



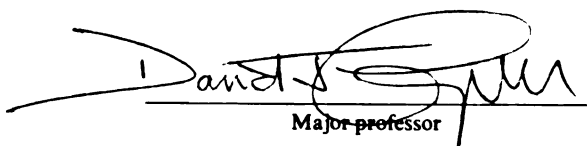
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DIMINISHING RETURNS: CHANGING NATURAL RESOURCE
MANAGEMENT STRATEGIES IN THE SENEGAL RIVER VALLEY
AND CONSEQUENCES FOR ENVIRONMENTAL DEGRADATION
presented by

Julie Elizabeth Fischer

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Ph.D. degree in Geography


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**DIMINISHING RETURNS:
CHANGING NATURAL RESOURCE MANAGEMENT STRATEGIES
IN THE SENEGAL RIVER VALLEY
AND CONSEQUENCES FOR ENVIRONMENTAL DEGRADATION**

Volume I

By

Julie Elizabeth Fischer

A DISSERTATION

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

DOCTOR OF PHILOSOPHY

Department of Geography

1994

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ABSTRACT

DIMINISHING RETURNS: CHANGING NATURAL RESOURCE MANAGEMENT STRATEGIES IN THE SENEGAL RIVER VALLEY AND CONSEQUENCES FOR ENVIRONMENTAL DEGRADATION

By

Julie Elizabeth Fischer

The relationships between natural resource access, use and management and environmental degradation are explored through a case study of the evolving local resource management systems in several village territories in the Senegal River Valley. The dissertation attempts to interpret the interrelationships between the effect of climatic change, the impact of people degrading their own use environment, and the influence of wider social, political and economic relations on local resource management.

The study details a wide range of interactions and reactions between society and nature throughout the twentieth century. Two central themes are explored: 1) the relations between access rights to natural resources and patterns of resource use and management; and, 2) the changes in the economic, social, political and environmental conditions that have reinforced or altered the processes and patterns of resource access, use and management.

This analysis traces the relations between society and the physical environment through time and between different spatial scales of analysis. An historical and multi-scale approach is taken because the nature/society relationship is continually changing over time and across spatial scales, with past changes affecting present processes and structures and with transformations at one spatial scale influencing, and being influenced by, systems at other

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This study of local resource management revealed that: 1) historically rooted haal-Pulaar social relations help explain current patterns of access to and control over resources; 2) non-local circuits of accumulation and surplus extraction and non-local ideologies and administrative structures have affected local resource use and misuse; 3) the deterioration of indigenous management strategies and failure to replace them with effective alternative systems has had negative environmental impacts; and 4) the local population, faced with difficult social and economic conditions in a degraded physical environment, has had few alternatives but to satisfy short-term subsistence requirements that lead to further environmental degradation.

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1994

To Linda,

**"When the world moves against me with a disapproving frown,
it is sister who puts the ground back under my feet,
and I love you woman."***

With love and much, much more.

*** Paraphrased excerpt from the song "Every Woman"
by Sweet Honey in the Rock**

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ACKNOWLEDGEMENTS

As I set to the task of finishing this dissertation at my desk in the highlands of Fouta Jalon, living so far from those whom I have dreamed of acknowledging some day, I relish the opportunity to gather everyone together in my thoughts. There is no way to separate the dissertation process from life itself, and the people who have been woven into my life over the past decade have played a role in this effort. You know who you are and I thank you all – for the love, encouragement, support, tolerance, and challenges that you have offered me.

No words can express the magnitude of my love and gratitude for my family. From my father, who continues to play a vital role in my life even though he wandered from this world many years ago, to my sweet Linnea, Matthew and Austin, who have just awoken to life, my family holds a pivotal place in my soul. Father, Mother, Linda, Tim, Dawn, Maj, Mormor, Morfar, Bestamor, Deb, Jim, Dale, Sarah, Charles, Linnea, Matthew and Austin and all those to follow – I hold you dear. I trust that you know in your hearts the depth of my love for you.

Soul-mates, an essential element in my life, have surrounded me with the perfect balance of love, patience, humor, encouragement and direction. Katie, Frank, Diana, Jude and Paul, Cynthia, Karen and Mark – thank you for the laughter, shared meals, discussions, places to sleep, tolerance, exercise, errands run, and good counsel. But most of all, thank you for your love and the balance that you have added to my life. New friendships with Steve and Erin have helped me through the last days of this endless process.

The people that I came to know during my fieldwork in Senegal hold a special place

in my heart since I was so dependent on their good will, kindnesses and support. Thank you Sonja, Lillian, Gary and many others for the shared moments.

Ousmane Sall, my research collaborator and dear friend, thank you for the amazing patience and dedication to this effort. I thank Yero Doro Diallo for sharing his incredible knowledge of Fulbe society with me and spending several memorable weeks in the field. There is no possible way that I can adequately communicate my affection and gratitude to all of the men, women and children of NDulumaaji Demße and surrounding villages who patiently discussed the unending topics that I approached them with. May Allah bless you all in your suffering.

My thanks to Francis Pierce and others at the Michigan State Soils Lab for their assistance. Thanks to all those who worked on my maps at the University of Wisconsin Cartography Lab and the cart lab in Guinea. Becky, thanks for your translations and your spirit. Dawn and Jim – thank you for the patience and the wonderful job! I thank all of you who answered computer questions and gave me other sorts of technical advice.

I have had the opportunity to work with a wonderful doctoral committee who has shown me unfailing support. David Campbell, Dave Robinson, Gary Manson, John Hunter and Jim Bingen offered me encouragement and sound advice throughout this effort. Special thanks to David Campbell and Dave Robinson, for many challenging exchanges and for their complete and unwavering confidence in my abilities.

I have the great fortune of having several grant agencies to thank for their financial support of my doctoral research. The research project was assisted by grants from the Joint Committee on African Studies of the Social Science Research Council and the American Council of Learned Societies with the funds provided by the Rockefeller Foundation, the National Science Foundation Geography and Regional Science Program under Grant No. SES-8912471, and a U.S. Department of Education Fulbright-Hays Doctoral Dissertation Research

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Abroad Fellowship. I also want to thank all the supportive people behind the scenes who answered my questions and helped me with logistics, budgets, paperwork and all that stuff that I have no patience with.

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PREFACE

This dissertation responds to a call, in the mid-1980s, for greater interdisciplinarity in research on African agriculture – to transcend the conventional boundary between social and natural sciences. To further this effort the Social Science Research Council established a research grant aimed at supporting interdisciplinary research efforts. The program funded dissertations that attempted, in some way, to bridge the chasm between the natural and social sciences. The funding provided for limited pre-research training in physical and natural sciences and technical fields to improve the student’s capacity to incorporate an interdisciplinary approach in her/his research.

The receipt of this grant enabled me to pursue course work outside of my social science program before leaving for the field in 1990. In this capacity I completed work at Utah State University and University of Arizona in 1989. The emphasis of the grant program corresponded directly with my interest in pursuing a topic in political ecology.

Senegal, and more specifically the Senegal River Valley, was selected for this study on local resource management issues and their relationship to environmental degradation. The Middle Senegal River Valley was a familiar place to me after having lived there for two years (1984-1986) as an agricultural extension agent for the U.S. Peace Corps. I was inspired to pursue my interests in resource management strategies, environmental degradation, questions of access and control over resources, and interactions between multiple user groups as I lived and worked among the haal-Pulaar. Back in 1986 I knew that I would return to explore these issues further.

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Another initial reason I selected the Senegal River Valley was an interest in examining the significance of an international boundary on the evolution of local natural resource management. The river between Senegal and Mauritania, designated during French colonial rule as an international border, divided an historically united society whose resource use space straddled the river. Ethnic tensions and war conditions in 1989-1990 prohibited me from investigating this research question and from entering Mauritania. The hostilities between Mauritania and Senegal further influenced my research in that I decided to work and live away from the Senegal River for security reasons.

My familiarity with the culture and my ability to speak the local language facilitated entrance into the villages and all of the other places I visited. As a speaker of Pulaar, the local African language, I was able to carry on casual conversations and formal interviews. I elected to work with a research assistant, however, throughout my tenure in Senegal. Ousmane Sall provided French translations of the Pulaar to assure a fuller understanding of the exchanges.

An extended time in the field, prior experiences in the region and an interdisciplinary approach enabled me to explore many of the complexities of human-environment relationships in the Senegal River Valley. The story of these explorations lies on the pages that follow.

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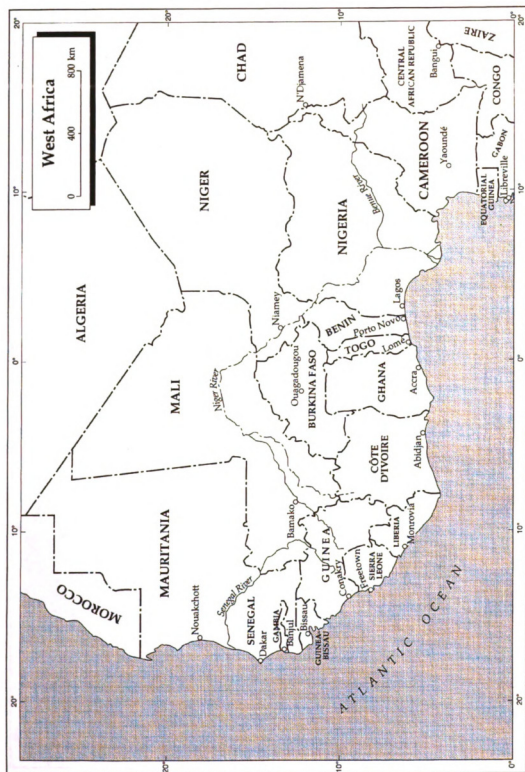
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LIST OF ABBREVIATIONS

ANS	Archives Nationale du Sénégal
AOF	Afrique Occidentale Française
CEHSAOF	Comité d'Etudes Historiques et Scientifiques de l'Afrique Occidentale Française
CSE	Centre de Suivi Ecologique
GIE	Groupement d'Intérêt Economique
IFAN	Institut Fondamental d'Afrique Noir
ISRA	Institut Sénégalais de Recherches Agricoles
JO	Journal Officiel
JORS	Journal Officiel de la République du Sénégal.
MAS	Mission de l'Aménagement du Fleuve Sénégal
OERS	Organisation des Etats Riverains du Sénégal
OMVS	Organisation de Mise en Valeur du Fleuve Sénégal
PIV	Périmètre Irrigué Villageois
SAED	Société d'Aménagement et d'Exploitation des Terres du Delta du fleuve Sénégal et de la Falémé
SIP	Société d'Indigène Prevoyance







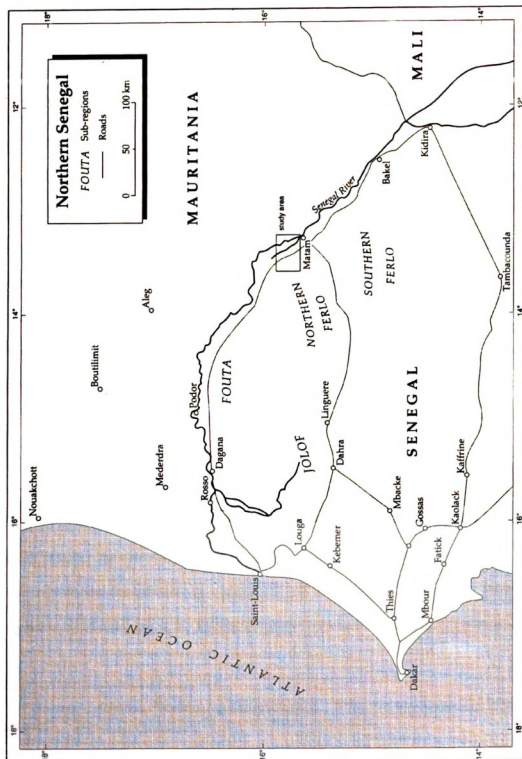


Figure 2. Map of Northern Senegal

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CHAPTER I

INTRODUCTION: ENTERING THE NATURE-SOCIETY DEBATE

INTRODUCTION

Environmental degradation in Africa is part of the lamented "crisis" on the continent. The Sahel has been a focal point of research on causes, processes and repair of dryland degradation since early in the century, culminating with the 1968-1973 drought.¹ The cited causes of degradation range from global climate change to the effects of land use practices, population growth and land tenure systems. The range of opinion on causes of degradation shifts as current ideologies change and move along a nature-society continuum. Often the analyses of environmental degradation mistake symptoms for causes and infer process from form. In this thesis a synthetic and integrative approach is attempted in an effort to more clearly expose the nature-society relationship of one locality; whereby the multiple links between environment, economy and society are explored.

The story found on these pages attempts to combine three, often disparately treated, sets of factors: the effect of climatic change, the impact of people degrading their own environment, and the influence of wider social and economic relations.² Four premises, suggested by Blaikie, are at the foundation of this approach. They are: 1) that African

¹ Steven L. Rhodes, "Rethinking Desertification: What Do We Know and What Have We Learned?," World Development 19, no. 9 (1991): 1137-1143.

² This approach is summarized in W. M. Adams, Green Development: Environment and Sustainability in the Third World (London: Routledge, 1991), pp. 87-112.

natural resource use systems "can be understood in terms of a series of technical operations with a variety of biological, social, political and ecological processes acting upon each of them"; 2) that resource use systems "can only be understood in relation to the overall patterns of resource control"; 3) that political, economic and cultural structures in Africa are continually changing; and 4) that household, local, regional, national and international systems are interdependent.³

This research effort attempts to address first, the uncertainty about the relationship between environment and access to resources, and secondly, the polarization between nature and society in discussions of environmental degradation. Adopting a place-specific and historical approach, the complex and ever changing interactions between several rural communities and their natural environment can be detailed. In this study the emphasis is placed on the relationships between natural resource management systems, access to and use of natural resources, and environmental degradation. The interrelationships between social and environmental processes are explored in the specific setting of the Senegal River Valley in northern Senegal.

The capacity to manage natural resources is grounded in the differential patterns of access to and control over resources operating at a multiplicity of levels. "There is a dynamic relationship between patterns of access to resources and the 'environmental data' on which the outcomes of patterns of access are played out....these outcomes modify the environmental data so that future patterns of access both adapt to and further change the environment in a recursive and dialectical manner."⁴ The transformation of, and struggles over, complex

³ These four premises are cited from Piers Blaikie, "Environment and Access to Resources in Africa," *Africa* 59, no. 1 (1989), p. 18. They are the four premises that underlie the JCAS research initiative that inspired and partially funded this project.

⁴ P. Blaikie, "Environment and Access," p. 18.

multiple uses and overlapping rights, and the consequences of these changes on the local natural environment are examined in this study. The focus is on the evolving constraints and opportunities related to changes in access to and control over natural resources in rural Africa.

The major questions examined in this study include: 1) the relations between access rights to natural resources and patterns of resource use and management; and 2) the changes in the economic, social, political and environmental conditions that have reinforced or altered the processes and patterns of resource access, use and management. Of particular interest are the nature of overlapping rights, the relationships between entitlements of individuals and resources held in common, the relationship between usufruct and ownership, the interactions between local and extra-local institutions and the connection between the nature of resource rights and issues of scarcity, responsibility and resource management.⁵ There are multiple reasons to examine these issues, but the principal focus of this work is on how the issues relate to local resource management systems and environmental degradation in rural Africa.

This analysis traces the relations between society and the physical environment through time and between different spatial scales of analysis. An historical and multi-scale approach is taken because the nature/society relationship is continually changing over time and across spatial scales, with past changes affecting present processes and structures and with transformations at one spatial scale influencing, and being influenced by, systems at other scales. Comaroff and Comaroff clarify the time/scale issue in writing: "No social world may be properly understood without reference both to its internal historicity and to its unfolding

⁵ Pauline E. Peters, "Embedded Systems and Rooted Models: The Grazing Lands of Botswana and the Commons Debate," in The Question of the Commons: The Culture and Ecology of Communal Resources, edited by Bonnie J. McCay and James M. Acheson (Tucson: University of Arizona Press, 1987), p. 171.

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⁶ John Comaroff
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⁷ Ibid., p. 10

⁸ Ibid., p. 10

⁹ E. LeBras
Noire: Pratiques
(Paris: Karthagos)

¹⁰ This definition of
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relationship with its wider context."⁶ They continue by asserting:

The historical encounter between two social worlds -- however circumscribed the one, or expansive the other -- is always dialectical; that is each works to transform the other, even as they are being joined in a new order of relations....The ratio of determination varies across situations -- although local social and cultural forms invariably mediate the direction of historical movements, even when they are being radically altered by them.⁷

Comaroff and Comaroff go on to elucidate that although these were once different worlds, cross-influencing of the two worlds finally makes them one, distinct from either of the original "worlds."⁸ This study is interested in identifying and understanding the threads that string together the past and present in a particular locale.

