between supply and demand induced by population growth and deforestation, but that they are instead the result of a set of complex interrelated factors.¹ These factors, both obvious and subtle, combine to shape the complicated character of woodfuel energy issues.

The results of the categorization phase of the research, described in Chapter 5, contribute toward a more inclusive "inventory" of variables related to the energy-environment problem in Senegal. The fuller picture of the energy-environment dynamic that emerges fills in some of the lacunae of earlier analyses conducted in this locale. Results from the process phase of the study, described in Chapter 6, point to a number of issues that help us to better understand the complexity of the energy-environment relationship. In turn, this understanding compels us to take a closer look at decentralization and local

¹ My study reinforces such conclusions regarding the "woodfuel problem" as reached by Dewees (1989), Cline-Cole, Main & Nichol (1990), and O'Keefe & Munslow (1989).

participation - as currently conceived - as strategies to attenuate the negative environmental consequences of Senegal's woodfuel production system.

Findings from the study indicate that the call for decentralized resource management in Senegal faces many challenges in terms of achieving effective participation at the local level. As has been noted elsewhere, reconciling the relationships between actors at global, national, and local scales, and working out mechanisms for moving successfully from policy formulation to policy implementation, are essential prerequisites for addressing the root causes of problems associated with woodfuel energy dependence.²

In terms of the interface between national and local levels of analysis, findings from the study illustrate how attempts to achieve sound resource management for woodfuel energy supply have been confounded during both historical and contemporary periods. For example, as noted in Chapter 6, the forest services in francophone Africa in general, and in Senegal in particular, have, since the colonial era, relied on draconian legal measures to manage forests in ways that exclude local populations from having a stake in the long-term management of these resources. As a result, there exists little in the way of effective cooperation between the state and the rural population in promoting sustainable forestry management practice.

² Soussan et al. 1992.

The consequences of this historical experience now stand juxtaposed to newly revised national environmental policies, motivated in large part by adherence to international directives, that depend heavily on cultivating productive relationships between government agencies and local populations. Results of my investigation reveal, however, that social, economic, and political circumstances at the local level pose serious questions concerning the prospects for successful outcomes of proposed policy changes.

Recognizing the substantial risks of increased environmental degradation that exist in the semi-arid Sahel, and acknowledging the problems experienced so far with large-scale, top-down approaches in attempts to better manage these risks, international and national development agencies are now focused on promoting local community participation in natural resource management. In Senegal, a commitment to decentralization is apparent in statements made in public policy and environmental circles. At the political level, the government is attempting, at least on paper, to find ways to achieve more inclusive administrative and territorial reforms. In the environmental arena, the move toward decentralization is being driven by the philosophy that popular participation is an indispensable means to assure more successful natural resource management practice.

Stating a commitment to decentralized natural resource management is one thing, but overcoming the obstacles to

achieving effective decentralization is another. As the findings from this study illustrate for the case of Senegal, attempts to implement decentralized natural resource management confronts a number of institutional, technical, and sociocultural barriers. Overcoming these will be of critical importance, especially if decentralized resource management is expected to contribute to a more effective resolution of the woodfuel problem than have earlier demand reduction, supply enhancement, and fuelswitching approaches.

In response to one of the main questions of this study, namely whether there is scope for local participation to help solve Senegal's woodfuel problem, findings indicate that many obstacles must first be overcome in order to make this a viable proposition. For example, the likelihood that local village associations and community groups in the Lour Rural Community will find a niche in the urban woodfuel production market seems remote at this time. A host of problems related to land tenure, silvicultural skills for woodland management, organizational and financial management capability, and the equitable sharing of both benefits and costs of possible participation in the woodfuels market converge to make this an unlikely prospect.

Furthermore, the current state of affairs with respect to local institutions in the study area presents major impediments to better local resource management. As this investigation reveals, the rural council lacks the

managerial skill, information base, and participatory democratic apparatus required to turn it into an effective mechanism for local resource management. Such circumstances impede the flow of important information relevant to changes in official land use policy that could have a positive impact on the management of woodland resources.

An example to illustrate this last point can be drawn from Senegal's new forestry code. In the event that articles of the new code are implemented as intended, such as those conferring certain legal rights to individuals or groups who engage in reforestation activities, one must ask how this information will be effectively transmitted to a rural population whose participation is regarded as critical to improved resource management. Presently, the primary mechanism for information dissemination is rather ineffective. In fact, the rural council's ability to understand the contents of the new forestry code remains somewhat dubious at this time.

There are other institutional problems that need to be addressed. For example, segments of the rural community's population who might seek access to the commercial woodfuels market, such as the members of village development associations, face stiff opposition from entrenched and interrelated local interests represented by powerful religious figures, large "founding-family" landowners, and well-placed political operatives such as the rural council presidents. As Ribot notes, many of the

latter groups maintain strong reciprocal relationships with the state that provide them with preferential access to woodfuel resources and markets.³ The institutional reforms necessary to broaden the opportunity for local community associations to engage in woodfuel production activities are likely to be very difficult to achieve.