These issues are examined through a case study of the social, political, economic and ecological relations surrounding local natural resource control, use and management in several village territories in the Senegal River Valley. Local analysis is the optimal scale for observation of practices and strategies, of processes and systems of social relations.⁹ Several natural resource user groups -- cultivators, herders, fishers, hunters, collectors and gatherers -- have overlapping and multiple uses of the local natural resources. Yet the inductive approach of local scale analysis easily fragments and obscures these interactions and overlapping rights, often treating the locality as an autonomous unit. Recognizing that the locality is not an island in space or time,¹⁰ this study moves between scales of analysis, from

⁶ John Comaroff and Jean Comaroff, Ethnography and the Historical Imagination (Boulder: Westview Press, 1992), p. 96.

⁷ Ibid., p. 97.

⁸ Ibid., p. 122.

⁹ E. LeBris and E. LeRoy, "Le local et l'échelle de Jacob," in Espaces Disputés en Afrique Noire: Pratiques foncières locales, edited by Bernard Crousse, Emile LeBris and Etienne LeRoy (Paris: Karthala, 1986), p. 348.

¹⁰ This description comes from John Lovering, "The restructuring debate," New models in geography: The political-economy perspective, edited by R. Peet and N. Thrift (London: Unwin

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This study of local resource management attempts to illustrate the relationships between access to and control over resources and environmental degradation by examining the social, political, economic and environmental processes affecting local resource users. The case study revealed that: 1) historically rooted haal-Pulaar social relations help explain current patterns of access to and control over resources; 2) non-local circuits of accumulation and surplus extraction and non-local ideologies have affected local resource use and misuse; 3) many of the multiple uses and overlapping rights to local natural resources have become mutually exclusive in the face of change; 4) the deterioration of indigenous management strategies and failure to replace them with effective alternative systems has had negative environmental impacts; and 5) the local population, faced with difficult social and economic conditions in a degraded physical environment, has few alternatives but to satisfy short-term subsistence requirements that lead to further environmental degradation.

This chapter introduces three themes that run through the dissertation. First, the theme of nature-society in geography and the social sciences is examined. Geographers and others have long been interested in exploring the environment/society question. The role and "power" given to the physical environment versus society in the debate shifts according to the approach and ideology in vogue. This study seeks to contribute to the development of an analytical synthesis for human-environment research.

Second, a brief survey of the topic of environmental degradation and related concepts, especially desertification, in the African context is provided. The objective is to review evidence of ecological degradation and the social and ecological interpretations offered to explain this degradation. The relationship between environmental degradation and society

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remains nebulous due to a lack of reliable data, especially on environmental change, and the impossibility of reliably identifying causes – human agency or climatic change, for example -- in environmental change.¹¹ As Adams states: "The impact of the history of social relations in the colonial Third World is a lot better known than the impact this has had on the natural environment."¹²

The chapter ends with a discussion concerning resource access, tenure and management. This dissertation addresses the debate over the relationship between natural resource management and tenure systems and environmental degradation. The objective is to explore the principal theories and assumptions that abound as to the effect of tenure on environmental conditions.

NATURE AND SOCIETY

Exploring the relationship between nature and society has been an important theme in geographic inquiry for centuries. The wholeness of geography, uniting the social and the physical, is most possibly achieved in human-environment interaction studies. Interest in the subject has waxed and waned, and the lenses through which geographers have viewed human-environment interactions have varied in association with broader trends in geography, the social sciences, and the wider society. After enduring a long dormant period, the nature/society relationship has acquired new vitality.

The study of nature and society experienced a demise during this century for several reasons. The separation of human and physical geographies in the late 19th century, in reaction to the growing prominence of natural science disciplines, "broke the original

¹¹ See P. Blaikie, "Environment and Access."

¹² W. M. Adams, Green Development, p. 103.

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geographical bond."¹³ Geography became the inquiry of two separate foci, human society and external nature. Environmental determinism evolved as an (over)reaction to this rift.¹⁴ The responses of many to the extreme views of environmental determinism only deepened the intellectual schism between human and physical geography. Another division within human geography that has stifled research on nature and society has been the separation of nature and space.¹⁵ Critical analysis of space advanced during recent decades, but this space was devoid of nature. Although these divisions persist today, greater numbers of human geographers have shown growing interest in the issue of social nature.¹⁶

Development of the French School of regional geography,¹⁷ since early this century, pursued the analysis of interactions between the social and the physical within the context of the region, which was viewed as an organic whole. In the 1950s and 1960s the French School, influenced by Marxist analysis, began to interpret environmental decline as part of an

¹³ Margaret Fitzsimmons, "The Matter of Nature," Antipode 21, no. 2 (1989): 106-120.

¹⁴ See, for example, Ellsworth Huntington, Civilization and Climate (New Haven, Conn.: Yale University Press, 1924) and Ellen Churchill Semple, Influences of Geographic Environment on the Basis of Ratzel's System of Anthro-Geography (New York: Russell and Russell, 1911).

¹⁵ M. Fitzsimmons, "The Matter of Nature" and M. Fitzsimmons, "Hidden philosophies: How geographical thought has been limited by its theoretical models," GeoForum 16, no. 2 (1985): 139-149.

¹⁶ See, for example, Michael Watts, Silent Violence: Food, Famine and Peasantry in Northern Nigeria (Berkeley: University of California Press, 1983); Michael Redclift, Development and the Environmental Crisis: Red or Green Alternatives? (London: Methuen, 1984); Michael Redclift, Sustainable Development: Exploring the Contradictions (London: Methuen, 1987); Piers Blaikie and Harold Brookfield, Land Degradation in Society (New York: Methuen, 1987); Judith Carney, "Struggles over crop rights and labor within contract farming households in a Gambian irrigated rice project," Journal of Peasant Studies 15 (1988): 334-349 and Jesse Ribot, "Markets, States and Environmental Policy: The political economy of charcoal in Senegal" (Ph.D. dissertation, University of California-Berkeley, 1990).

¹⁷ Paul Vidal de la Blache, Geographie universelle (Paris: A. Colin, 1927) and Paul Vidal de La Blache, Principles of human geography, translated from the French by Millicent Todd Bingham (New York: H. Holt, 1926).

historical process of change in traditional human-environment systems¹⁸ leading to the political economic approach to nature-society interactions.¹⁹ The evolution of the French School is of particular interest to this study of Senegal, since much of the geographical and anthropological research of the region has been conducted by French scholars working in these traditions. Throughout the history of the French School, scholars have attempted to avoid the schism between society and nature that occurred in academic geography in the United States. However, this work has failed to develop persuasive theory linking social and biophysical processes. The physical environment remains as a backdrop, separated from the dynamic social processes.

Renewed attention to the nature-society theme arises from several disparate directions. Increasing significance of environmental issues in the contemporary world, be it local resource degradation or concern for global warming, has led some to examine the role of society in these transformations. Such studies have tended to be technocratic and positivistic.²⁰ Most recently, postmodernist inquiry in geography promotes a return to the

¹⁸ See for example J. Gallais, Pasteurs et Paysans du Gourma (Paris: Centre d'Etudes de Géographie Tropicale, 1977); E. Bernus, "L'évolution récente de relations entre éleveurs et agriculteurs en Afrique tropicale: l'exemple du Sahel nigérien," Cahiers ORSTOM, série Sciences Humaines 11, no. 2 (1974): 119-126; J. Dresch, "Les Transformations du Sahel Nigérien," Acta Geographica (June 1959): 3-12 and G. Nicholas, "Un village Bouzou du Niger: étude d'un terroir," Cahiers d'outre-mer 15, no. 58 (1962): 138-165.

¹⁹ See for example, Jean Copans, Sécheresses et famines du Sahel. Vol. 1: Ecologie, dénutrition, assistance. Vol. 2: Paysans et nomades (Paris: Maspéro, 1975) and C. Meillassoux, "Development or exploitation: is the Sahel famine good business?" Review of African Political Economy 1 (1974): 27-33.

²⁰ See, for example, Robert W. Kates and Ian Burton, Geography, Resources, and Environment: Themes from the Work of Gilbert F. White, Volumes I and II (Chicago: The University of Chicago Press, 1986); Larry Grossman, "Man-Environment Relationships in Anthropology and Geography," Annals of the Association of American Geographers 67: 126-144; B. L. Turner II and William B. Meyer, "Land Use and Land Cover in Global Environmental Change: Considerations for Study," International Social Science Journal, forthcoming 1991; and research by the Earth Transformed Program at Clark University.

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study of localities, and with that a renewed reflexive exploration of human-environment interaction and the social construction of environmental ideas and practices.²¹ The departure from the human ecology approach to that of political ecology emphasizes the synthesis of human ecology concerns and the political economy of access to and control over natural resources.²²

Current interest exists in re-uniting society and nature, so that nature is no longer treated as abstract and external to the human world, but as constructed by society.²³ Social structures and the environment are not static but in dynamic relationship, often in contradictory relations. Contemporary work on this theme tends to emphasize social nature and the significance of geographical context and contingency.²⁴ The political ecology model, linking society, political economy and environment, provides a framework for pursuing anew some of the principal and historic concerns of human geography. The primary objective of such work is to illuminate the "black box between theory and broad empirical pattern."²⁵ This study seeks to contribute to the development of an analytical framework that will expand our understanding of the relationship between societal and ecological changes in the Sahel.

This new approach to society/environment research calls for locality studies or a micro-territorial approach. Even as the conceptual framework demands analysis of the

²¹ J. Rees, Natural resources: allocation, economics and policy (London: Methuen, 1985) and J. Emel and R. Peet, "Resource management and natural hazards," in New Models in geography: the political-economy perspective, p. 72.

²² See P. Blaikie and H. Brookfield, Land Degradation and Society, for the fullest development of the political ecology approach.

²³ Piers Blaikie, The Political Economy of Soil Erosion (London: Methuen 1985); M. Fitzsimmons, "The Matter of Nature" and P. Peters, "Embedded Systems."

²⁴ J. Emel and R. Peet, "Resource management and natural hazards," pp. 60.

²⁵ Neil Smith, "Uneven development and location theory: towards a synthesis," in New models in Geography, p. 157.

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broader and non-location specific social, political and economic structures, the need for place-based studies of human-environment interaction is widely emphasized.²⁶ Resource use and environmental degradation occur "at the juncture of human activity and a given site with particular physical characteristics. It is caused by repeated decisions on the use of land which derive in turn from the agrarian political economy."²⁷ Commencing with the local resource users, in their specific natural and social environment, "grounds" the analysis of historical processes. Environment/society analysis requires a constant shifting, however, between the local, regional, national and international spatial scales and over time. Turning once again to Comaroff and Comaroff who elucidate the importance, and difficulties, of considering different scales or, as they state, "different worlds":

The lines of demarcation between the 'internal' world of any society and the 'external' universe beyond – between the local, the regional, and the global – are neither preordained and fixed. They shift as processes of engagement take their course, and they alter relations of power and production. They shift, too, at the level of experience and representation, although not necessarily in direct proportion to structural changes....Both political order and social life were, by their very nature, liable to assume widely differing contours over space and time.²⁸

The issue of multiple spatial and temporal scales remains analytically problematic, especially when combining social and physical processes. We must move between scales for the analysis to be meaningful, but conditions at one scale may not provide accurate information when extrapolated to another scale. Furthermore, the interactions that occur between scales are not unilinear. Very significant errors have been shown to occur when

²⁶ P. Blaikie and H. Brookfield, Land Degradation in Society; P. Blaikie, "Environment and Access"; and David Campbell and Jenny Olson, "Framework for environment and development: The kite," CASID Occasional Paper No. 10 (East Lansing, Michigan: CASID, 1990).

²⁷ P. Blaikie, "Environment and Access," p. 24.

²⁸ J. Comaroff and J. Comaroff, Historical Imagination, pp. 97 and 100.

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²⁰ See Mike Storer, "49-63; Steven L. Rhee, "Learned?" *World Development*, 1990, 18, 1001-1010. *Drought: farmers*, University Press, 1990.

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local site-specific physical data are extrapolated to the regional level.²⁹ One premise of this work is that the functioning of households, regional economies and national and international systems are interdependent, but determining precisely how these different levels of abstraction and scale are to be involved in analysis must be assessed empirically. The manifestation of general social processes or change vary according to place-specific environmental and social conditions. Generalizations that do not differentiate between the general and specific add confusion and little insight into the interdependencies.

Moving between different time scales presents difficulty because of the time lags, cyclical rhythms, and synergisms involved in interactions and change, especially when the interactions between social and physical processes are the foci of analysis. "[F]or *analytical purposes*, the synchronic time perspective must be extended beyond the notion of linear time in which the present is seen as merely an outcome of past events and the basis for the future."³⁰ Diachronic analysis is required to determine the long-term patterns of interactions. Distinct concepts and scales of time are required to analyze different issues and processes.

Recent research on the theme of nature and society is struggling with these issues of scale, generality and specificity, cause and effect and making new strides to re-unite the analysis of nature and society.

²⁹ See Mike Stocking, "Measuring land degradation," in Land Degradation in Society, pp. 49-63; Steven L. Rhodes, "Rethinking Desertification: What Do We Know and What Have We Learned?" World Development 19, no. 9 (1991): 1137-1143; Michael Mortimore, Adapting to Drought: farmers, famines and desertification in West Africa (Cambridge: Cambridge University Press, 1989) and P. Blaikie, "Environment and Access."

³⁰ D. Campbell and J. Olson, "Framework," p. 21.

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ENVIRONMENTAL DEGRADATION IN THE SAHELIAN CONTEXT

Deciphering the meaning of environmental degradation and desertification in the Sahelian context must occur before exploring the relations between the society and environment. Since the Sahelian drought of 1968-1973, debates over the meaning and the causes of desertification have revealed incompatibilities in interpretations. Watts writes: "a good deal of the discussion of Sahelian degradation remains hopelessly entangled in unproven generalities and dubious, though unstated, assumptions...."³¹ The concept of desertification, the processes it involves, and their causes lack precise definition even though vast amounts of financial and human resources have been invested to halt its occurrence. After years of conflicting and contrasting definitions, desertification is now commonly, albeit broadly, defined as the "process of environmental degradation in and around arid lands, resulting from either human activities, climatic variations, or both."³²

Due to the ambiguities and mis-use associated with the term desertification, this study prefers the expression environmental degradation. Climatic causes and unidirectional change are less likely to be assumed with environmental degradation.

Employing the term environmental degradation does not avoid altogether multiple interpretations and meanings, however.³³ The multiple meanings of degradation stem from the diverse perspectives of different land users and managers, rather than due to attributing different causes to the process, as is the case with desertification. For example, clearing a

³¹ M. Watts, "The agrarian question in Africa: debating the crisis," Progress in Human Geography 13 (1989), p. 8; see also P. Blaikie, "Environment and Access," p. 19.

³² Michael Glantz, "Man, State and the Environment: An Inquiry into Whether Solutions to Desertification in the West African Sahel are Known but not Applied," Canadian Journal of Development Studies 19 (1980), p. 76; see also M. Mortimore, Adapting to Drought.

³³ P. Blaikie and H. Brookfield, Land Degradation in Society and Peter Grieg, "Commentary," in Land Degradation: Problems and policies, edited by Anthony Chisholm and Robert Dumsday (Cambridge: Cambridge University Press, 1987), pp. 9-26.

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forest to create a field degrades the area according to some potential users but improves it for other uses. Natural scientific language, viewed as external to society, is employed to define degradation in "neutral" terms, but this only weakly masks the competing social definitions of degradation. Blaikie and Brookfield note:

Socially, degradation must relate to capability, and it is only if the degradation process under one system of production has reduced the initial capability of land in a successor system, actual or potential, that degradation is, as it were, carried across the allocation change. In actual practice, this is often the case, since more serious degradation reduces capability for most, if not all, future possible land uses.³⁴

This dissertation endeavors to examine the multiple definitions and meanings of degradation through time expressed by diverse local resource users as well as colonial administrators, state officials and others.

Cries that the Sahara is advancing rapidly southward³⁵ have subsided but the issues surrounding environmental degradation in the Sahel are far from settled. The problem of data – their scarcity, unreliability, insignificance and vagueness – and the difficulties associated with empirically demonstrating cause and effect remain unresolved.

A simplistic polarity between two positions on environmental degradation – change due to social versus natural causes – quickly evolved in the literature. Blaikie argues that it is necessary to overcome this division "since it is the dialectic between environmental and social change which must provide the context in which land degradation is discussed."³⁶

³⁴ P. Blaikie and H. Brookfield, Land Degradation in Society, pp. 6-7.

³⁵ See for example, E. P. Stebbing, "The encroaching Sahara: the threat to the West African colonies," Geographical Journal 85 (1935): 506-524; U.N. United Nations Conference on Desertification, OPI/NGO/SB/96, 20 May 1976, p. 1; H. N. LeHou  rou, "The Nature and Causes of Desertification," in Desertification: Environmental Degradation in and around Arid Lands, edited by Michael H. Glantz (Boulder: Westview Press, 1977), pp. 17-38; and Lester Brown, World Population and Food Supplies: Looking Ahead, Conference Background Paper (U.N. World Population Conference, Bucharest, 19-30 August 1974).

³⁶ P. Blaikie, "Environment and Access," p. 22.

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Attempts to attribute degradation solely to natural forces, such as climate change, are scorned as "merely a bourgeois red herring."³⁷ On the other hand, some reject the emphasis given to the role of human agency and over-exploitation or political economic structures at the expense of that of meteorological drought.³⁸

In the literature four categories of explanation for environmental degradation prevail:³⁹ 1) climatic factors; 2) environmental mismanagement and misuse, particularly, overgrazing, poor cultivation methods, burning and deforestation; 3) population pressures; and 4) structural interpretations of environmental degradation. None of these positions are adequate as unique explanations of environmental degradation. Any of the hypotheses associated with these four categories requires verification and empirical support, which has been rare except in a small number of locality-specific case studies.

Single hypotheses and single theories offer clarity and simplicity, but bring us no closer to understanding the complexities of the historical processes we seek to interpret. The

³⁷ Ibid.

³⁸ M. Mortimore, Adapting to Drought, p. 187.

³⁹ This follows Mortimore, Adapting to Drought, pp. 199-217. The following references cite works supporting the four hypotheses discussed. For the climate change hypothesis see: M. Mortimore, Adapting to Drought; examples of the mismanagement argument can be found in: Jeffery A. Gritzner, The West African Sahel: Human Agency and Environmental Change, Geography Research Paper No. 226 (The University of Chicago, 1988) and John Cloudsley-Thompson, "Human Activities and Desert Expansion," The Geographical Journal 144 (1978): 416-423. The population pressure hypothesis is developed in: H. N. LeHouérou, "Ecologie, démographie et production agricole dans les pays méditerranéens du Tiers Monde," Options Médit 17 (1973); H. N. LeHouérou, "Rehabilitation of degraded lands," in Can Desert Encroachment be Stopped?, edited by Anders Rapp, H. N. LeHouérou and B. Lundholm (Stockholm: Secretariat for International Ecology, 1976), pp. 189-206 and Lester Brown, World Population and Food Supplies. See M. Watts, Silent Violence; R. Franke and B. H. Chasin, Seeds of Famine: Ecological Destruction and the Development Dilemma in the Western Sahel (New Jersey: Allenheld, Osmun and Co., 1980) and J. Copans, "The Sahelian drought: social sciences and the political economy of underdevelopment," in Interpretations of Calamity, edited by K. Hewitt (London: Allen and Unwin, 1983), pp. 83-97 for examples of the structural argument.

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impact and meaning of degradation can only be understood in relation to the overall, long-term patterns of resource access and control. Multiple and interacting factors explain environmental degradation in any particular locale. Difficult as they may be to demonstrate empirically, complex, multi-directional interactions exist between society and the environment.

RESOURCE ACCESS, TENURE AND MANAGEMENT

The relations between property rights and access to resources, on the one hand, and natural resource use and management, on the other, have long been debated and continue to be of fundamental concern in sub-Saharan Africa. The central controversy revolves around which property system -- open access, communal, private or state -- assures the most sound management and efficient use of natural resources.⁴⁰ Open access implies the absence of defined, recognized rights of access to the resource. The resource is unregulated, free and open to all. With a breakdown in the system, common property can become open access. This transformation has been shown to have occurred, for example, with colonialism.⁴¹ Common property denotes that rights are held by a recognized group that distinguishes between insiders and outsiders. Equal access by all insiders is usual. Private property

⁴⁰ Numerous studies have discussed these property systems. See for example David Feeny, *et al.*, "The Tragedy of the Commons: Twenty-Two Years Later," Human Ecology 18, no. 1 (1990): 1-19; S. V. Ciriacy-Wantrup and R. C. Bishop, "'Common property' as a concept in natural resource policy," Natural Resources Journal 15 (1975): 713-727; F. Berkes, ed., Common Property Resources: Ecology and community-based sustainable development (London: Belhaven Press, 1989); D. W. Bromley and M. M. Cernea, "The management of common property natural resources" (Washington, D.C.: World Bank Discussion Paper, 1989); C. Gibbs and D. W. Bromley, "Institutional arrangements" and E. Orstom, "Issues of definition and theory: some conclusions and hypotheses," in Proceedings of the Conference on Common Property Resource Management (Washington, D.C.: National Academy Press, 1986), pp. 997-615.

⁴¹ See, for example, D. Johnson and D. Anderson, eds., The Ecology of Survival: Case Studies From Northeast African History (London: Crook, 1988).

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indicates that either individuals or groups have the right to exclude and regulate use. These rights are often exclusive and transferable. State property means that the rights are invested in the government. This system can involve coercive power.

The dominant Western assumption has been that only private property rights guarantee responsible and efficient management of resources.⁴² Recent evidence contradicts this position, with special attention given to the relevance of many common property systems.⁴³ In actuality the four ideal types of property often overlap, with complex and multiple rights evolving and proliferating over time. Berry maintains that this multiplication of overlapping rights has affected patterns of rural investment and rural differentiation.⁴⁴

Variations of all four of the property systems listed above have occurred in the study area during the twentieth century. The logic of the relations between people and the environment has evolved as economic, political and social structures and the physical environment have changed. Fixing exogenous models of property rights and tenure on the society has had drastic effects on the local populations' relationship to their environment, and consequently on their use and management of natural resources.

In the following chapters the ways that social relations have influenced the meaning and construction of property rights and patterns of differential access to natural resources are examined. A multiplicity of links and claims to the use of commons and private holdings

⁴² Much of the contemporary debate over common versus private property principally is a reaction to Hardin's "tragedy of the commons" thesis. See Garrett Hardin, "The tragedy of the commons," Science 162 (1968): 1243-1248.

⁴³ See, for example, J. L. Gilles and K. Jamgaard, "Overgrazing in Pastoral Areas: The Commons Reconsidered," Nomadic Peoples 10 (1982): 1-10; B. McCay and J. M. Acheson, The Question of the Commons: The Culture and Ecology of Communal Resources (Tucson, AZ: The University of Arizona Press, 1987) and F. Berkes, ed., Common Property Resources.

⁴⁴ Sara Berry, "Property rights and rural resource management: the case of tree crops in West Africa," Cahiers de Sciences Humaines 24, no. 1 (1988), p. 13.

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have existed, and continue to exist, in the local society. The historical factors that have recast the local resource tenure systems are investigated in the context of the present case study. This study reveals that incomplete, ambiguous and conflicting specification of property rights, and the breakdown of authority enforcing access and use rights, can affect resource management, and by implication, can lead to environmental degradation.

Local resource users, faced with unmet subsistence demands under any property system, may be expected to make resource use and management decisions where all that matters is meeting present survival needs. Under these conditions people may seek surpluses from the environment, which could cause environmental destruction, to delay their own devastation.⁴⁵ The social, economic and political processes that could produce "resource degradation as a by-product of a strategy to survive"⁴⁶ are explored in the present study.

The continuously shifting meanings of insiders and outsiders, in relation to resource access and use, are explored through time. The fluidity of these categories functions, in part, as a management strategy, affecting access to resources. Who defines the resource user groups is, in part, an issue of power relations, and whether the definitions are imposed, accepted or contested, are crucial issues in interpreting the constantly changing systems of resource use rights. Berry emphasizes social identity as a critical factor in the ability to gain access to resources. "Since pre-colonial times, Africans have gained access to land, labor, and capital for agricultural production both through exchange and through membership and

⁴⁵ C. P. Perrings develops a model where resource degradation is an optimal response to adverse changes in the world economy. See C. P. Perrings, "Optimal path to extinction? Poverty and resource degradation in the open agrarian economy," Journal of Development Economics 30, no. 1 (1989): 1-24.

⁴⁶ B. A. Larson and D. W. Bromley, "Property rights, Externalities, and Resource Degradation," Journal of Development Economics 33 (1990), p. 243.

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status in various social units."⁴⁷ Findings from the present study support the claim that the historically rooted social relations which depend on social identity continue to engender selective patterns of resource access. However, these social relations and groups are continually being reshaped and redefined. As Berry asserted in an earlier work, ambiguities surround property rights that are embedded in multi-stranded social relationships.⁴⁸

STRUCTURE OF THE DISSERTATION

The present study explores the relationships between local natural resource users and their physical environment from the inception of colonial rule to the present day in a micro-region in the Senegal River Valley. This interdisciplinary study explores the complex interactions between social, political and economic structures and the physical environment across multiple spatial scales and through different time frames.

Research methods and data are discussed in the following chapter. The multiple methodological and diverse data issues that must be confronted in a study on human-environment interaction are examined. In addition, the chapter includes an account of the field research site selection, study duration and field methods. Chapter III provides an introduction to the dynamic setting of the case study. Descriptions of the society and the physical environment of the region provide the reader with an introduction to the study area. The section includes analysis of the changes occurring in the local physical environment.

The subsequent two chapters trace the historical processes that have taken place with respect to the use and management of natural resources in the region. Chapter IV explores the complex local systems of resource use, access and management in the indigenous society

⁴⁷ S. Berry, "Social Institutions and Access to Resources," p. 41.

⁴⁸ S. Berry, "Property rights and rural resource management," p. 13.

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at the dawn of French administrative control of the region. In this section the multiple uses and overlapping rights to natural resources, and ways that local social institutions served as channels of access to resources and shaped resource use and management strategies, are explored. The evolution of local resource strategies under colonial rule is the focus of Chapter V. The chapter describes the resource management systems and use strategies that emerged as a consequence of the integration of the region into the colonial state. The effect of colonial policies and legislation on resource use and management, and the methods of resource appropriation by the state, are examined.

Chapters VI and VII focus on the contemporary situation of resource management in the region. Chapter VI presents an account of the current legislation pertaining to resource management in Senegal, revealing the "family resemblance between the colonial and post-colonial schema of explanation-cum-prescription in matters of land tenure."⁴⁹ The local reactions to and diverse meanings of the legislation for the different resource users are considered. Chapter VII analyzes the complex contemporary relationships between resource access and environment. The effects of recent social and physical changes on patterns of access to resource use and overlapping rights are explored.

The concluding chapter provides a summary and conclusions of the study presented in this dissertation. First, an integrative summary of the case study material is provided. Subsequently, the methodological approach employed in the study is reviewed and assessed. Returning to the three main themes presented in this introduction, the study's contribution to a conceptual framework for understanding human-environment interaction is examined.

⁴⁹ See P. Peters, "Embedded Systems," p. 150.

CHAPTER II

METHODS AND DATA

"...[W]e may never know as much as we would like because each time a layer of ignorance is removed, a new layer appears. It is disquieting to think that nature might be infinitely divisible but the suggestion indicates that practical solutions require a halt to reductionism."¹

"It has been our aim to clarify complexity, but not to reduce it."²

The subject of human-environment interaction is by its very nature interdisciplinary. Analysis of the social, political, economic and environmental factors affecting local natural resource management requires multiple methodologies and diverse data. This chapter introduces the different facets of the study, choice of study area and the methods by which data were acquired. To conclude, a brief discussion of the problems associated with interdisciplinary research, and particularly those related to analysis of the interactions between society and environment, is presented.

THE RESEARCH SITE

The study site (see Figures 3 and 4), an area encompassing seven villages but centered in NDulumaaji Demße, is situated along the Jammel tributary in the Middle Senegal River Valley, approximately twenty-five kilometers downstream from Matam. The other principal

¹ R. Wasson, "Detection and measurement of land degradation processes" in Land Degradation: Problems and Policies, p. 60.

² P. Blaikie and H. Brookfield, Land Degradation and Society, p. 240.

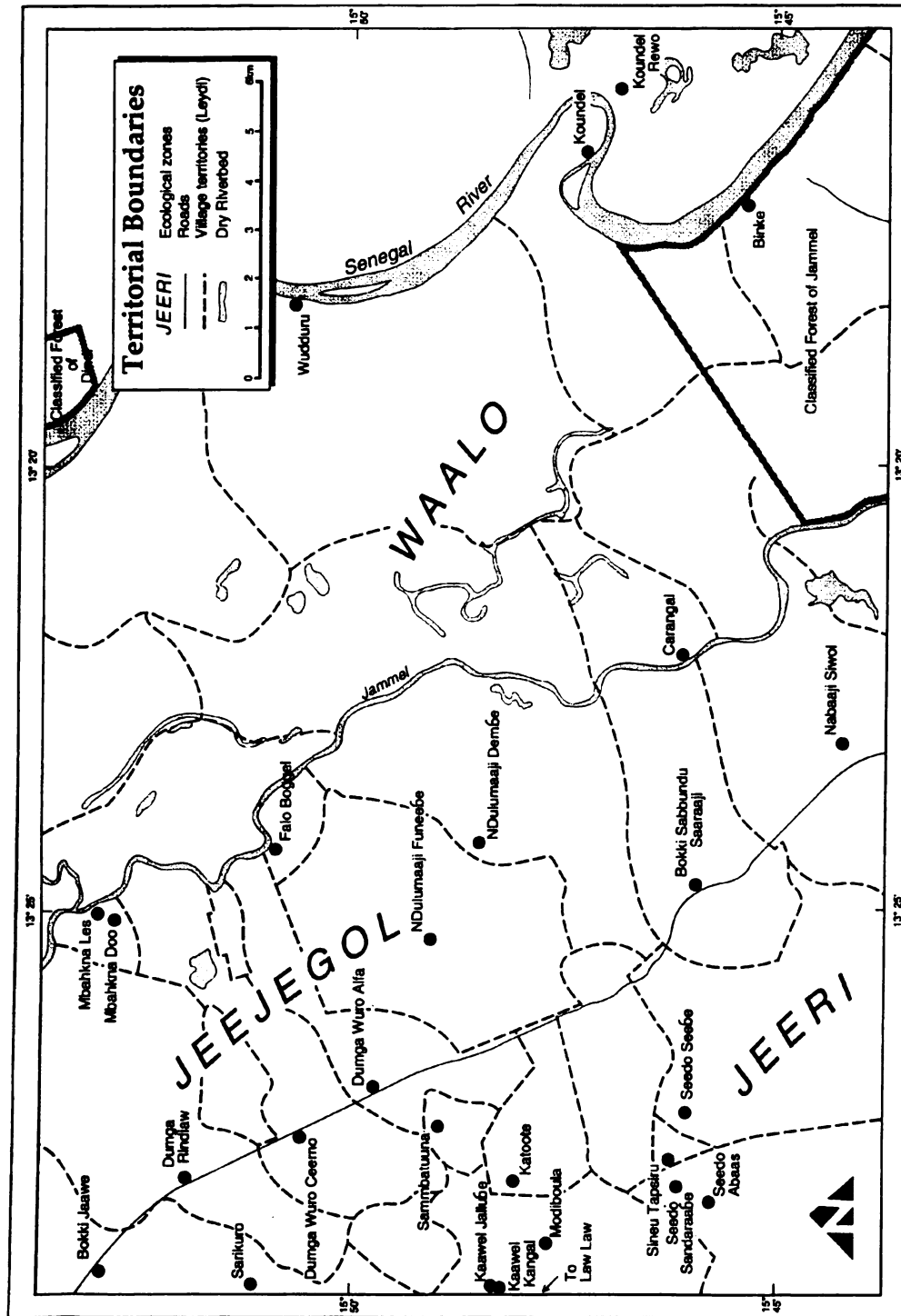


Figure 3. Map of Territorial Boundaries in the Study Area

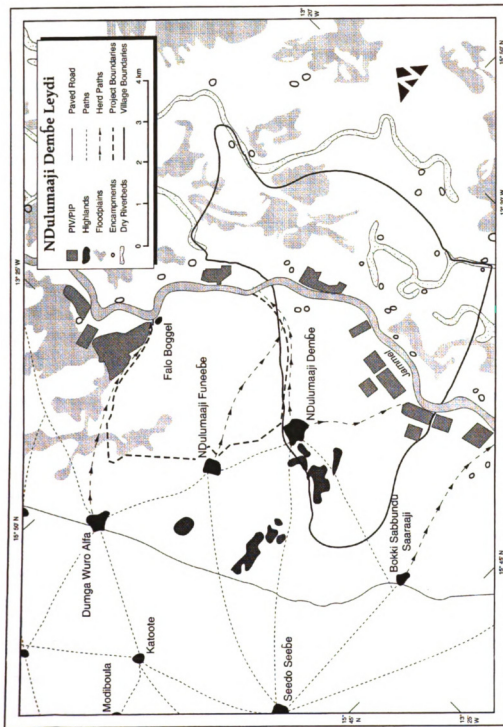


Figure 4. Map of NDulumaaji Dembe Leydi

villages included in the study are NDulumaaji Funeeße, BokiSaboudou, Kaawel, Falo Bogel, Wuduru, Katote and scattered Fulße encampments in the floodplain. Nabaaji Siwol, MBahkna, LawLaw and Seedo Abbas were also visited and several interviews were conducted in each. Residence in NDulumaaji Demße for one year facilitated the assembly of a wide range of social and physical data.

The Senegal River Valley constitutes an appropriate research site for the study of local resource management issues and their relationship to environmental degradation for several reasons. These are: 1) multiple resource user groups interact directly with the environment and with each other within a relatively small area; 2) the complex social stratification of the haal-Pulaar society permitted an examination of how these social divisions affected resource access and use; 3) the enduring French involvement in the area meant the availability of data covering a long time span; 4) the area is currently experiencing drastic social and environmental change, presenting the opportunity to study the issues in a contemporary arena; and 5) Senegal is actively involved in regulating natural resources, and has been since the early colonial era, permitting an exploration of the effects of such regulations and the nature of interactions between local society and the state.