In order to overcome these difficulties, national and local leaders must first concentrate on the fundamentals of education and training. Focusing on civic political awareness and practical skills development are two main avenues for promoting genuine social "empowerment." The benefits of increased knowledge and participation may be substantial indeed, but, as we have seen in the case of the Lour Rural Community, there are formidable obstacles to obtaining them. Not the least of these obstacles entails overcoming the entrenched interests of local elites and government officials who stand to lose the most from the establishment of more truly participatory practices.

At the international level, actors engaged in helping Senegal achieve the goals of social progress, economic growth, and environmentally sound development, and who in some instances are poorly informed about the reality of local conditions, must find more constructive ways to contribute to this process. In the end, Senegal and its international partners must come to terms with these difficult issues in order to realize the purported benefits

³ Ribot 1990.

to both people and the environment of decentralized resource management.

Participatory Development and the Environment: Old Wine in New Bottles?

Decentralization and local community participation are recurrent themes in the strategic plans that currently guide efforts to resolve Senegal's energy-environment problems. Much of the discussion throughout the dissertation has concentrated on examining the prospects for local community involvement to achieve a more sustainable system of woodfuel production. The emphasis now placed on local participation in Senegal is in part a reflection of the past failures of top-down, centralized structures - such as the forest and rural extension services - to achieve national development objectives in the forestry and environment sectors. In this section of the chapter, I consider the findings of my study with respect to the "development from below" theoretical position discussed in the introduction to the dissertation.

In Chapter 1, the question of local participation was couched in terms of the dichotomy between top-down and bottom-up approaches to socioeconomic development. In terms of geographic space, reference was made to Friedmann and Weaver's conception of agropolitan planning as a territorial approach to regional development. In Senegal, the current development paradigm in the natural resource sector reflects many of the same theoretical propositions put forward nearly two decades ago by regional development

planners such as Friedmann and Rondinelli.⁴ Ironically, many of the same circumstances that explain the failure of previous bottom-up approaches to induce sustainable rural development resurface as pitfalls in the present round of planning efforts in Senegal.⁵ Such circumstances include: the absence of viable democratic institutions, a lack of local financial autonomy, clashes between individual and vaguely defined communal or "territorial" interests, unequal social relations and access to resources, and the absence of a "developmental," "facilitative" central state bureaucracy.⁶

At a conceptual level, an instructive analogy can be made between Friedmann's "agropolitan district" and Senegal's Rural Community. Both entities are designed to promote a balanced spatial structure for socioeconomic development, thereby counteracting the polarizing forces that tend to produce wide disparities between the core and periphery of a national economy. In addition, both are based on the assumption that decision making authority is ultimately devolved from the central state to the local level, particularly with respect to land tenure and budgetary matters.

The findings of my investigation, despite the limitation of representing but a single case study in one rural community, reveal a number of inconsistencies between

⁴ Friedmann 1979; Rondinelli & Ruddle 1978.

⁵ See chapter 7 of Gore (1984) for a critique of bottom-up approaches.

⁶ On the role of the central state in agropolitan development, see Friedmann and Weaver (1979: 203-04).

theoretical and practical perspectives of the development from below paradigm. The first of these has to do with the integrity of the rural community as a territorial planning unit. However much emphasis may be placed on the idea of spatial closure, i.e., the ability of local decision makers to decide the modalities of resource exploitation with an eye toward minimizing the "leakage" of resources vital to local development, it is evident that not all decisions are made at the local level, by local people, or in the best interests of the local community. With respect to exploiting the natural resource base for woodfuel production, and despite recent changes to Senegal's forest code, most decisions are made outside the territorial unit of the rural community.⁷ To paraphrase Whitney and colleagues regarding the urban bias exhibited in many developing countries where woodfuel resources have become increasingly scarce, the "locus of political power and decision-making" in Senegal still resides far from the forests and their nearby communities.⁸

A second issue that flows from the circumstances surrounding the territoriality of decision making has to do with certain assumptions about the social, political, and economic composition of the agropolitan planning unit. Inherent in the theoretical underpinnings of the territorial framework is the notion that a "community of destiny," marked by the intersection of shared cultural,

⁷ It is important to note, however, that this often occurs with the complicity of powerful local actors.

⁸ Whitney et al. 1987.

political, and economic spaces, exists in which decisions are made for the greater good of the entire community.⁹

That such a community exists in the case of the Lour Rural Community is debatable given the deep sociocultural and political divisions among the Community's residents based on factors such as gender, lineage, religious affiliation, and landholding status.

The idea of a community of destiny reflects the same misguided notion revealed by Niang's critique of the "myth of the rural collective" as applied to rural forestry projects.¹⁰ Of concern here for Senegal is the assumption made in the currently popular "Community Based Natural Resource Management" paradigm that the Rural Community suffices as the territorial entity within which one finds the prerequisite "community of destiny." Empirical evidence here and elsewhere leads to contradictory conclusions.¹¹ What is particularly troubling about this situation is the possibility that the participatory approach to natural resource management, as promoted by national and international development agencies, might actually reinforce rather than redress unequal social relations at the local level.¹²

⁹ Friedmann and Weaver 1979: 196-97.