The field research site, located along the Jammel tributary, incorporates significant areas in all of the ecological zones in the Valley, and includes populations from the full range of social categories.³ The study covered an area large enough to explore interactions within and between *leydi*, or village territories, focusing on the territory of NDulumaaji Demße. The present study made no attempt, however, to specify a closed unit for the purposes of the research. The intent, rather, was to ascertain the spatial extent of past and present interactions between people and their environment.

³ Descriptions of the ecological zones and social categories can be found in Chapter III.

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ORGANIZATION OF THE STUDY

To explore and analyze the relationships between natural resource access, use and management and environmental degradation required data on: 1) the historical developments affecting natural resource access, use and management for the study area; 2) the transformations of the social institutions which regulate the channels of access to natural resources; 3) the history of Senegal's natural resource policies; 4) the interactions between local resource user groups over time; 5) the evolution and nature of interactions between local society and regional institutions and the state; 6) the biophysical environment over time; 7) the social, economic and political factors affecting the biophysical environment; and 8) the ways that the changing biophysical environment influences society.

These data requirements determined that the study be organized into a number of different components. Local historical and contemporary data were collected through formal and informal interviews with diverse members of the society, through participant observation, using archival sources and from secondary sources. Analysis of the historical and contemporary extra-community natural resource policies required archival research and key informant interviews with government officials, interviews with local residents, and observation of the application (or non-application, as the case may be) of policies. Village level studies of resource users and their relationships to other resource users and to regional and national structures involved individual and group interviews, primary data collected from other socio-economic studies in the area, participant observation and a formal questionnaire survey. The series of questions that were posed during extensive interviews constantly evolved and expanded over time as more was learned about the relevant issues. Frequently return visits were required to carry out subsequent interviews with individuals after the initial contact.

Data on the physical characteristics were acquired through field work, from archival

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research and secondary data sources and through analysis of two sets of air photographs of the region. Interviews with local residents on the characteristics of the biophysical environment and changes over time provided rich qualitative physical data. Soil samples from degraded and fertile areas were collected in the study area. Tree density measurements and an inventory of currently found tree species were collected. The soil and vegetation data cannot be used for quantitative analysis of change over time because there are no data with which to compare them. The information does permit qualitative comparison, however, with data collected in interviews, and from archival and secondary sources. The physical field measurements also provide important baseline data that could be useful in future studies.

RESEARCH PROCEDURES AND DATA SOURCES

Assessments of the cause and effect relationships between society and environment are subject to wide degrees of error. Identifying, much less measuring, the social, economic and political changes, especially over long periods, presents enormous difficulties. Often it is only possible to reconstruct qualitative processes.

The Middle Senegal River Valley has been the site of a vast number of studies during the twentieth century, with a marked influx during the past twenty years. This presented both positive and negative consequences for the current research project. On the positive side, data collected in the previous studies could be used efficaciously, providing important background information and sometimes allowing for comparative and time-depth analysis. On the negative side, the local residents were often weary of further queries, sometimes rendering them less receptive than they might otherwise have been.

The period of the present study starts at the turn of the century, as colonial rule was being established in Fuuta Toro. First indigenous resource use systems and the nature of the interactions of local resource users at the time the French established control in the region are

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depicted. The subsequent portions of the study chronicle changes from the turn of the century to the present day.

Information gathered from archival and oral sources was combined to reconstruct the historical information relevant to the study. The documents gathered in the *Archives Nationales du Sénégal* (ANS) provided rich and detailed data that has not yet been extensively explored by researchers. Local post reports, particularly the administrative reports for Matam (*Rapports de Cercle*), proved especially helpful, providing direct and internal evidence.⁴ Short monographs (*Notices*) appearing at the beginning of the century constitute lay anthropological and historical studies and provide relevant data on the local societies. The recently catalogued agriculture documents proved extremely abundant in information pertinent to this study. Important demographic information was collected throughout the colonial era, and although the flaws and biases of the data limit their utility, they offer the possibility for comparative analysis.

Key informant interviews included discussions with: *Société d'Aménagement et d'Exploitation des Terres du Delta* personnel (SAED),⁵ Forestry Service agents, the *sous-préfet* of Ourosougui, the president of the Nabaaji Siwol rural council, representatives for several development projects, and other researchers working in the region. Time was spent examining materials at government documentation centers, the libraries of the *Institut Fondamental d'Afrique Noir* (IFAN), the *Université Cheikh Anta Diop*, *Institut Sénégalais de Recherches Agricoles* (ISRA) and the *Centre de Suivi Ecologique* (CSE).

⁴ See M. Kane, "A history of Fuuta Tooro, 1890s-1920s: Senegal under colonial rule. The protectorate, (PhD dissertation, Michigan State University, 1987) and D. Robinson, The Holy War of Umar Tal: The Western Sudan in the Mid-Nineteenth Century (Oxford, Clarendon Press, 1985), Chapter I for a fuller discussion of archival sources for the Senegal River Valley.

⁵ The Société d'Aménagement et d'Exploitation des Terres du Delta is the Senegalese parastatal established to develop the Senegal River Delta and Valley.

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The problems associated with retrieving the histories of people like the haal-Pulaar from official colonial and post-colonial records have been raised recently.⁶ As Comaroff and Comaroff indicate, historical ethnographic research "cannot content itself with established canons of documentary evidence, because these are themselves part of the culture of global modernism -- as much the subject as the means of inquiry....we must work both in and outside the official record."⁷ The colonial documents are products of their time and cannot be interpreted without reference to the processes of their production. Moreover, far from presenting a unified account of "facts," colonial records reveal the conflicting philosophies and internal struggles between colonizers.

Interviews provided another source of historical data, focusing on 'informal traditions' and 'personal recollections.'⁸ Efforts were made to listen to the accounts of a diverse group of informants, including people from all of the social classes and castes and various resource user groups; men and women; old, middle-aged and young; individuals with formal Western education and those without; villagers living in the region and those who have left; insiders and outsiders; land owners and landless; the powerful and the powerless. In addition, group interviews were conducted over a series of ten days in seven villages with Yero Doro Diallo, an historian of Fuuta society.

Historical research based on oral sources raises several important issues. The present study supports Kane's claim that oral traditions are an extremely important primary source,

⁶ See for example, J. Comaroff and J. Comaroff, Ethnography and Historical Imagination, p. 33ff; J. Comaroff and J. Comaroff, Of Revelation and Revolution: Christianity, Colonialism, and Consciousness in South Africa, Vol. 1 (Chicago: University of Chicago Press, 1991) and Ranajit Guha, Elementary Aspects of Peasant Insurgency in Colonial India (New Delhi: Oxford University Press, 1983).

⁷ J. Comaroff and J. Comaroff, Ethnography and the Historical Imagination, p. 36.

⁸ For a discussion on the categories of oral traditions see P. D. Curtin, "Field Techniques for collecting and processing oral data," Journal of African History IX, 3 (1968), pp. 367-395.

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providing an account from the written sources. Two significant tendencies were encountered during interviews seeking historical data on social and physical phenomena. First, interviewees were inclined to "telescope" their accounts.⁹ Changes that occurred slowly, over many years, were often grouped together and brought forward in time. In other words, a transformation that began in the early twentieth century and continued throughout the colonial period was often remembered by informants as a more sudden process of change that occurred entirely in the 1950s. Using key dates and events along a time line, that are familiar to most informants, helped sift and order the information. Completion of archival research prior to the field portion of the study I had chronological data from which to proceed.

The second trend involved idealization of historical events. Informants often remembered the colonial era with fondness, referring to it as 'the days when life was easy.' The remembered past is a selective and subjective account, influencing reconstruction. "Personal recollections...are subject to the full play of the human psyche. Some memories will be unconsciously suppressed. Others will be warped to bring them into line with the self-image."¹⁰ Questioning informants directly about specific events and known negative aspects of the colonial era helped move some informants away from idealizing the past.

A major component of the field work consisted of semi-structured in-depth interviews with diverse members of society, key informants and focus groups. Walking excursions throughout the zone with key informants facilitated collecting information about the biophysical environment and resource use. Prior to interviews a question guide was prepared, and was referred to and expanded over the course of the meeting. In this way, topics were addressed in an informal and open but systematic way. Sensitive issues were often not

⁹ D. H. Fischer, Historians' Fallacies (New York, Harper and Row, 1970), p. 147.

¹⁰ P. D. Curtin, "Field Techniques for Collecting and Processing Oral Data," pp. 367-385.

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The quest for information about resource access, use and management and the expressed interest in resource related conflicts and competition and conflict resolution were often met with skepticism. The most significant resistance was encountered when investigating land tenure and local charcoal production. The reasons for this stem partially from basic human nature but also reflect local residents' reactions to current circumstances and events whereby they feel that "outsiders" are appropriating their natural resources. Dispelling these suspicions required patience, respect of local mores, a full explanation and definition of the goals of the research and an ability to approach a single issue repeatedly and from many perspectives. Dwelling in the village and participating in daily life greatly eased tensions and facilitated communication.

Pursuing interactions and information beyond the archival record and the spoken word, turning to unspoken forms, revealed dimensions and detail needed in the analysis of the historical processes under study. Living in the field permitted the collection of a vast amount of data that were invaluable even if they are not quantifiable. Direct observation and daily association with the society exposed important relationships and interactions invisible in written records and unspoken in oral accounts.

Combining large numbers of these scattered fragments gleaned from diverse sources revealed contradictions and the chasms that often occur between motivations and consequences. Such a methodology attempts to capture "the simultaneous unity and diversity of social processes, the incessant convergence and divergence of prevailing forms of power and meaning....without falling into the trap of typifying history in general -- or histories in particular -- as an expression of the radical contrast between modern (or postmodern) worlds and their 'traditional' antecedents."¹¹ One world did not replace the other, nor did either

¹¹ J. Comaroff and J. Comaroff, Ethnography and the Historical Imagination, p. 37.

function free of internal contradictions. The two dynamic social systems changed one another. The study follows this rallying between different historical orders by way of the everyday encounters over natural resource access, use and management.

Exploring the interactions between society and the biophysical environment is problematic in a region where local residents ascribe environmental degradation completely to the climatic fluctuations of the past quarter century or to the will of Allah. They perceive the situation solely in terms of "underprecipitation," not as "overexploitation."¹² Ready acknowledgement and brief discussion of lack of rainfall often facilitated advancing to a dialogue concerning the anthropomorphic influences on the physical environment. Pointing out felled trees, citing population statistics, and so on, often aided the process. Encouraging each user group to speak about the impact of actions of other user groups proved effective, as one is far more inclined to expose another's detrimental actions rather than one's own.

One formal questionnaire, on forest product uses and on issues of natural resource protection, was administered in three villages and to eleven scattered herder compounds. Random sampling procedures were used to select heads of households – most of the time men, very occasionally women, but also included a smaller group of women considered single heads of households. A second group of respondents consisted of wives of some of the sample's male household heads. The analysis of the data involved frequencies and cross-tabulations, calculated using SPSS statistical computer software.

Niamir cites four principal methodological approaches for the study of long term allogenic changes in vegetation and soil: 1) longitudinal studies of plots; 2) clipping studies; 3) "chronosequences" and 4) anecdotal or observational information.¹³ Longitudinal studies

¹² M. Mortimore, Adapting to Drought.

¹³ M. Niamir, "Grazing Intensity and Ecological Change in Eastern Senegal: Implications for Monitoring of Sahelian Rangelands" (Ph.D. dissertation, University of Arizona, 1987).

have been claimed to be the most valid method but there are practical problems associated with the time requirements of such studies. Clipping studies are not considered a sound method because they cover only a very short term and the method involves multiple technical problems. The "chronosequence" method, employed by Niamir, "refers to the selection of a series of plots with similar state factors that differ only in terms of allogenic factors.... They represent a 'homology' between space and time...a variation in space is assumed to be equivalent to a temporal variation."¹⁴ This method allows for measurement and quantification of change of a particular set of allogenic factors, in Niamir's case, increasing livestock pressure. The "chronosequence" method is not appropriate, however, for studying the actual interactions between society and environment in a particular place.

Long term vegetation changes in Africa have most often been studied based on anecdotal and observational records. This study relies primarily on these methods to study environmental changes in the study area. Although these methods rarely yield data for quantitative analysis, they provide sound indications of changes.

Data on environmental change and degradation were derived from interviews, the questionnaire, secondary sources, analysis of air photographs, measurement of cleared land, soil analysis and vegetation inventories and density measures. Tree density measures were made using the quadrat method along transects in each of the ecological zones.¹⁵ Comprehensive inventories were completed for each of the ecological zones based on personal observation, interviews, and surveys. These were compared to lists that had been compiled in previous studies to determine vegetation changes (see Appendix I for vegetation lists).

Forty-three soil samples were collected and analyzed from fourteen sites. Taking

¹⁴ Ibid., p. 46.

¹⁵ For a discussion of this methodology see C. D. Bonham, Measurements for Terrestrial Vegetation (New York: John Wiley & Sons, 1989).

samples of the same soil type from degraded and fertile areas provided a proxy for time-depth data. Details on the soil samples and analysis procedures can be found in Appendix II.

Two series of air photographs, taken in 1954 and 1980, were analyzed using accepted interpretation procedures. First a simple classification system to categorize vegetation cover was established. After the land areas in the photos were assigned to these categories they were measured for both sets of images. Finally the percentages assigned to each category on the 1954 photos were compared with those of the 1980 images to evaluate change over time (see Appendix IV for the analysis of these data).

ISSUES ASSOCIATED WITH RESEARCH ON HUMAN-ENVIRONMENT INTERACTIONS

Recently more of us recognize that research on human-environment interaction and environmental degradation requires an interdisciplinary approach. Yet the challenges to "prove" the linkages between society and environment and show causation have stopped many from participating in this research. Stocking asserts that "in land degradation research, data collection itself is probably the major source of error."¹⁶ To pursue such analysis requires data, a great deal of data, that are not easily obtained.¹⁷ Multiple methodologies and diverse data, drawn from both the physical and social sciences, are required for a complete investigation.

In the analysis of human-environment interaction, there are technical problems of definition and measurement. Establishing the relationship between physical changes and

¹⁶ M. Stocking, "Measuring Land Degradation," p. 50.

¹⁷ The issues of measurement of environmental change and proving the nature of the relationships between society and environment are addressed in M. Stocking, "Measuring Land Degradation"; M. Mortimore, Adapting to Drought, pp. 12-23 and R. Ellen, Environment, Subsistence and System: The Ecology of Small-Scale Social Formations (Cambridge: Cambridge University Press, 1982), pp. 8-20. P. Blaikie and H. Brookfield, Land Degradation and Society, pp. 15-16, provide the basis for this discussion.

productivity presents dilemmas. Quantification of flows between people and regions is troublesome because it requires conversion of qualitatively different flows. Most data available today, particularly ecological and human behavioral data, are far from adequate in quality, quantity and time-depth to be useful for building sophisticated models with effective prediction capabilities and for structuring transformations.¹⁸

To arrive at an explanation of environmental degradation requires measurement of the degradation process and determination of the causes of that process. Calculating degradation processes requires time-depth data, or a way to measure and control for change over time. Often we are forced to rely on 'incidental observation' for want of better data.¹⁹ These data can be misleading – when observations are separated by a long period of time we have no way of knowing whether change took place over an extended time frame or occurred in a single extreme event. This study relies primarily on qualitative data, incidental observations found in administrative reports, travel accounts and interviews with little baseline data from which to measure change.

When seeking explanation of these processes the researcher must cast the net as widely as possible so as not to forego any possible causal factor. Unilinear deterministic hierarchical models are inappropriate because we are dealing with multivariate problems and systemic relationships. The interplay between society and ecology can only be explained through a consideration of multiple factors. "In all areas of diagnosis, explanation and prescription we still have to rely heavily on logical deduction from facts and principles which are established by locality-bound empirical research, but must recognize that both the 'facts' and the logical system reflect uncertainty in measurement and different theories of social

¹⁸ M. Redclift, Sustainable Development: Exploring the contradictions.

¹⁹ J. B. Thornes and D. Brunsden, Geomorphology and Time (London: Methuen, 1977).

processes."²⁰

The spatial and temporal scale problems discussed in Chapter I apply to data measurement as well as their analysis. "The detection and measurement of phenomena in different parts of the space-time field require different techniques, and extrapolation from one scale to another requires careful consideration of locations in that field and the methods by which extrapolation is effected."²¹ Measurements of environmental degradation at one scale cannot be used to infer rates of degradation at other scales.²² The time lapses that often occur between cause and effect in human-environment interaction makes measurement and analysis extremely onerous. Identification of the myriad social and environmental causal variables that occur at different spatial scales and through various time frames is preconditioned by the experiences, presuppositions and prejudices of the observer. Wasson cites time-space scale considerations as one of the biggest challenges to land degradation studies:

Herein lies a large gap in the study of land degradation, identifying both the characteristic scales of process and the important cross-scale influences. To tackle this problem we need careful case studies of land degradation, especially historical studies of ecological and social processes and their interactions with considerable concern for attitudes and action toward land.²³

The present study is aimed at contributing to this effort.