¹⁰ See Chapter 5, p. 149.

¹¹ See Bellot (1988) and Blundo (1994).

¹² In this vein Ribot (1995: 1595) suggests that, absent careful and equitable implementation, provisions in the new forest code that open up opportunities for local community participation in the woodfuels market may also result in situations in which villagers are exploited through contract arrangements with the Forest Service or entrepreneurs in the Forest Products Cooperatives. In some

A third issue pertains to the role of international actors actively engaged in the process of bottom-up development. As noted in Chapter 6, the Lour Rural Community's experience with the French-sponsored PARCE reforestation project indicates that such outside influence may actually thwart local initiative or lead to a dependency mentality with respect to participation in natural resource management activities. In addition, on a larger scale, the national Forest Service depends on the flow of major foreign development assistance just to maintain daily operations.

Such reliance on outside assistance, particularly at the local level, belies the position boldly stated by Friedmann and Weaver that agropolitan development "does not expect a transfusion of strength from 'donor' countries abroad."¹³ Expectations aside, development from below as currently practiced in Senegal relies on a significant flow of resources from far above.

The foregoing issues, in addition to the failure of the Senegalese state to fulfill its developmental role and the glaring lack of historical perspective on local human-environment relationships, call into question the community-based agropolitan approach to natural resource management as presently envisioned for Senegal. Efforts to address the consequences of rural-urban transfers of resources such as woodfuels, which so far have achieved

instances, the entrepreneurs are members of the socioeconomic elite at the local level.

¹³ Friedmann & Weaver 1979: 200.

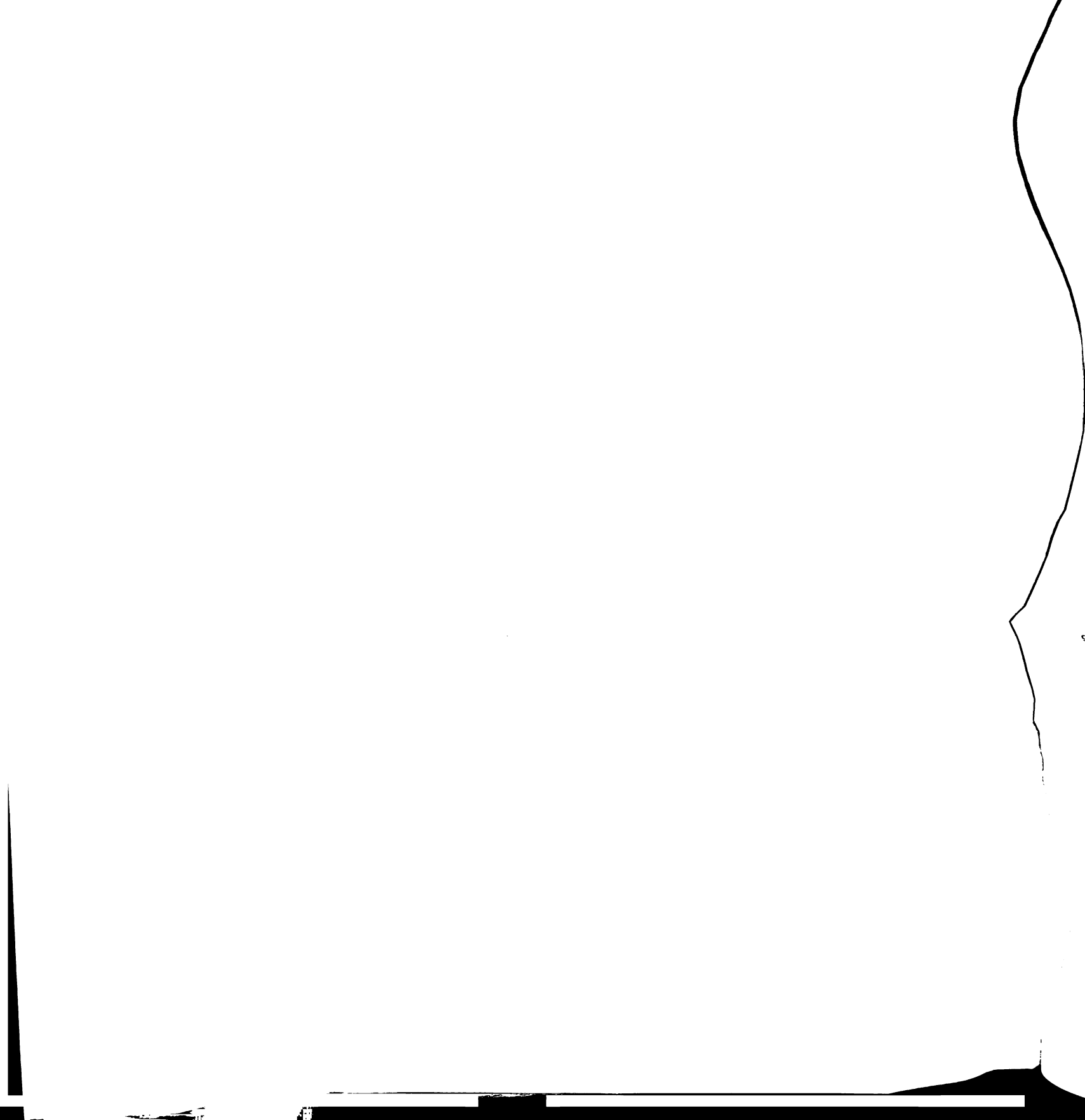
very little in terms of local development yet have contributed to environmental degradation and socioeconomic hardship, must go beyond simply shifting the locus of decision making to the rural community.