These are real and serious issues which we need to confront and work to resolve but researchers can not let positivist data requirements freeze us into inaction. The complexities that are of interest in this study lead to uncertainties that many past models and theories explain away through assumptions. But by explaining away the uncertainties they fail to

²⁰ P. Blaikie and H. Brookfield, Land Degradation and Society, p. 240.

²¹ See R. Wasson, "Detection and measurement of land degradation processes."

²² M. Stocking, "Measuring Land Degradation," p. 53.

²³ R. Wasson, "Detection and measurement of land degradation processes," p. 53.

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address many of the interesting questions about human-environment interaction and make little advancement toward achieving understanding. Many of the processes and linkages that are of interest can be analyzed qualitatively and much of the necessary information can be acquired through field study. Once the key categorical variables have been defined, the interactions between society and environment across different spatial scales and through time can be established logically and many of the processes these interactions reflect can be identified. The objective is to identify the sources of complexity and to build theories which allow for the complexity. The following chapters venture to contribute to this goal.

THE CASE STUDY APPROACH TO HUMAN-ENVIRONMENT INTERACTION ANALYSIS

In a time when social scientists are consumed with human agency, postmodern social science and particularities of the encounter between the global and the local, locality studies provide a constructive methodological approach. The method attempts to "enlarge the specific experience to the dimensions of a more general one."²⁴ As such, the case study facilitates examination of the actual relations between a specific society and a specific physical environment. The method focuses on event, not structure, and history rather than form. As a geographer, retaining the wholeness and the focus on interactions between environment and society remains an important aspect of the approach.

A case study approach is crucial for exploring many of the issues raised in Chapter I. Examination of the relationship between society and environment can only occur through place-based analysis because of environmental variability and spatial variations. The present analysis begins with the relationship between the actual resource user's interactions with the

²⁴ Claude Levi-Strauss, Structural Anthropology (New York: Basic Books, 1963), p. 17.

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environment because it is here that the data are less dubious.²⁵ Case studies can contribute to the construction of models and theories and generalization appropriate for explaining human-environment interactions.

The particular methodological approach employed in this study requires situating the local systems in the wider political and social spheres of which they are part. What is found through such a study is not a closed, entirely coherent, consistent system, but rather polyphony. The historical case study permits exploration of the processes that make and transform particular worlds by attempting to situate the fragments into complex structures.²⁶ The case study allows for, and seeks to understand, the contingent and the contextual.

Human-environment interactions are historically contingent and historically situated. The relationship between society and environment is a dynamic one, with relations varying through time as well as across space, requiring an approach that permits comparisons across time as well as across space. The case study approach facilitates understanding of historically situated contexts. Many of the questions that are posed in this work may be universal, but the responses are specific to time and place. Any theory of human-environment interaction is necessarily also a theory of history; the two cannot be divided. Quoting Comaroff and Comaroff once again: "For Leach (1954:4), 'every real society is a process in time': Internal change – either transformation within an existing order or the alteration of its structure (p. 5) – is perennial, ongoing, inevitable."²⁷

²⁵ Ibid., p. 16.

²⁶ This follows the Comaroffs' conceptualization of "how to do" historical anthropology. See J. Comaroff and J. Comaroff, Ethnography and the Historical Imagination, p. 31.

²⁷ Ibid., p. 22.

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CHAPTER III

THE DYNAMIC SETTING: THE SOCIAL AND ECOLOGICAL COMPONENTS

INTRODUCTION

This chapter introduces many of the principal characteristics of the society and physical environment of the Middle Senegal River Valley. Examining the basic elements of the biophysical environment and local society provides the necessary components for analyzing the interactive relationship between society and environment. Transformations in the local resource management systems have occurred from both biophysical changes and social impacts; the processes bringing about these transformations will be explored in subsequent chapters of the study.

Descriptions of climate, land forms and soil types not only provide the reader with a sense of the physical place where the study is situated; these details also are intimately linked to developing an understanding of the possible interactions between resource users and their physical environment. The problem with describing features of the landscape is that they appear static – unchanging and unchangeable. To avoid this rigidity the following descriptions include information on the evolution of the physical environment, focusing on the period encompassed in this study.

The indigenous resource users have a land classification system that has evolved over time and is based on topography, soils, vegetation, and land use. In the following sections the relevant classification systems utilized by the local populations are introduced.

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The Senegal River Valley as a Region

The meandering Senegal River, flowing 800 km from Bakel to Saint-Louis through the Sahel, has been at the heart of society, struggles, and transformations for centuries. The fertile floodplain has held promise for the indigenous inhabitants and outsiders alike. The contemporary administrative unit known as the Senegal River Region extends from Saint-Louis to Bakel and occupies 44,127 km², or 22.54% of the total surface area of Senegal. Although presently recognized as a region for administrative purposes, there exists great social and physical diversity in the area and the region historically was not a social or political entity.

The Senegal River Region is often divided between the Upper, Middle and Lower Valley which includes the Delta. The Middle Valley, the valley section with the most extensive floodplain, is further divided into the upstream and downstream portions. The characteristics separating the two Middle Valley sections are the height of the levees, attributes of the flood, and rainfall differences. The upper Middle Senegal River Valley, where the study area is located, receives higher rainfall and is flooded at an earlier date by higher flood waters, creating better agricultural conditions. Rain-fed agriculture remains possible today in the upper Middle Valley because of slightly higher rainfall. The lower section, where the river flows further north, currently receives insufficient precipitation for rain-fed cultivation (see Figures 5 and 6).

Note: Adopted from Horowitz, et. al. "Suivi des Activités du Bassin du Fleuve Sénégal"

Figure 5. Senegal River Cross-Section

Ecological Zone	Rainy Season June–October	Cool Dry Season November–February	Hot Dry Season February–June
River– <i>Maayo</i>	Fishing Irrigation (t) Watering herds	Fishing Irrigation (t) Watering herds	Fishing Irrigation (t) Watering herds
Floodplain– <i>Waalo</i>	Irrigation (t) Herding	Fishing (p) Recession cultivation Herding	Fishing (p) Herding Irrigation (t)
Riverbank– <i>Falo</i>		Cultivation	Cultivation Herding
Levees– <i>Fonde</i>	Cultivation (p) Collecting Irrigation (t)	Collecting Herding	Collecting Irrigation (t)
Transition Zone between <i>Waalo</i> and <i>Jeeri– Jeejegol</i>	Cultivation (t) Herding Collecting	Herding Collecting	Herding Collecting
Dryland– <i>Jeeri</i>	Cultivation (p) Herding Collecting	Herding Collecting	Herding Collecting

(t) Today (p) Past

Figure 6. Seasonal Activities in the Ecological Zones of the Study Area

THE REGION'S CLIMATE AND ITS SEASONAL RHYTHMS

The rainfall regime is the single most important factor that conditions the hydrologic and the vegetative cycles in the Senegal River Valley. The annual flood is primarily responsible for shaping the alluvial valley of the Senegal River, but the long dry season also has dramatic effects on the ecology. Thus, two aspects of regional climatic patterns play a principal role: the annual amount and distribution of precipitation, referred to as 'rainfall effectiveness,' and the length of the dry season.

The climatic regime of the Sahel results from the seasonal movement of and interplay between two surface air masses, the continental tropical mass and the maritime tropical mass.¹ The northward progression of the Intertropical Convergence Zone (ITCZ) triggers the rainfall in the region. The variability in the ITCZ's precise position at any given time, from year to year and season to season, is the cause of some of the annual and short-term irregularities in the precipitation of the region. The maximum amount of precipitation falls in August with the rainy season lasting for three to four months in the study area, with an average of 37.4 rainfall days, with coefficients of variability of nearly thirty percent.²

The climatic pattern, namely the seasonal dryness, is more predictable during the rest of the annual cycle. Other climatic variables that explain the minor climatic fluctuations are the coastal wind patterns, temperatures, relative humidity and evaporation. Following the end of the rains, humid conditions predominate until the end of December/January. A north-easterly air stream builds up during this period, provoking important eolian erosion in the denuded zones. This dust-laden and desiccating wind persists from late November through

¹ Sharon E. Nicholson, The Sahel: A Climatic Perspective, Sahel D(82) 187 (Paris: Club du Sahel, 1982) and Sharon E. Nicholson, "The Climatology of Sub-Saharan Africa," in Environmental Change in West African Sahel (Washington: National Academy Press, 1983), pp. 71-92.

² P. Michel, Les Bassins des Fleuves Sénégal et Gambie (Paris: ORSTOM, 1973), p. 100.

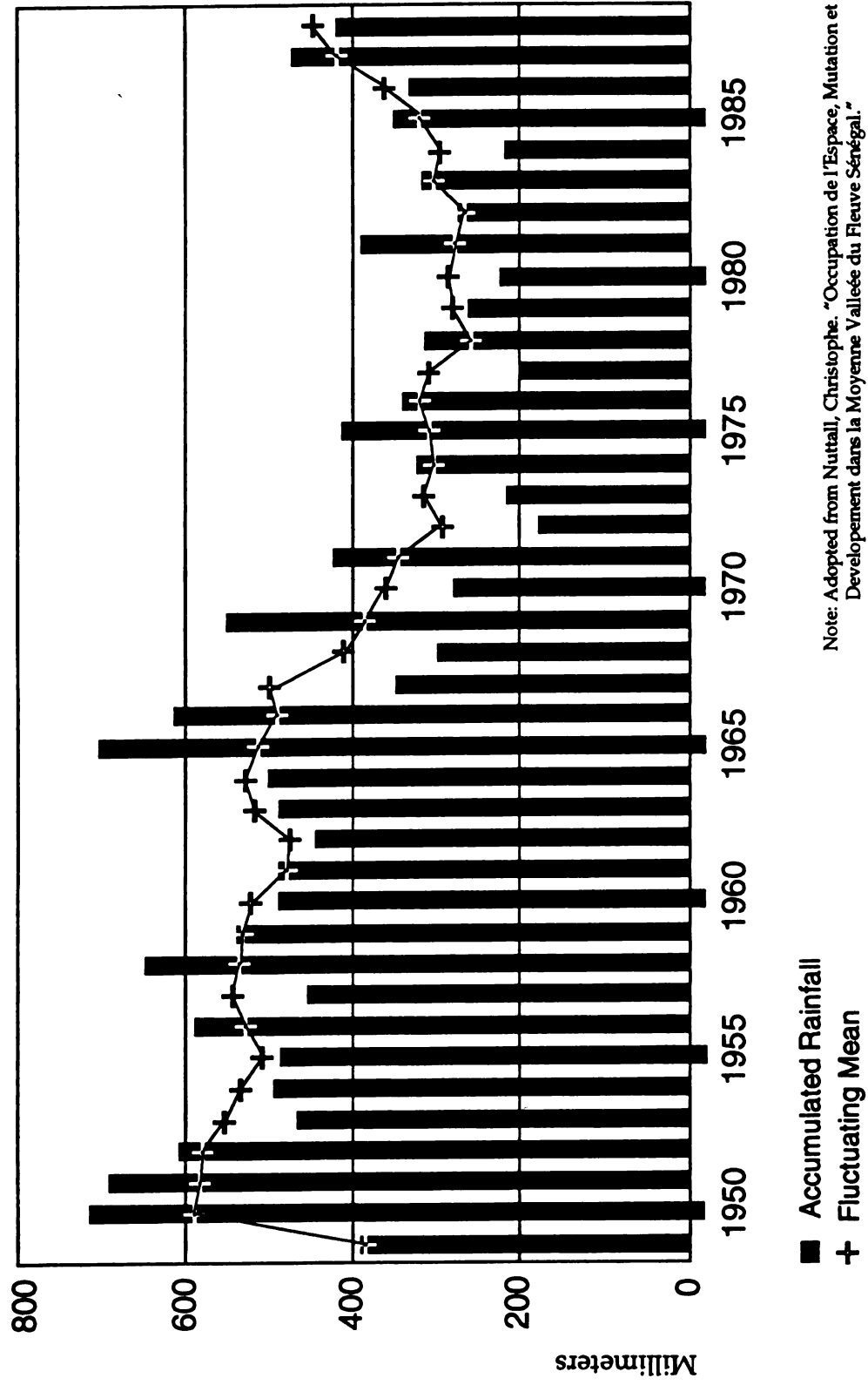


Figure 7. Inter-Annual Rainfall for Matam, 1949-1988

March. During this same season, evapotranspiration increases to twice that of the rainy season. As the annual cycle nears the rainy season, the winds decline but the temperatures climb; relative humidity drops and evaporation reaches its extreme maximum. Many of those interviewed maintain that the seasonal temperature extremes were greater in the past but the winds that blow today are far worse than anything experienced previously.

Rainfall effectiveness or utility strongly influences local resource use strategies.

Three factors are of crucial importance in this marginal rainfall zone: the total amount of annual precipitation, the duration of the dry season and the spatial and temporal distribution of rainfall. Coping with the existence of annual variations of rainfall patterns affects resource management strategies as much as does the total quantity of precipitation. Periods of desiccation occur during the growing season due to the irregular intervals between rainstorms and the varying intensity and quantity of the rain. Precipitation variations, both for a single event and annually, occur over very short distances.

The intensity and regularity of rainstorms influence soil erosion rates and vegetation growth patterns. High-intensity rainfall events lead to large water losses because of run-off, especially on the alluvial soils in the Valley with high clay and silt percentages. Much of the run-off is lost and unavailable to crops and other vegetation. Evaporation is another vital factor when assessing the effectiveness of rainfall and yet the data remain largely unavailable or so imprecise as to be of little use.

The most drastic climatic change occurring during the study's time frame has been the declining total rainfall throughout the region. Between 1949 and 1966 the mean rainfall at the Matam station was 537.5 mm, it fell to an average of 335.9 mm between 1967 and 1988 (see Figure 7). Not only does the actual quantity of rainfall vary, but the number of rain days has also diminished. With so little rainfall received, even in the wettest years, the timing of the

rain events is highly significant for agricultural production. Over the period 1949-1965 Matam had an average of 41.3 days of rain; this average dropped to 33.5 days for the 1966-1988 period. Also, during this latter interval the spatio-temporal repartition was much more irregular.

Climatologists disagree as to the significance of the recent decreases in precipitation. One camp argues that the decline in rainfall since 1968 is part of a long-term cyclical pattern and that in time the average will once again increase.³ Certainly drought is a recurrent theme in the Sahel and the resource use systems are adapted to cope with periodic droughts. Others assert that the past twenty-five low rainfall years represent an irreversible change in precipitation patterns and constitute part of a general world wide pattern of climatic change.⁴ Whether a cyclical pattern or a unidirectional decline, the decrease in rainfall in the study region has contributed to the severe upset in the socio-economic systems in the region, as well as leading to drastic changes in soil development processes, the quality and quantity of vegetation, the existence of wildlife, and local hydrologic systems. Together these changes have provoked grave transformations in the local resource use and management systems. The immense impact of twenty-five years of low rainfall cannot be denied, but it is vital not to attribute all change to the climatic fluctuations. This study seeks to show that other factors, both local and external, have played vital roles in determining the potential resource use capacity of the region.

The impact of vegetation cover on local precipitation remains unclear but several

³ S. E. Nicholson, The Sahel and S. E. Nicholson, "The Climatology of Sub-Saharan Africa."

⁴ Correlations have been made between worldwide sea surface temperatures and Sahelian climatic fluctuations, relating the interactive changes to the "greenhouse effect." See C. K. Folland, *et al.*, "Sahel Rainfall and Worldwide Sea Temperatures, 1901-85," Nature 320 (1986): 602-606 and Debora MacKenzie, "How the Pacific Drains the Nile," New Scientist (16 April 1987): 16-17.

climatologists have argued that the influence of vegetation cover on Sahelian precipitation is strong. Charney maintains that "large-scale losses of vegetation increases surface albedo, which would, in turn, affect the atmospheric energy budget in such a way that the subsidence which promotes aridity in the Sahel would be intensified."⁵ Other sources maintain that one-third to two-thirds of Sahel's precipitation is derived from soil moisture released to the atmosphere through evapotranspiration.⁶ Should these hypotheses prove correct, the significance of loss of local vegetation sharply steepens.

THE SAHEL'S SCARCE RESOURCE – WATER

The Senegal River is a fundamental feature, a source of life, in this Sahelian landscape and its flood cycle is an important component for most of the region's production systems. The river originates in the highlands of Guinea, where rains begin earlier and are more plentiful, and stretches approximately 1,700 km from its southern catchment area to the Atlantic coast. At Kayes, approximately 950 km from its mouth, the river has virtually finished its descent with only twenty-one meters of altitude remaining.⁷ The minor gradient of the channel and flat terrain of the Valley create a meandering river course and an expansive floodplain, extending as much as fifteen miles on either side. As the height of the river increases to its high water mark in late August or early September, water flows through the tributary channels which breach the levees, into the lower alluvial lands, flooding as much as 54,000 square kilometers. The duration and effectiveness of the annual flood are

⁵ J. G. Charney, "Dynamics of Deserts and Drought in the Sahel," Quarterly Journal of the Royal Meteorological Society 101, no. 428 (April 1975): 193-202; quoted in J. A. Gritzner, The West African Sahel: Human Agency and Environmental Change, p. 8.