As illustrated in the case of the Lour Rural Community, many assumptions upon which the bottom-up paradigm operates, e.g., self-reliance in decision making, communal equality, control over local resources, are either weak or altogether absent. The fundamental social, political, and economic prerequisites of the territorial approach to community-based natural resource management have been neglected in the current movement to "responsibilize" the rural population. They must be dealt with in order for the development from below paradigm to produce the intended results of better resource management and improved economic conditions.

Political Ecology, Geography, and Human-Environment Relationships

The opening quotation at the head of Chapter 1 speaks to a challenge before geography in the present era of rapid and oftentimes deleterious global environmental change. The challenge, according to Douglas, is for the discipline to develop new "conceptual approaches" and techniques for the analysis and evaluation of environmental problems.¹⁴ Douglas intimates that geography's practitioners risk being seen as little more than a corps of "environmental technicians supplying maps and data," rather than a well-

¹⁴ Douglas 1991.



rounded cadre of creative thinkers contributing to the analysis and resolution of environmental problems.

In the light of concern over global environmental issues now being voiced in numerous quarters of society, it would seem that this challenge is indeed significant for geography as a discipline - a discipline which, at least in North America, has struggled in recent decades for academic survival and professional recognition. In this context, the term environmental "technician" evokes an important point. Although it can be said that geography has experienced a certain renaissance in recent years, a good portion of the newfound interest is attributed to advances in geographic techniques such as remote sensing, computer cartography, and geographic information systems (GIS). Less of this resurgence, I would argue, can be attributed to theoretical or intellectual breakthroughs in the way geographers "do" geography. As any good GIS or remote sensing specialist is aware, however, the effective use of advanced tools and techniques depends on a thorough and well-grounded conceptualization of the geographic problem at hand.

The immediacy with which many now regard the state of the global environment demands that efforts be redoubled in order to arrive at better understandings of human-environment relationships - the longtime "concern of geography" as noted at the beginning of this work. This, I would argue, symbolizes the challenge geographers face. Finding ways to achieve such understandings, especially

from a theoretical perspective given the incredibly complex nature of human-environment problems in widely different regional contexts, is indeed a formidable task.

Political ecology is proposed by some geographers as a conceptual framework that responds to this challenge and that offers a more comprehensive, multidimensional consideration of complex nature-society relationships. Following from the present study, several important observations can be made about the application of political ecology to the analysis, resolution, and theoretical underpinnings of human-environment problems.

First, political ecology has the capacity to create order out of the sometimes chaotic complexity of human-environment relationships. This study, which examines one particular problem in the realm of nature-society relationships, illustrates this capacity. In attempting to understand the energy-environment problem in Senegal, the utility of the political ecology conceptual framework is demonstrated by its ability to capture and elaborate multiple aspects of a complex problem that has eluded resolution based on more limited analyses. The combination of analytic and synthetic perspectives helps to structure and add coherence to a problem that is defined by a number of variables that are manifest at different points in space and time. This approach to structuring the problem is one of the more valuable attributes of the political ecology framework, allowing the researcher to uncover a multitude of linkages among and between different sets of variables.

Second, the results of this study illustrate how a political ecology perspective builds upon previous conceptual frameworks such as human and cultural ecology by addressing aspects of human-environment problems that were not considered by these earlier approaches. For example, political ecology emphasizes the identification of linkages between multiple loci of analysis rather than focusing on more limited spatial scales of analysis that marked previous approaches. It is also concerned with recognizing the role of the central state in local human-environment relationships, and revealing how the exercise of power on the part of a wide spectrum of actors spanning a local-global continuum also affects these relationships.

Evidence presented in this case study and other research conducted in Senegal illustrates how the resource management activities of a population at the local scale are affected by relationships that exist between that population and other actors at local, national, and international levels. At each level the exercise of power - whether financial, political, or social - influences these relationships. For example, my analysis shows how members of the Lour Rural Community and various international development agencies, international organizations and the Senegalese Forest Service, as well as other government agencies, local elites, and ordinary villagers are all enmeshed in a variety of relationships that bear on access to resources for woodfuel production and the environmental outcome of exploiting them. The

recognition and elaboration of these relationships expressed in this study contribute toward a more informed understanding of where attention needs to be focused when searching for solutions to Senegal's energy-environment problems.

Third, the political ecology framework also strives to understand human-environment issues within an historical context. Consideration of the time element is an important innovation in this approach. As my research has shown, current land use practices in the study area related to agriculture and woodfuel production are the product of long established customary (indigenous) and formal (state-sponsored) arrangements.

The present situation in the Kaolack Region and Lour Rural Community indicates that these arrangements are yielding only slowly, if at all, to the exigencies of new environmental policy directives designed to stave off further resource scarcity and environmental degradation. Furthermore, historical precedent concerning woodland resource management does not bode well for the prospects of community-based approaches to alleviate future environmental pressures related to the woodfuel production. Although the possibility of change in the desired direction cannot be dismissed, knowledge of the historical context within which natural resources have been exploited certainly makes for more informed assessment of ways to promote better resource management in the future.

Despite its multidimensional and multiscalar analytical matrix, its emphasis on the role of the state and the exercise of power, and its recognition of the importance of historical perspective, there are aspects of the political ecology framework that remain problematic. Statements by Bryant on the need for further analytical refinement, and by Whitesell concerning the development of common methodological tools for the study of nature-society relationships, reverberate forcefully when one considers that results derived from much political ecology-driven research are contingent on the specific procedures employed by the given social or natural scientist.¹⁵

One issue with the framework that requires greater attention is the need to develop a more standardized set of procedures that are applicable from one case study to another, particularly in the process phase of synthesizing data from a number of disparate variables. As I mentioned in Chapter 2, determining the nature of relationships between multiple components of the analysis, and drawing substantive conclusions about human-environment problems from this process, are presently contingent upon the specific interpretations of the individual researcher. The challenge remains one of reconciling the innovative attributes of the political ecology framework, such as flexibility in methodological and analytical procedure that allows one to identify critical connections between people

¹⁵ See chapter 1, pp. 16 & 21ff.

and the environment, with the imperative of scientific rigor.

A second issue that requires further refinement has to do with political ecology's broader applicability across the disciplines. To address human-environment problems in a way that incorporates multidimensional, multiscale, and diachronic perspectives is a welcome innovation. It is also, I would argue, an undertaking that is perhaps beyond the capacity of any one discipline or individual researcher to tackle single-handedly. As I pointed out in Chapter 1, much of the work to date that employs a political ecology framework has been carried out by researchers whose specialties lie in the social sciences. Rare is the natural scientist who uses this approach.

The inclusive, plural, systems approach perspectives of political ecology convey its essential interdisciplinary qualities. Such interdisciplinarity, however, demands the application of cooperative, team-oriented methods in order for the approach to be a successful research vehicle and tool for theory development. To realize its full potential as a conceptual framework for the study of human-environment relationships, more collaborative use of political ecology among social and natural scientists should be encouraged.

Conclusion

Whether the political ecology conceptual framework ultimately contributes to a more advanced, holistic theory

of human-environment relationships still remains to be seen. At this point in time, the strength of political ecology as a research tool lies in its ability to deal effectively with complexity. It helps us find our way - like the "theoretical compass" Whitesell describes it to be - through the manifold manifestations of human-environment problems in space and through time. Dealing with complexity is unavoidable, indeed imperative in the search for a fuller understanding of nature-society relationships and the solution to human-environment problems. It is important that the geographer - or the political scientist, biologist, forester, anthropologist, or economist - remember to cast a broad net in the search for this understanding.

Summoning the intellectual resources necessary to fully comprehend the complexity of human-environment relationships is indeed a challenging endeavor. However, I would argue that geography, among all disciplines, is uniquely placed to respond to the this challenge. As practitioners of such an eclectic discipline, geographers have the potential to tap an immense in-house reservoir of wide-ranging expertise in both the physical and social sciences. Geographers who recognize the interdisciplinary potential of the political ecology framework must seek ways to bridge the gap between the often antagonistic, and ultimately artificial, human-physical dichotomy within the field. By constructively engaging the discipline's own vast intellectual resources, geographers can avoid the

minimalist cachet of environmental "technician" and instead continue to develop more sophisticated conceptual approaches to understanding human-environment relationships.

APPENDICES

APPENDIX A

List of Research Centers, International Agencies and Projects, and Government Ministries Visited

DAKAR

- * Université Cheikh Anta Diop de Dakar (UCAD)
 - Institut des Sciences de l'Environnement (ISE)
 - Department of Geography
 - Institut Fondamental d'Afrique Noire (IFAN)
- * Environnement et Développement du Tiers Monde (ENDA), Energy Programme
- * ORSTOM (French Research & Technical Cooperation Organization) Documentation Center
- * Centre de Suivie Ecologique (CSE)
- * USAID Documentation Center
- * USAID Senegal Reforestation Project
- * International Development Research Center (Canada) Documentation Center
- * UNFAO Project Headquarters: Appui au Programme de Développement de la Foresterie Rurale
- * UNFAO Forestry Programme, Documentation Center
- * Caisse Centrale de Coopération Economique (France), Documentation Center
- * World Bank Documentation Center
- * Headquarters, Peace Corps Senegal
- * Ministère de l'Environnement et de la Protection de la Nature, (formerly Ministère du Développement Rural et de l'Hydraulique)
Direction des Eaux et Forêts (National Forest Service)
- * Ministère de l'Intérieur,
Direction du Centre d'Expansion Rurale
- * Institut Sénégalais de Recherche Agricole,
Direction des Recherches sur les Productions Forestières