⁶ J. A. Gritzner, The West African Sahel, p. 8.

⁷ Bonaya Adhi Godana, Africa's Shared Water Resources (London: Lynne Rienner Publishers, 1985), p. 91.

determined by total rainfall for the season in the upper reaches of the watershed.

The river's flow fluctuates drastically between seasons and years. Whereas the annual pattern of flooding is consistent, the height of the flood and the area sufficiently inundated for cultivation are extremely erratic. The irregularities occurring between years and series of years has been devastating to the populations dependent on the water's flow. Annual flooding has been minimal over most of the past twenty-three low rainfall years. When a flood occurs, it normally begins in August, lasting through October, but the flood is so variable in all its features that generalizing about the flood cycle is difficult. The alluvial plain is almost completely inundated at the peak of the flood. These back low lands are submerged four to ten weeks a year during which time the water drops its suspended sediment load. The thickness of the clay deposits is one to one and one-half meters on the well drained depressions but reaches more than three meters in the lowest parts where the water is stagnant for a longer period of time.⁸ Little data has been collected on the correlation between the extent of land area flooded and river levels. The farmers cultivating the floodplain prefer at least twenty-one days of submersion but not more than forty days, since a flood within this time period provides the best cultivation conditions.

The Senegal River and Jammal are water resources utilized for a vast array of activities and by a wide range of resource user groups. The flooding river inundates the agricultural lands, replenishing the sediment-nutrient base of the heavy clay alluvial soils and supplying the water necessary for the entire crop cycle. These water bodies and other smaller sources also provide watering points for animal herds throughout the zone. The river, creeks, and lakes are the resource base for the many inhabitants who rely on fishing as their primary activity or as an important secondary economic enterprise. The fish species found in the past

⁸ P. Michel, Les Bassins des Fleuves Sénégal et Gambie, p. 30.

in these waters were extremely numerous and their quantities plentiful. Today very few families, if any, are able to survive relying on fishing, and most of those depending on fishing for a major portion of their subsistence are in dire circumstances. The fish species common in the past and those still existing today are listed in Appendix IV.

The river's flow has been altered recently by the construction of two major dams. The Diama dam located at the mouth of the river to reduce salt water intrusion, and the Manantali dam located in the upper reaches of the basin to reduce seasonal fluctuations in flow, have long been envisioned as the technical solution to climatic and water flow variability in the region. The dams are designed to stabilize the river's flow at 300 m³/s at Bakel to permit irrigation, navigation, and hydroelectric power. Until irrigation infrastructure is in place (predicted for year 2000), an annual artificial flood is meant to replicate natural conditions. However, the artificial flood has either not been released or was deficient for all but one of the possible flood seasons. The occurrence of an artificial flood may cause severe channel scouring if the suspended sediment load is greatly diminished. This may not be a major problem if the artificial flood is coordinated with the high flows of other tributaries.

The lack of available water sources in the higher drylands south of the floodplain prohibits much of the pasture from being exploited by animal populations during the dry season. Seasonal water deficiencies and the non-existence of bore wells in the past forced whole villages to temporarily relocate closer to dry season surface water sources. During the later part of the colonial era well digging and bore well programs constituted a substantial part of the administration's public works agenda in the region.

The wells and bore wells tap into various subterranean aquifers. The Continental Terminal ground water aquifer is located at depths of as little as twenty and up to one hundred meters below the Senegal River Valley. More superficial and irregular alluvial

aquifers are situated at fifteen to twenty meters below ground level in the study zone. The Maestrichtienne aquifer, considered the most significant subterranean water source in Senegal, is found at varying depths throughout most of the country and is the source of water for most of the bore wells.

THE SOIL RESOURCES IN THE STUDY AREA

The soil diversity found in the Senegal River Valley is integral to the agricultural production systems which have evolved in the area. Variations in climate, vegetation density and type, soil use, erosive forces, the duration and magnitude of flooding and other factors affect soil development in the Senegal River Valley. Western soil scientists have classified these soils according to morphology, particle size and color, while the indigenous classification system is based on water retention, texture, location in the landscape and agricultural potential. This section utilizes the indigenous classification system and western soil classification (see Figure 8 for a summary of this information).

The *hollalde* soils are the most valuable agricultural soils for the indigenous population and are located predominantly in the *waalo*, or the floodplain, and along drainage ways and in low lying areas in the *fonde*, *jeejegol* and *jeeri*.⁹ The clay-rich (40-70%) *hollalde* soils are subdivided into finer categories according to where they are situated in the drainage ways, inundated depressions and basins in the floodplain. Distances between seed pockets in fields are determined by the clay content and water retention capacity of the soil.

⁹ These terms refer to the major biomes in the region. *Fonde* refers to the levees, *jeejegol* is the transitional zone between the floodplain and the drylands, and *jeeri* denotes the higher drylands.

Soil	Characteristics
Hollalde Soils <i>Hollalde Baleere</i> <i>Hollalde ranere</i> <i>Hollalde wallere</i> <i>Hollalde jakre</i> <i>Hollalde hoynde</i> <i>Hollalde naalde</i> Other variants of Hollalde soils mentioned by local residents.	Clay-rich (30-70%). Vertisols. Hydromorphic and pseudogleyed, characterized by mottles and concretions. Gray-black or brown olive. Commonly found in <i>waalo</i> , and low lying areas of other ecological zones. Most valuable agricultural soils. Black soil. Found in lowest topographic positions. Degrade if not annually flooded. Sandy clay. Found in the higher topographic positions. Black soil. Silty. Found in low topographic positions. Brown soil. Found in the zone of eroded thalwags. Little evolved. Receives sediment deposits during flooding. Sandy clay soil. Poor water retention. Presents profound cracking when dry. Clay. Found in upper topographic positions. "Hard" soil that presents profound cracking when dry. <i>Hollalde wakajiju</i> , <i>hollalde hoore</i> , <i>hollalde walece</i> , <i>hollalde rimre</i> , <i>hollalde wođeere</i> .
Wakajiju soils	Clayey sand. Positioned between <i>hollalde</i> and <i>fonde</i> soils. Agriculturally inferior to <i>hollalde</i> soils.
Jakre	Loamy to silty. Dark deep soil. Vertisol. Found on riverbanks and other significant drainage channels and occurs in depositional zones in the <i>jeejegol</i> . Often receives new sediment deposits. Limited in extent but very important agricultural soils. Degrades with continuous cultivation.
Fonde soils <i>Fonde ranere</i> <i>Fonde Baleere</i> Other variants of Fonde soils mentioned by local residents	Silt clays to clayey silts. Hydromorphic to pseudogley with mottling at depth or little evolved hydromorphic soils. Found on the alluvial and wind deposited levees. Crusting and eroded surfaces are common. Water holding capacity high but rarely flooded. Varying agricultural value. Today — zone of irrigation. Silty clay or silty clay loam. Whitish color. Considered poor agricultural soil associated with unidentified toxicity. Decrease in clay (20-30%). Black soil. Pseudogleyed but vertisolic. Higher humus content. <i>Fonde wadeere</i> , <i>flaaruwal</i> , <i>fonde jakre</i> , <i>fonde wakajiju</i> .

Figure 8. Soils and Their Characteristics by Ecological Zone

Soil	Characteristics
Soils found in the <i>jeejegol</i> identified by local residents	<i>Ñaarawal, ñaarawal dokkere, ñaalde, wallere, seebo, ñeemeeji, leydi Ñaleero, leydi daneejo.</i> Soils vary between those typical for the <i>Jeeri</i> and those found in the <i>Fonde</i> .
<i>Seeno</i> soils <i>Seeno Ñaleejo</i> <i>Seeno daneejo</i> <i>Seeno woðeere</i>	Sandy soils. Sand or loamy sand surfaces and loamy sand or loam subsurfaces. Located in the <i>jeeri</i>. Shallow to deep soils. Lack distinct horizons. Low in organic matter. These soils show marked fertility loss after three consecutive years of cultivation. Sandy. Black or brown. Higher organic content. Sandy. Whitish. Sandy. Red brown. Poor quality. High in iron.
<i>Balwalde</i>	Clayey sands. Dark clayey. Occur in depressions and along drainage ways in the <i>jeeri</i> . More fertile than <i>seeno</i> soils. Low water holding capacity.
<i>Ñaarawal dokkere</i>	High clay content. Resembling some <i>hollalde</i> soils, although more rocky. Low permeability. Requires more water for cultivation than <i>seeno</i> soils. On higher ground. Susceptible to erosion.
<i>Ñaarawal tan</i>	Requires more water for cultivation than <i>seeno</i> soils. Low permeability.
<i>Baljol</i>	Very black <i>jeeri</i> soil, found in low lying areas where water and sediments collect. Rich in humus. Low water retention.
<i>Karawal/kartulowel</i>	Eroded crusty soils, devoid of most vegetation. Increasingly found in the <i>jeeri</i> and <i>fonde</i> .

Cultivators report that decreased yields occur on soils that have been submerged longer than two months. Tabor and Ba explain that the yield decreases could be due to the toxicity of manganese in soils that develops because of the lack of oxygen for extended periods.¹⁰ Other non-soil related explanations for the yield decreases could be the effect of a shortened suitable growth period and the effect of hot dry winds on crops planted late in the year.

According to Western classification these soils are vertisols, little evolved soils which have been recently transported to their present location. They are hydromorphic and pseudogleyed, characterized by the presence firstly of mottles, and secondly of concretions. These vertisols are gray-black or brown olive and marked by very distinct humid and dry periods. One study recently found that some of the *hollalde* profiles had an increase of sand content at 70 cm, which may be a recent phenomena caused by an increase in the wind blown sands deposited in the cracks.¹¹ In the *waalo*, *Borreria verticillata* and *Cyperus tuberosus* characterize poorer soils.

The river bank or *falo* soils, called *leydi jakre*, are found on the banks of the high levees and other significant drainage channels. They are deep soils that are flooded every year and retain their fertility from the yearly deposition of new sediments. The area covered with these soils is limited in extent but they are nevertheless extremely important recession agriculture soils. *Falo* soils are vertisols according to Western classification.

Fonde refers to a landscape that contains a variety of soils but can also refer to a general category of soils. *Fonde* landscapes are the alluvial and wind deposited levees that have formed along the Senegal River, the Jammel Creek and other tributaries and the deltas within the floodplain. The textures of the soils in these locations range from silt loam to

¹⁰ J. Tabor and Djiby Ba, "Soil and Soil Management for Agriculture, Forestry, and Range in Mauritania," Mauritania Agricultural Research Project (USAID: Nouakchott, 1987).

¹¹ Ibid.

clays, and crusting on eroded surfaces is common. Water holding capacity is normally high for these deep soils, but they are rarely inundated and seldom cultivated. In general the soils are less clayey than the *hollalde* soils, making them easier to work and more accessible at an earlier time in the agricultural year but they are considered less productive.

The *jeejegol* is a transitional zone between the *waalo* and *jeeri* (drylands) where flooding can occur from 0 to 30 days. The soils found on the *jeejegol* land are multiple and the relative proportions of sand, silt and clay in these soils are highly variable. The most important soil in the *jeejegol* is the *jakre* soil, which occurs in depositional zones from runoff from the *jeeri*. The deep, dark soil is loamy to silty in texture, degrading with continuous cultivation. This zone has only recently been cultivated in the study area as rainy season fields. Previously the *jeejegol* was a very important dry season grazing area.

Jeeri or dryland soils are brown and red brown sands located in the higher non-flooded zones. These soils lack distinct horizons and are low in organic matter. *Seeno*, the Pulaar word for sand, is a general soil category that is usually sub-divided according to color. These deep sandy soils, with sand or loamy sand surfaces and loamy sand or loam subsurfaces can be cultivated for approximately three years before yields decline. Their water holding capacity is low, withstanding drought periods of only sixteen days, and are generally of low fertility. Manure was regularly added to these soils in the past through a well organized system of herd rotations but the farmers currently resist adding manure to these fields because the increase in organic matter under low rainfall conditions increases the risk of rapid drying. Many Fulße herders refer to black and white zones of the *jeeri*; white zones are productive for herds and black zones are poor grazing. Degraded *jeeri* soils have been identified by the manifestation of *Annoma senegalensis*, *Cyperus tuberosus*, and *Hygrophila auriculata*.

Sangre refers to an ecological zone rather than to a specific soil type. The *sangre* is

the ferruginous *jeeri* located south of the study area (versus the sandy *jeeri* to the west). The flat soil surface is very often covered with small rocks or pebbles.

Karawal and *kartulowel* soils are increasingly common in the *jeeri* and *fonde* zones. These are eroded crusty soils, devoid of most vegetation. Increased devegetation in the study area exposes more denuded surfaces to erosion. The wind and water erosion remove the permeable sandy surface from the soils. The more clayey subsurface horizon is exposed and a crust forms on the newly exposed surface. The crusted surface greatly decreases the soil's water absorbing capacity leading to further vegetation loss and an increased decline of the water table. Increased runoff also leads to more gully erosion during high intensity rainfall events. When a new top layer of soil is deposited over the eroded surface these soils are referred to as *poosafusoode*, and can be fertile and productive if cultivated immediately after a heavy rain. *Toccoonde* refers to eroded termite mounds, and can be confused with crusted soils at their late erosional stage. The *toccoonde* are characterized by bare, compacted ground, completely denuded and often littered with pebbles at the surface. The Fulße informants referred to all eroded and degraded soils as *toccoonde*.

Soil erosion caused by water and local eolian deflation are significant throughout the region. Recent increases in soil erosion have caused many depressions in the *waalo*, *jeeri* and *jeejegol* to fill with sediment deposits. Important depressions or lakes (*weendu/beeli* (pl)), currently filling with deposited sediments, are no longer retaining the pools of water that were integral to the agro-pastoral system and transhumance patterns throughout the zone. Herders mentioned numerous temporary lakes or stream beds that no longer retain water for any significant period. They listed multiple causes for the demise of these lakes. In the past the lake bottoms were deepened by hoof action, but now that the animals no longer frequent these lakes at the opportune time to penetrate the lake, they are left to fill in. The herders of Law-

Law consider hoof action on the lake bottoms essential for maintaining the existence of these water bodies. A second reason for the disappearance of the lakes stems from the erosion occurring on surrounding denuded lands. During the dry season sand is wind blown and during the rainy season it is water born and deposited on lake bottoms. Scouring occurs in the rainy season even where the slope is very minor. Third, increased tree/branch cutting, and hence litter, in the depressions – a very new practice – functions to trap soil particles on the lake bottoms.

Gullying occurs throughout the zone, with downcutting reaching one to three meters in depth and evolving rapidly during the course of one rainy season, devastating large expanses of arable land. Some of the gulling has created new lakes where there were none. Wind blown sands and silts are also being deposited over the fertile clay *waalo* soils as devegetation of the zone continues.

VARIATIONS IN VEGETATION

The Senegal River Valley is composed of a number of biomes but the most extensive is open savanna or drylands. Vegetation distribution in the study zone is affected by regional and local hydrological and topographic factors as well as human and herd impact, all of which influence the composition and density of the vegetation.¹² The complex micro-relief of the Valley greatly affects the nature and distribution of the vegetation. While much of the

¹² In a study in 1940 Trochain asserted that the presence of *Balanites aegyptiaca* in the Senegal River Valley indicates a replacement of the zonal *Acacia raddiana* in cultivated areas. Bradley compares studies on vegetation changes associated with degradation. Among others, Boudet *et al.* describes the influence of grazing pressure on grass species. See J. Trochain, "Contribution à l'étude de la végétation du Sénégal," Mémoire IFAN, no. 2 (Paris: IFAN, 1940); P. N. Bradley, "Vegetation and Environmental Change in the West African Sahel," in Landuse and Development, African Environment Special Report 5, pp. 34-54, edited by Phil O'Keefe and Ben Wisner (New York: International African Institute, 1975) and G. Boudet, F. Lamarque, J. P. Lebrun and R. Riviere, "Pâturages naturels du Dallol Maouri (République du Niger)," Etude Agrostologique 26 (Alfort-Seine: IEMVT, 1969).

vegetation is representative of the Sahelian zone, that found in the flooded and humid zones near the river exhibit characteristics that are atypical for the semi-arid environment. The influences of soil, topography and hydrology often greatly obscure the general zonal pattern. The principal species presently found in each of the local biomes, and the changes in composition that have occurred in the recent decades, are discussed below. Vegetation lists in Appendix I provide a more complete inventory of present vegetation and vegetation change in the region.