DAKAR (cont't)

- * Ministère de l'Industrie, du Commerce et de l'Artisanat,
Direction de l'Energie, des Mines et de la Géologie**
- * Ministère de l'Economie, des Finances et du Plan,
Direction de la Prévision et de la Statistique.**
- * Archives Nationales**

PARIS

- * Centre Technique de Foresterie Tropicale**
- * Association Bois de Feu**
- * ORSTOM (French Research & Technical Cooperation
Organization), Documentation Center**
- * Institut Géographique National**

APPENDIX B

List of Interviews

The following is a list of interviews conducted during field research in Senegal from October 1992 to October 1993. The individuals whom I interviewed are identified by their position and/or organizational affiliation. Names are withheld in keeping with the research protocol I established assuring interviewees of anonymity. "Group" indicates a group interview (usually a village association) with a specific focus. For example, "group/historical profile/TAM" indicates group interviews held to gather background information on the settlement history of Touba Aly Mbenda.

Abbreviations used in the list of interviews.

Ag.	= Agricultural
ATI	= Appropriate Technology International (NGO)
CER	= Centre d'Expansion Rurale (GOS Rural Extension Service)
CSE	= Centre de Suivi Ecologique (Ecological Monitoring Centre)
Dev. Cte.	= Development Committee (Koungheul Entente)
Dir.	= Director
E&F	= Eaux et Forêts (Forestry Service)
ENDA	= Envrionnement & Développement Tiers Monde (NGO)
Ent.	= Entente (Koungheul Entente)
GOS	= Government of Senegal
IFAN	= Institut Fondamental d'Afrique Noire/UCAD
ISE	= Institut des Sciences de l'Environnement/UCAD
ISRA	= Institut Sénégalais de Recherche Agricole
MICA	= Ministry of Industry, Commerce & Trades
NGO	= Non-Governmental Organization
Nat. Res.	= Natural Resources
PCV	= Peace Corps volunteer
Prog.	= Program
Proj.	= Project
PTC	= Principal Technical Consultant
TAM	= Touba Aly Mbenda (village research base in Lour Rural Community)
UCAD	= Université Cheikh Anta Diop (Univ. of Dakar)
UNFAO	= United Nations Food & Agriculture Organization
URCEF	= Union Regionale des Cooperatives des Exploitants Forestiers (charcoal producers cooperative)

No.	Date	Person(s) Interviewed	Location
001	29OCT92	Dir. Nat. Res. Prog./Peace Corps	Dakar
002	12NOV92	PCV Forestry Prog./Peace Corps	Dakar
003	16NOV92	Dir. Nat. Res. Prog./USAID	Dakar
004	19NOV92	Dir. Kaolack Prog./AFRICARE	Dakar
005	20NOV92	PTC MICA/Energy division	Dakar
006	30NOV92	Dir. of Research/ISE	Dakar
007	30NOV92	Agent/Energy Prog./ENDA	Dakar
008	30NOV92	Agent/Energy Prog./ENDA	Dakar
009	05DEC92	Dir./Energy Program/ENDA	Dakar
010	08DEC92	Dir. Reforestation Proj./USAID	Dakar
011	09DEC92	Agronomist/ISRA	Dakar
012	09DEC92	Dir. Commercial Forestry/E&F	Dakar
013	09DEC92	Prog. Officer/Reforestation/USAID	Dakar
014	10DEC92	Dir. CSE	Dakar
015	11DEC92	Biogeographer/Geog. Dept./UCAD	Dakar
016	15DEC92	Dir. Forestry Program/UNFAO	Dakar
017	16DEC92	National Asst. Dir./E&F	Dakar
018	16DEC92	PTC/Rural Forestry Proj./UNFAO	Dakar
019	18DEC92	Ag. Economist/ISRA	Kaolack
020	07JAN93	Regional Dir./E&F	Kaolack
021	13JAN93	PCV Kaolack Forestry Prog.	Nioro
022	14JAN93	E&F Agent/Norwegian Mission	Nioro
023	19JAN93	Chief Commercial Forestry/E&F	Kaolack
024	22JAN93	Dir. Rural Extension Office	Kaolack
025	25JAN93	Dir. Regional Planning Office	Kaolack
026	25JAN93	Dir. Regional Office MICA	Kaolack
027	27JAN93	Forestry Extension Agent/E&F	Kaolack
028	29JAN93	Village Reforestation Group	Tiaré
029	01FEB93	Geographer/IFAN/UCAD	Dakar
030	02FEB93	Prog. Asst./ATI	Dakar
031	03FEB93	Regional Inspector/E&F	Kaolack
032	05FEB93	Group/E&F Officers	Nioro
033	24FEB93	Regional Inspector/E&F	Kaolack
034	10MAR93	Sector Chief/E&F	Kaffrine
035	17MAR93	National Dir./E&F	Dakar
036	18MAR93	Agent/Rural Forestry Prog./UNFAO	Dakar
037	31MAR93	Arrondissement Chief/E&F	Koungheul
038	01APR93	President URCEF-Kaolack	Koungheul
039	02APR93	Rural Extension Agent/CER	Koungheul
040	14APR93	Former Chief/Koungheul CER	Dakar
041	19APR93	Regional Inspector/E&F	Kaolack
042	20APR93	Sector Chief/CER Kaffrine Dept.	Kaffrine
043	22APR93	Forestry Agent/E&F	Koungheul
044	29APR93	Former Chief/Koungheul CER	Koungheul