The nature and the density of the vegetation play a major role in the morphogenesis of the land. The action of roots causes mechanical and biochemical decomposition of the rocks. Vegetation cover also protects the soil from raindrop impact and variations in temperature and humidity. Continual leaf cover reduces solar insolation and wind deflation by acting as a wind break. In the study area leaf cover occurs during the rainy season and lasts for a mere five to seven months, with the exception of the infrequently occurring *Acacia albedo* which produces leaves during the dry season. Vegetation density is a very important variable in this zone of high evaporation, solar insolation, eolian erosion and high intensity rainfall events. Any discontinuity in cover permits wind deflation and diffusion of rain water flow. These two erosional mechanisms transport soil particles and expose plant roots. Areas that have been clear cut for cultivation or other purposes are completely exposed to the effects of erosion. Local inhabitants state that areas devoid of trees also fail to produce grass.¹³

Along the river and in the inundated clayey depressions in the floodplain azonal vegetation types occur. *Acacia nilotica* forests dominate, associated with *Mitragyna inermis*, with the typical density of these forests exceeding the normal range for this latitude. But the

¹³ Some studies have supported this observation. See P. N. Bradley, "Vegetation and Environmental Change" and J. C. Delwaulle, "Désertification de l'Afrique au sud du Sahara," Bois et Forêts des Tropiques 149: 3-20.

occurrence of these stands diminishes continuously with increased land clearing and decreased flooding. The extent of flooding and tree density once prohibited development of grass cover in these forests but with greater clearing *Vetiveria nigritana* began replacing the *Acacia nilotica* in many cleared zones. The vetiveraie, once very common in the Valley and important to resource users for a variety of purposes, such as grazing, thatch for construction, and basket making, have now practically disappeared. Vegetation still frequently growing in the floodplain includes *Balanites aegyptiaca*, *Acacia albedo*, *Borreria ruelliae*, *Ziziphus mucronata*, *Ziziphus spina-christi*, *Ziziphus mucronata*, *Bauhinia reticulata* and *Leptadenia hastata*. The floodplain forests, some constituting extremely dense stands as little as forty years ago, are quickly disappearing leaving completely denuded soil.

The majority of tree species have greatly diminished within this degraded environment and have been replaced by denuded soils, or with *Leptadenia hastata* and *Balanites aegyptiaca*,¹⁴ two species that now occur commonly in all of the local biomes. Only isolated individuals of most other surviving species can be found in the *waalo* today. Many of the tree, shrub and grass species once common in the zone can not survive without regular flooding or greater rainfall. Runoff is high on these bare and compacted clay soils, leaving the soils in all but the lowest depressions with insufficient moisture levels for vegetation production. The grasses that have largely disappeared from the *waalo* include *Vetiveria nigritana*, *Glinus lotoides*, *Polygonum limbatum*, and to a lesser degree *Hygrophila*

¹⁴ Trochain suggests that the presence of *Balanites aegyptica* in the Senegal River Valley occurs as a substitute for the zonal *Acacia raddiana* on land that has been cleared and cultivated; see J. Trochain, "Contribution à l'étude de la végétation du Sénégal," p. 40. Bradley maintains that "the change in species composition, reduced density, and the increased ground cover of prostrate and semi-prostrate ephemerals are retrogressive changes which are evident from the full body of data." He states that the decline of *Commiphora africana* may be a useful indicator of degradation, as is the profusion of *Calotropis procera* and the rise in the importance of short cycle species such as *Monechana ciliatum* and *Zornia glochidiata*, see P. N. Bradley, "Vegetation and Environmental Change in the West African Sahel," p. 47.

auriculata.

The *fonde* lands, bordering the Senegal River, and the *jeejegol* lands that separate the *waalo* from the *jeeri*, were densely forested and penetrated with difficulty in the recent past. One area in the *fonde* was referred to as *kasu*, or prison, because the density of vegetation blocked out all light. Villages are often located in close proximity to the *jeejegol* and recently the forest resources have been aggressively exploited for a multitude of uses. Today the forests are primarily composed of partially open stands of *Balanites aegyptiaca*, *Ziziphus mauritiana*, *Maytenus senegalensis*, *Combretum aculeatum*, *Acacia raddiana*, *Acacia senegal*, *Bauhinia reticulata*, *Capparis decidua*, *Capparis corymbosa*, *Bauhinia rufescens*, *Guiera senegalensis* and *Feretia apodanthera*. *Balanites aegyptiaca* now strongly dominates in the zone. The occurrence of *Calotropis procera* continually increases in enclaves throughout the *fonde*, a common sign of soil and vegetation degradation.

The mixed forests of the *fonde* and *jeejegol* are composed of several strata of vegetation:¹⁵ 1) the tree stratum forms a canopy cover with trees growing eight to ten meters; the most common species found in these zones are *Balanites aegyptiaca*, *Pilostigma reticulatum*, *Bauhinia reticulata*, *Celtis integrifolia*, *Mitragyna inermis*, *Acacia albedo*, and *Salvadora persica*; 2) the bush stratum, not growing over four meters high, primarily includes *Bauhinia rufescens*, *Guiera senegalensis*, and *Maytenus senegalensis*; and 3) grass stratum of quite varied composition. The distinction is often made between the less important annuals and the more desired perennials *e.g.*, *Vetiveria nigriflora*, *Panicum anabaptistum*, and *Andropogon gayanus*. Smaller enclaves of vegetation similar to the species found in the floodplain inhabit the more moist areas, such as depressions and interior drainage systems.

¹⁵ This categorization is based on J. Trochain, "Contribution à l'étude de la végétation du Sénégal."

Species common to both the drylands and the floodplain are found in these intermediate zones, in addition to the species that are more unique to these habitats.

Tree cover in the *jeeri* has been very discontinuous for centuries but perennial grasses once carpeted the zone. The grasses most common to the drylands include *Panicum turgidum*, *Aristida longiflora*, *Borreria radiata*, *Blepharis linariifolia*, and *Zornia glochidiata*. These grasses grow to eighty centimeters in height during the rainy season, but die back and decompose during the long dry season. The tree species commonly found in the *jeeri* today, often occurring only as isolated individuals, include *Acacia raddiana*, *A. senegal*, *A. seyal*, *Balanites aegyptiaca*, *Sclerocarya birrea*, *Capparis decidua*, *Combretum aculeatum*, *C. glutinosum*, *Commiphora africana*, *Guiera senegalensis* and *Ziziphus mauritiana*. These spiny trees, reaching a mere four to six meters, grow in a highly dispersed manner. Trees have all but disappeared in the *jeeri*, and in their place the euphorbes proliferate, a clear sign of an arid and often degraded environment. South of the national highway the only frequently occurring shrub is *Boscia senegalensis*. Other species common to the lower growth stratum include *Euphorbia basamifera*, *Leptadenia pyrotechnica*, *Tephrosia lineraris* and *Calotropis procera*. On the rocky basaltic inselbergs surrounding NDulumaaji Demße *Pterocarpus lucens*, *Combretum glutinosum*, *Adenium obesum* and *Boscia senegalensis* once dominated but these slopes are now largely barren of both soil and vegetation.

Many of the grass species that grew in the *jeeri* in the past continue to regenerate today when the rains are plentiful, but the total number of species appearing in the region even with good rains has decreased. According to local herders, the highly valued forage grasses *Blepharis linariifolia*, *Andropogon gayanus*, *Blepharis maderaspatensis*, and *Lepidagathis anobrya* disappear when human and animal impact is too great, and are uncommon today. *Tribulus terrestris*, a poor quality forage plant, now largely replaces higher

quality grasses. Fulße of Kaawal referred to three species as "invader" species, appearing in degraded lands – *Calotropis procera*, *Euphorbiaces sp.*, and *Tephrosia linearis*. None of the animals graze the latter two and cows will not eat any of the species.

Azonal vegetation occurs near the temporary lakes and in proximity to other *bas-fonds* in the drylands. Residents of SammbaTuuna, a village located in the *jeeri* but in close proximity to a large seasonal lake, recall the rich variety of vegetation that grew in their midst. Trees normally found in the *waalo* zone could be found growing near the lake. Today only *Calotropis procera*, *Balanites aegyptiaca*, *Capparis decidua*, *Capparis corymbosa*, *Boscia senegalensis*, and isolated *Guiera senegalensis* survive; all but the *Boscia senegalensis* have largely disappeared in the last several years. *Calotropis procera*, a species attesting to environmental degradation, first appeared in the area five years ago.

The zones that have experienced greatest devegetation and general degradation are the low lands, depressions and the areas peripheral to villages. The *jeeri* villagers commented on the novelty of having such an open, expansive horizon whereby they can see all the neighboring villages even tens of kilometers away. In the past, they maintain, they never could have seen such distances because of vegetation. On the other hand, the people of NDulumaaji Demße consistently detailed in their oral history other episodes of devegetation and environmental degradation. Many of these local residents view the present conditions as periodic and passing. A majority of the local population assert that all the vegetation changes can be attributed to the climatic fluctuations of the past twenty-five years and they see no anthropomorphic influences in these processes of change. However, others noted that the greater density of trees in such places as village cemeteries, that are protected against cutting, attest to the human and animal impact on vegetation.

Tree density measurements collected in the *jeeri*, *jeejegol* and *fonde* provide baseline

data for the study area. Appendix V summarizes these findings. Comparing the *jeeri* data collected in the study site with those reviewed by Bradley from a study conducted in Fété Olé,¹⁶ a relatively protected area in the near-*jeeri*, the average tree density was lower in the former, ninety-two (92) trees per hectare versus 133 trees per hectare. Fété Olé and the *fonde* zone in the study area are actually more comparable, showing equal densities and greater similarity of species composition.

Comparing 1954 to 1980: Analysis of Air Photographs

Comparison of the 1954 and 1980 air photographs of the study area reveals a dramatic change in vegetation cover over the twenty-five year period (see Figures 9 and 10, see also Appendix III for summary of the data). The densely forested areas, minor tracts even in 1954, had disappeared by 1980. Only fragments of the open forests remained, although the gallery forests, along the water courses and in low-lying floodplain areas, experienced a less dramatic decline. The total area classified as forest decreased from 13.35% of the land area to 5.30% or a 60.30% decline.

The large majority of the zone experienced a transformation from denser vegetation, from forest, open tree cover or bush savannah, to grass savannah, virtually devoid of trees and bushes. There was a striking increase in the expanses of grass savannah, increasing from 19.28% to 53.03% of the total land area.

There were minor increases in the area classified as cultivated and a new category emerged, that of land developed for irrigation. Increases in sand accumulations included the widening tracts surrounding villages, as well as devegetation of the near *jeeri* grazing zone.

¹⁶ P. N. Bradley, "Vegetation and Environmental Change in the West African Sahel," pp. 34-54.

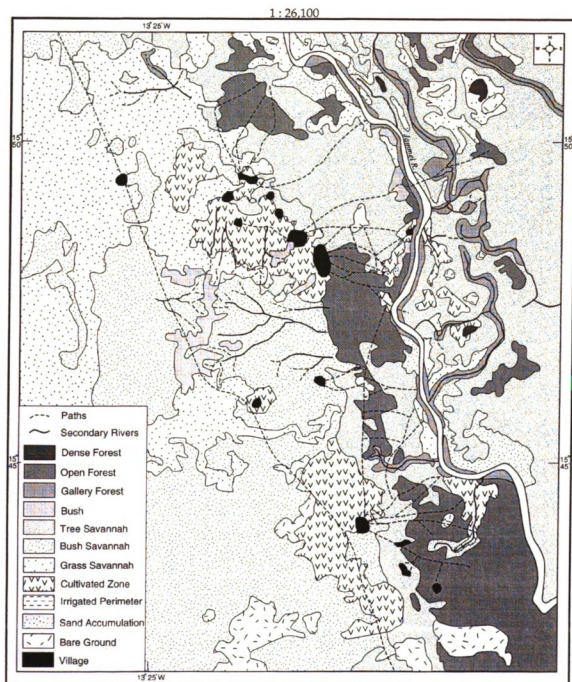


Figure 9. Map of Vegetation Cover, 1954

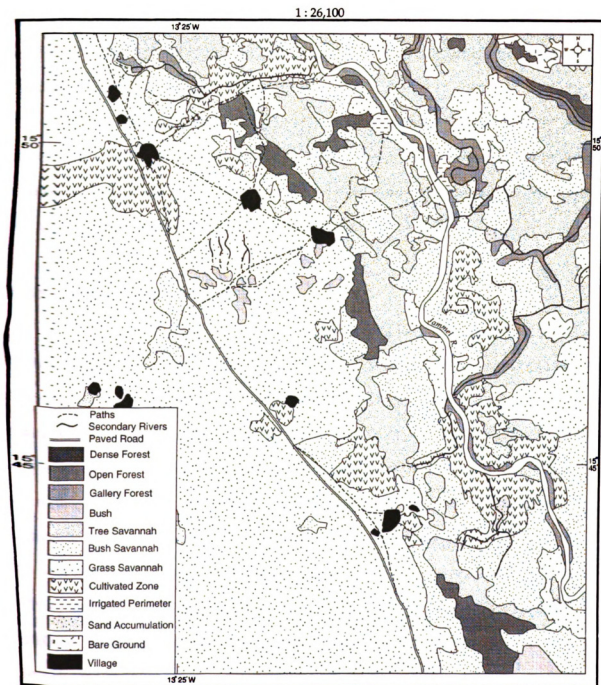


Figure 10. Map of Vegetation Cover, 1980

Several vegetation categories presented interpretation problems. Differentiating between cultivated zones and denuded zones was difficult because the photos were taken in February and harvested fields could not always be distinguished from denuded zones. Errors in classifying these zones correctly may account for the rise in denuded zones between 1954 and 1980. The majority of land classified as denuded in 1954 may actually be harvested fields.

In general, the air photo analysis reveals a rapid decline in vegetation density over the twenty-five year period. The region changed from a varied forested and tree/bush savannah zone to a largely homogenous grass savannah. Fallow areas no longer experienced regrowth of tree and bush species but remained in grass cover.

THE WILD ANIMALS THAT ROAMED

The numbers of wild animals were so numerous in the past that herders slept in the midst of their herds to protect them and no one dared to venture off the beaten paths into the forests. These are not recollections of generations past but exist in the living memory of many of the informants. Descriptions from twenty or thirty years ago contain stories of lions, hyenas, large and small monkeys, wild boars, African wildcats, serval, karakul, cheetah, warthogs, bushbuck, Bohor reedbuck, gazelles, panthers, jackals, sand fox, leopards, ostriches, deer, antelope, crocodiles, hippopotamus, elephants and giraffes (earlier), etc. Local inhabitants do not tend to blame the decline in rainfall for the vanishing of wildlife. They attribute these disappearances to excessive hunting and poisoning, degradation of habitats through the extension of agriculture and degradation of woodlands, increased noise levels, and increases in human populations. Hunting these animals has become totally obsolete in this region.

Birds have been abundant in the Valley because of the year-round water source.

According to Gritzner birds represent important indices of environmental change because of **their** highly specific adaptations.¹⁷ Hunting and reduction or elimination of habitat has **eliminated** birds that once fed on crop pests, provided an important food source and dispersed **seeds**. Other species, such as the black-face dioch, that fed on perennial grass seeds in the **past** now consume grain crops, devastating crop yields. Cultivators tend to clear cut their **fields** to eliminate perching and nesting places for birds they consider detrimental to **production**.

INTERACTING WITH THE PHYSICAL ENVIRONMENT: LOCAL SOCIAL CATEGORIES

The study area is situated in the historical socio-political region known as Fuuta Toro, **which** stretches from Bakel to Dagana along both banks of the Senegal River. Written **sources** and oral tradition trace the history of Fuuta Toro at least to the 8th century A.D.¹⁸ **The** region increasingly became consolidated under the influences of Islam, sedentarization **and** centralized state rule. The people who settled in the region originated from diverse **ethnicities** that blended to form a new ethnic group, the Tukulor, or haal-Pulaar'en (speakers **of** Pulaar).

For centuries the Middle Senegal River Valley has been the nexus of a highly **diversified** and complimentary agro-halio-pastoral production system. The socially stratified **and** inegalitarian haal-Pulaar society is composed of three principal hierarchical levels: **persons** of free status, endogamous artisan castes, and descendants of slaves (see Figure 11).

The Rimbe category, or people of free status, is composed of four groups. The

¹⁷ J. A. Gritzner, The West African Sahel, p. 37.

¹⁸ M. Kane, "A History of Fuuta Tooro, 1890s-1920s," p. 30.

Fulße, sometimes separated out as a separate ethnic group, are descendants of the first, pre-Islamic rulers of Fuuta Toro. The **Torooße**, the clerics, are the dominating ruling nobility in **haal-Pulaar'en** society. This group gained power at the end of the 18th century when Fuuta **Toro** came under Islamic rule. Prior to coming to power **Torooße** membership depended on practice and knowledge of Islam. After gaining power, the **Torooße** became a closed group with inherited status.

The free status commoner groups include the **Seßße**, **Subalße** and the **Jawamße**. The **Seßße** are the descendants of the ancient warriors during both pre-Islamic and Islamic eras. They held the roles of warriors and tax collectors. The **Subalße** or fishers are situated in villages along the watercourses throughout the Fuuta. The small **Jawamße** group traditionally served as political counsellors to chiefs.

The **Nyeenyße** include both the casted artisans and the laudators or griots. This group consists of **Maabuße/weavers**, **Sakkeeße/leather workers**, **Lawße/wood workers**, **Wayilße/blacksmiths and goldsmiths**, and **Awluße and Wambaaße/entertainers and oral historians**. The traditional slave category, the **Maccuße**, still regroups the descendants of slaves. Even today members of this caste often have connections to the family that once considered them property.