No.	Date	Person(s) Interviewed	Location
045	22MAY93	Group/historical profile	TAM
046	23MAY93	Group/historical profile	TAM
047	24MAY93	Group/historical profile	TAM
048	27MAY93	Lour Rural Council Member	TAM
049	03JUN93	Dev. cte. member/Koungheul Ent.	TAM
050	02JUL93	Ag. cooperative member	TAM
051	03JUL93	Extension agent/Koungheul Ent.	Lour Escale
052	04JUL93	Extension agent/Koungheul Ent.	TAM
053	09JUL93	Group/land tenure profile	TAM
054	10JUL93	Group/Koungheul Ent.	TAM
055	10JUL93	Extension agent/Koungheul Ent.	TAM
056	11JUL93	Dev. cte. member/Koungheul Ent.	Touba Thiarène
057	11JUL93	Dir. tree nursery/Koungheul Ent.	Touba Thiarène
058	13JUL93	Lour Rural Council member	Coura Mouride
059	13JUL93	Dir. tree nursery/Koungheul Ent.	Coura Mouride
060	13JUL93	Dev. cte. member/Koungheul Ent.	TAM
061	14JUL93	Lour Rural Council member	TAM
062	15JUL93	Group/Koungheul Ent.	TAM
063	22JUL93	Dir. tree nursery/Koungheul Ent.	Lour Escale
064	24JUL93	Group/Koungheul Ent.	TAM
065	24JUL93	Extension agent/Koungheul Ent.	TAM
066	22AUG93	Brigade chief/E&F	Koungheul
067	26AUG93	Lour Rural Council member	TAM
068	26AUG93	Group/ag. cooperative	TAM
069	28AUG93	Group/land-use/charcoal	TAM
070	29AUG93	Group/land-use/tree tenure	TAM
071	28OCT93	Group/land-use/charcoal	Lour Escale
072	30OCT93	Group/women & charcoal	Touba Thiarène
073	30OCT93	Lour Rural Council member	Lour Escale
074	31OCT93	Dir. Reforestation proj.	Darou Mana

APPENDIX C

Household Woodfuel Survey Questionnaire

Page 0

Questionnaire ID # _____

E N Q U E T E S O C I O - E N E R G E T I Q U E
Q U E S T I O N N A I R E

N.B. Prière d'assurer la personne enquêtée que ses
réponses seront utilisées en confiance et
expressément dans le but de cette étude. Le
dépouillement des résultats sera effectué
anonymement.

Date ____/____/____

Village_____

Nom de l'enquêteur ou l'enquêtrice

Nom de la personne interrogée

L'epouse(s) de Monsieur

Pour chaque question, indiquez la ou les réponse(s) offerte(s) par la personne interrogée sur la ligne pourvue, ou cochez la réponse ou les réponses indiquée(s).

A. QUELLES SONT, A VOTRE AVIS, LES TROIS TACHES MENAGERES LES PLUS DIFFICILES EN ORDRE DE DIFFICULTE (C'EST A DIRE, QUI SONT LABORIEUSES OU QUI PRENNENT BEAUCOUP DE TEMPS)?

(1) _____ (2) _____ (3) _____

B. COMBIEN DE PERSONNES MANGENT CHEZ VOUS AUJOURD'HUI?

Hommes _____, Femmes _____, Garçons _____, Filles _____

Parmi ces personnes, y'a-t-il des *sourghas*?
oui__ non__

Si oui, combien sont-ils? _____

C. QU'EST-CE QUE VOUS PREPAREZ POUR...

le petit déjeuner? le déjeuner? le dîner?

D. QUEL TYPE DE FOYER UTILISEZ-VOUS POUR CUISINER?

- (1) trois pierres ("os")
- (2) trépieds métallique ("nopalé")
- (3) réchaud à gaz
- (4) foyer amélioré ("ban ak suuf")
- (5) autre (précisez)

E. QUEL COMBUSTIBLE(S) UTILISEZ-VOUS POUR CUISINER ET POUR CHAUFFER L'EAU?

- (1) bois de feu
- (2) charbon de bois
- (3) gaz butane
- (4) pétrole lampant
- (5) résidus agricole(s) ou autre matière végétale
- (6) bouse de vache ("neffaré")
- (7) autre (précisez)

F. EN OUTRE LA PREPARATION DES ALIMENTS, POUR QUELS AUTRES USAGES UTILISEZ-VOUS CES COMBUSTIBLES? (précisez)

Usage(s)

G. QUELQUES QUESTIONS CONCERNANT L'APPROVISIONNEMENT EN BOIS DE FEU...**I. Chez vous, le bois de feu est...**

- (1) collecté...
- (2) acheté...
- (3) autre (précisez).

Si le bois de feu est collecté...**II. Où allez-vous le collecter? (précisez le lieu)****III. Qui le collecte?**

- (1) femmes de la concession
- (2) hommes de la concession
- (3) enfants de la concession
- (4) autres (précisez)

IV. Comment le transport-on à la maison et avec quelle fréquence?**Moyen de transport****Combien de fois par mois?**

- | | |
|-------------------------|----------------------|
| (1) sur la tête (fagot) | _____ fois par mois. |
| (2) charette (charge) | _____ fois par mois. |
| (3) vélo | _____ fois par mois. |
| (4) véhicule (précisez) | |
| _____ | _____ fois par mois. |
| (5) autre (précisez) | |
| _____ | _____ fois par mois. |

V. Mettez-vous de côté des stocks de réserve de bois de feu?

Oui _____ Non _____

Si oui, vous le faites pendant quels mois ou en quelle saison?

VI. Est-ce que vous combinez le ramassage du bois de feu avec d'autres activités?

Oui _____ Non _____

Si oui, lesquelles?

Si vous achetez le bois de feu...

VII. Depuis combien d'années achetez-vous le bois de feu?

_____ années.

VIII. Où achetez-vous le bois de feu?

IX. Combien achetez-vous et avec quelle fréquence? (précisez l'unité indiquée par l'interrogée)

_____ par _____
(quantité) (fréquence)

XI. A quel prix l'achetez-vous?

_____ par _____
(prix en FCFA) (quantité)

H. QUELQUES QUESTIONS CONCERNANT L'APPROVISIONNEMENT EN CHARBON DE BOIS...**I. Comment vous approvisionnez-vous en charbon de bois?**

- (1) vous l'achetez.
 - (2) vous en récupérez à partir du bois de feu
 - (3) autre (précisez)
- _____

Si vous achetez le charbon de bois...**II. Depuis combien d'années achetez-vous le charbon de bois?**

_____ années.

III. Où achetez-vous le charbon de bois?

IV. Combien achetez-vous et avec quelle fréquence? (précisez l'unité indiquée par l'interrogée)

_____ par _____
(quantité) (fréquence)

V. A quel prix l'achetez-vous?

_____ par _____
(prix en FCFA) (quantité)

I. QUELQUES QUESTIONS CONCERNANT L'APPROVISIONNEMENT EN GAZ BUTANE...

I. Depuis combien d'années achetez-vous le gaz?

_____ années.

II. Où achetez-vous le gaz?

III. Quel type de bouteille de gaz achetez-vous et avec quelle fréquence? (précisez le type de bouteille et la durée de la charge indiquée par l'interrogée)

_____ par _____
(bouteille) (fréquence)

**N.B. (petite bouteille = "Blip Banekh" = 2,75 kg)
(moyenne bouteille = "Nopalé" = 6 kg)
(grande bouteille = "Gazinière" = 12,5 kg)**

IV. A quel prix achetez-vous le gaz?

_____ par _____
(prix en FCFA) (type de bouteille)

J. REVENONS AU SUJET DE L'APPROVISIONNEMENT EN BOIS DE FEU...

I. Quelle(s) espèce(s) d'arbre préférez-vous utiliser comme bois de feu?

<u>Espèce (nom local)</u>	<u>Pourquoi la préférez-vous?</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

II. Avez-vous constaté des difficultés en ce qui concerne l'approvisionnement en bois de feu?

Oui _____ Non _____

Si oui, quelles sont ces difficultés et comment essayez-vous de les surmonter?

<u>Difficultés alternatives</u>	<u>Solutions ou</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

**K. CONCERNANT UNE VISITE AFIN DE MESURER LA CONSOMMATION
DES COMBUSTIBLES LIGNEUX:**

Auriez-vous la gentillesse de nous permettre de
revenir chez vous une prochaine fois pour peser la
quantité de bois de feu et charbon de bois utilisée
dans votre ménage?

Oui _____ Non _____

REMERCIEMENTS A L'INTERROGEE(S)!!!!!!

Observations générales de l'enquêtrice sur le déroulement
de l'enquête:

Evaluation générale du standing du ménage d'après
l'enquêtrice:

Bas _____ Moyen _____ Haut _____

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