Hereditary caste divisions largely determine social status and position, forming a vertical division of society. Furthermore, each of these distinct groups dominates various economic activities within the community, constituting a horizontal division of the society. The major resource use/economic activities include cultivation, herding, fishing, and hunting, in addition to the specialized crafts of the artisans. Each of the local natural resource management systems is discussed in Chapter IV.

The vertical stratification of society into castes continues to exist today, with one's

Social Catagories	Groups	Traditional Powers and Roles
<i>Rimbe</i> Free	<i>Fulbe</i>	Previous aristocracy. Controlled land and politcal power. Herders.
	<i>Toroobe</i>	Clerics, spiritual leaders. Holders of land and political power. Cultivators.
	<i>Sebbe</i>	Previously warriors. Cultivators, hunters and fishers.
	<i>Suɓalbe</i>	Fishers.
	<i>Jaawambe</i>	Counselors.
<i>Nyeenybe</i> Artisans	<i>Maabulbe</i>	Weavers.
	<i>Wayilbe</i>	Blacksmiths, metal workers, and jewelry crafters.
	<i>Lawbe</i>	Woodworkers.
	<i>Burnaabe</i>	Potters, ceramicists.
<i>Nyeenybe</i> Dependants	<i>Awluɓe</i>	Griots, for all.
	<i>Wammbaabe</i>	Musicians, singers for <i>Fulbe</i> .
<i>Jyabe</i> Slaves	<i>Maccuɓe</i>	Slaves.

Figure 11. Social Categories in Futanke Society

social status still largely dependent on one's inherited position in the hierarchy. The society **has** evolved to the point whereby the horizontal divisions within the society, however, are **becoming** obsolete. Separation of groups according to their specialization of productive **activities** has become increasingly insignificant.

The favored status of men in the society and the strict division of rights and **responsibilities** between men and women contribute to the social, political and economic **disparities**. The ambition to respect mild forms of *purdah*, especially in the Torooße villages, **further** secludes women and sometimes limits their participation in agricultural activities if **alternative** labor exists.

Age also serves as a basis for differentiation within society. Access to natural **resources** is sometimes determined by age. This is especially true of field ownership, and **continues** to play an important role today. Age-sets or *pelle* are an important social **institution**, and assemble youth irrespective of caste or social status. Age-groups mimic larger **society** by maintaining its diversity, and participation in this institution prepares the youth for **involvement** in the wider society.

LOCAL POLITICAL ORGANIZATION

The following section reviews the historical and present political and administrative **institutions** and structures that have played various roles in the organization and operation of **local** resource management strategies. The specific functions of these political and **administrative** institutions in local resource management will be addressed in subsequent **chapters**. The story told on these pages reveals clearly that categories, such as the political **and** social categories described in these sections, have neither endured nor changed in an **absolute** and complete fashion. Social categories and relationships are at once reproduced and

transformed. In the following chapters, the *processes* involved in changes and/or lack of **change** are explored.

The village has been the basic political unit for the local populations for centuries **although** other institutions have been established recently to replace the significance and power **of the** autonomous village. The leadership of the village, the *jom wuro*, is elected from the **eldest** males of the founding family by an electoral council of senior members of the free **status** lineages in the village. In addition, the *imam* of the Mosque holds another very **important** role within the village, often acting as the key arbiter in disputes. Large land **owners** wielded vast amounts of power in the local setting. Besides being an important source **of wealth**, those vying for power could use land to increase their alliances and supporters **through** land grants and loans.

The village has functioned within a hierarchy of territorial divisions throughout Fuuta **Toro's** history. No attempt is made here to develop a detailed history of the various systems, **but** a glimpse at their organization and characteristics will facilitate discussions in succeeding **chapters** when considering the impact of political, economic, and social processes on resource **management** strategies.

Since centralized rule first began in the Fuuta, there has been a tension between the **centralized** state and local rule, often with power oscillating between the two. Under **Almamate** rule, many of the villages were virtually autonomous in their rule while other **villages** were grouped together under a paramount chief. Rarely did veritable power **supersede** village clusters to reach the provincial level, much less the regional and national **levels**.

Groupings of villages formed provinces, which were clustered nominally into regions. **These** provinces varied in size and political and economic importance within Fuuta Toro. The

study site is situated in what was Ngenaar province, situated in the upper reaches of the region controlled by the Almaamis. Rarely did the inhabitants of an entire province recognize a single leader and this held true for the Ngenaar province throughout its history. The ensemble of provinces was ruled ultimately by the Almaami and the electoral council, the members of which remained a very powerful counterforce to the Almaami's rule. The Almaamis of the nineteenth century, however, never truly commanded the authority to determine events at the local level, overrule local or paramount chiefs, or even ensure receipt of collected taxes and other payments.¹⁹

Under colonial rule the provinces became circles that were divided subsequently into cantons. Ngenaar province became Matam Circle and was subdivided into thirteen cantons, but the number of cantons fluctuated with time. The cantons were frequently redefined, regrouped and reorganized during the seventy year colonial era. Matam Circle was an area that posed numerous administrative and political problems for the French, who attempted to solve some of these dilemmas by continuously restructuring the province. Continual manipulation of the multiple boundaries and divisions actually created more problems for the colonial authorities.²⁰

Village politics and the power of village heads and elders have fluctuated greatly during the 20th century. The village chiefs suffered loss of internal power or legitimacy during the colonial era although Kane maintains that many village leaders "very often indulged in patent and daring shows of solidarity with their constituents."²¹ Presently in all

¹⁹ D. Robinson, Chiefs and Clerics: Abdul Bokar Kan and Futa Toro, 1853-1891 (London: Clarendon Press, 1975).

²⁰ See M. Kane, "A History of Fuuta Tooro, 1890s-1920s" for an extensive discussion of the establishment of the colonial system in Fuuta Tooro.

²¹ Ibid., p. 10.

of the villages in the study area there are on-going disputes over the rightful heir to the **village** leadership. Today, most villages are divided into several factions. These divisions **affect** even the day-to-day functioning of the village and often limit the village's ability to act **cooperatively** in regional politics. Many of these village factions appear to have existed prior **to independence** politics and have simply adopted new expressions. Villagers unanimously **agree** that the power of the village chief has vastly waned since independence.

The power of the elders has also dwindled. Their knowledge and advice are seldom **sought** when village decisions are being made, with many community members asserting that **the** elders have no advice to offer on contemporary issues. The younger generations have **assumed** increased decision making responsibility although the society continues to firmly **resist** allotting significant power to the youth. Out-migration of the younger segments of male **society** expose them to the current political, social and economic changes occurring in other **regions**, influencing them to take independent actions. They maintain that they are better **qualified** to make decisions because they are more attuned to the regional and national social, **economic** and political environments. Although the young out-migrants often earn substantial **wages**, they continue to face difficulties in gaining access to land resources in the village.

After independence in 1960 the spatio-administrative hierarchy continued to resemble **the** colonial system, with some minor changes in form, with even less change in substance. **The** villages in the study area became part of the Ourossogui Arrondissement of the River **Region**. More recently the Senegal has regrouped villages into Communautés Rurales for **administrative** and economic development purposes. This new territorial organization is **examined** fully in Chapter VII.

Land continues to be an important means for securing political power and economic **wealth**. Land remains in the hands of the older male members of the community and access

is controlled through inheritance rules. The traditionally powerful and land wealthy families continue to dominate in village and regional politics.

DEMOGRAPHIC DETAIL

The villages in the study zone (see Figure 3) are situated in the administrative sub-division of the Ourosogui Arrondissement, which has a total of 104 registered villages. The Arrondissement's population has dramatically increased from 31,220 in 1962, 35,738 in 1971, 45,280 in 1978, 57,989 in 1982, and 72,757 in 1988.²² The geographic distribution of this population situates 32.4% in the *waalo/jeejegol*, 44.2% along the national highway, and 23.4% in the *jeeri*.²³ Based on the 1980 census, the total population of the Senegal River region is 514,735 inhabitants, 10.15% of Senegal's total population, resulting in a population density of twelve people per square kilometer. With an annual growth rate for the region currently 2.8% or higher, the predicted 1990 population figure for the region is approximately 826,146 people. Appendix VI summarizes the population data available for the villages included in the study and other villages in the area.

The social composition of each of the villages in the study zone is unique. NDulumaaji Dembe is primarily a village of TorooBe, or people of noble-cleric status (see Figure 4, Map of the NDulumaaji Dembe *Leydi*). Families of FulBe²⁴, slave descendants, SeBe or warriors, and free artisans also populate this large village of approximately 2,400

²² M. M. Horowitz, *et al.* Suivi des Activités du Bassin du Fleuve Sénégal. Phase I: Rapport Définitif (Binghamton, N.Y.: IDA, 1990), p. 98.

²³ Christophe Nuttall, "Occupation de l'espace, mutation et développement dans la moyenne vallée du fleuve Sénégal" (Thèse de 3^e Cycle, Université de Rouen, 1989), p. 82.

²⁴ The FulBe, the traditional herding population, are considered a distinct ethnic or racial group from the haal-Pulaar, a mixed race ethnic group. The FulBe, as such, have not intermixed with other ethnic groups. The FulBe and the haal-Pulaar share a common language and many members of both groups consider themselves related.

inhabitants.²⁵ NDulumaaji Funeeße, with 1,268 inhabitants, and Bokisaboudou/Saraaji, a **smaller** village of 446, are dominated by Fulße. The Fulße also live in scattered **encampments** throughout the *waalo*. Subalße fishing people populate the edges of the Jammel in **the** villages of MBahkna Ley and Doo, with 452 and 361 people respectively, and Falo **Bogel**, inhabited by only a few families with a total population of approximately fifty. **Several** interviews were also conducted in: Wuduru, a cleric, warrior and fishing village on **the banks** of the Senegal River; Nabaaji Siwol, a roadside village of mixed castes but **dominated** by Toroöße; and in Kaawal, Katote, and Sedo Abbass, Fulße *jeeri* villages of **various sizes.**²⁶

A recent demographic change occurred in the region in 1989 with the arrival of tens of **thousands** of haal-Pulaar political refugees and their herds from Mauritania. At the same **time** Moors were forced to leave Senegal, but this out-migration was far less significant to the **region's** demographic situation. The short term impact of this overall population increase has **been** tempered with food aid distributions; the long term effects of this population influx are **difficult** to evaluate. The impacts of additional large herds on grazing resources and increased **demand** for agricultural land and other natural resources are bound to increase the risk of **environmental** degradation in the region. Although many of the local residents maintain that **by 1990** many of the Fulße from Mauritania had already left the immediate region, having

²⁵ The population figures used are from Senegal's 1988 census. See République du Sénégal, Ministère de l'Économie, des Finances et du Développement de la Prev. et de la Statistique, Repertoire des Villages, Région de Saint-Louis (Dakar, 1988).

²⁶ Mollien described, in 1820, Seedo as a very large and prosperous village of approximately 6,000 inhabitants; see Gaspard Mollien, Travels in the Interior of Africa, translated for the French (London, 1820). Robinson reports that the population in 1962-3 was 855, see D. Robinson, Chiefs and Clerics, p. 185; while the 1988 population was recorded to be 635, see République du Sénégal, Repertoire des Villages (1988).

moved southward into the Ferlo, their numbers remain high.²⁷ The border closure has also affected the quantity of natural resources to which the Senegalese populations have access. For generations, these resource users regularly crossed the river to exploit north bank agricultural fields, grazing lands and fishing territories that they maintained access to and control over.

SUMMARY

This chapter has been divided the whole into different components to allow the reader to familiarize her/himself with the segments before exploring how these elements are linked in the particular setting of the study area. But neither the physical elements, nor the social, are static or unchanging, but all are dynamic, forever affecting and being affected by each other. In subsequent chapters the physical and social characteristics of the locale will be examined with attention on their changing nature.

With the stage set, the rest of this dissertation concentrates on exploring how these components are interwoven, wholly inseparable in reality. The study presents an analysis of the complex constellation of relations and processes that bind together nature and society in this particular setting.

²⁷ See C. Santoir, "Les Peul 'Refuses.' Les Peul Mauritaniens Refugies au Sénégal (Département de Matam)," (Dakar: ORSTOM, 1990).

CHAPTER IV

LOCAL NATURAL RESOURCE MANAGEMENT STRATEGIES AT THE TURN OF THE CENTURY

INTRODUCTION

Complex local systems of resource use and management that distributed rights and responsibilities to the various segments of society existed in Fuuta Toro at the turn of the century. The local society recognized masters of the land, the hunt, water and fishing, and incorporated the idea of environmental management for community welfare. Many of the local resource use strategies relied on flexibility and diversity to cope with the spatial and temporal variability of resource availability. The resource users moved between different ecological zones and exploited diverse resources within each of these zones. Their management systems exploited the seasonal variations and planned for interannual variations and fluctuations. As such, local resource management strategies and production systems existing prior to colonization hinged on a broad understanding of the local environmental situation and resource endowments. This chapter examines these strategies and analyzes their impacts on society and environment.

The subject of this chapter is the situation in Fuuta Toro on the eve of direct French rule. Natural resource management systems and well-developed resource use strategies existed in Fuuta Toro long before French colonial rule. These systems and strategies were altered, manipulated, and transformed as contact with wider social and economic orders greatly increased in the 20th century. Such changes occurred, not in linear progression, but in

a dialectical relationship, with the local systems evolving into something wholly different from that which existed in either world before such interactions. Contact between the local and external worlds, however, had been significant for centuries prior to colonial rule, so treatment of the "local" systems and strategies in this chapter does not rest on a notion of an idealized or static indigenous society. Furthermore, local society has its own historicity, that began long before colonialism or capitalist penetration. All too often, however, the lack of detailed knowledge of their past causes us to treat noncapitalist communities as "peoples without history."¹

The lack of detailed data and information about historic processes and practices often leads to timeless romanticizing of the past. Comaroff and Comaroff speak to this tendency:

Models of noncapitalist orders abound, yet few demonstrate their internal capacity for transformation, stressing rather the mechanics of their reproduction.... Most merely show that they have been enmeshed in global connections for longer than previously thought; not that they were inherently, internally dynamic – if in their own particular ways – all along.... Without some way, however provisional, of grasping those historicities....anthropology will continue to cast "other cultures" in the timeless shadows of its own dominant narratives.²

This chapter attempts to expose the internal dynamics and the contradictory tendencies of the relationship between society and nature in Fuuta Toro. Harms warns that there is a danger of romanticizing non-industrial peoples, "projecting onto them a moral innocence and a natural intuition that makes them less complex human beings. The 'noble savage' of the 18th century French philosophers can easily become the 'conservationist savage' of the 20th century environmentalists."³ Romantic and fixed notions of local society, the tendency

¹ This phrase is derived from a book by Eric Wolf, Europe and the People Without History (Berkeley: University of California Press, 1982).

² J. Comaroff and J. Comaroff, Historical Imagination, pp. 24-5.

³ Robert Harms, Games against nature: an eco-cultural history of the Nunu of equatorial Africa (Cambridge: Cambridge University Press, 1987).

towards painting a "merrie Africa," are avoided in this chapter and yet the difficulties of actually succeeding at determining local social dynamics are openly acknowledged. Because of the problems involved in grasping the local society's historicity, the findings recounted in this section are tentative and represent only one step in a long process that we must embark on to capture the internal dynamics of the local society. The approach taken in this chapter is to address the dichotomies between standard assumptions and changing realities of the human/environment relationship at the end of the 19th century. The unanswered questions, changing patterns and situations of conflict and contestation are revealed. This approach provides a basis for conceiving a baseline situation for the remainder of the study.

Resource management strategies evolve over time through constant interaction between the local population, their resource base and neighboring populations. The level in society where these strategies evolve, are articulated and enforced varies according to the resource, its relative abundance or obscurity, the level of competition between resource users, and whether the resource is held in common or individually. The strategies develop for reasons of profit maximization, risk aversion, social cohesion, and occasionally for direct conservation purposes. Within local Futanke society, there were great differences between individuals and families concerning their resource endowments. Access to and use of natural resources varied greatly with social status, gender, age and other social categories.

Inequalities existed between lineages and households and within households, especially for the resources that could be held individually – land and animals. Less differentiation and inequality existed in access and use of common property resources, due to the inherent nature of these resources. The historical diversity and variation present in local society are treated in the subsequent sections.

Access to resources depended primarily on social identity and status. The haal-Pulaar

resource management strategies incorporated occupational specialization while retaining heterogeneity and flexibility. While few of the resource users limited their economic activities to one enterprise, specialization did occur based on a structured social hierarchy. The divisions within society largely determined access to and use of natural resources. The partial separation of groups by economic activity reduced competition between groups for access to resources, and helped secure superior resource access rights for social elites, especially in relation to land.

While this chapter will focus on contradictions and tensions surrounding natural resource management and use, it cannot be denied that the noncapitalist local management system evidenced in Fuuta Toro functioned primarily to replicate the natural systems rather than replace them, as have later systems. The local resource users placed a high value on the local resource base, in large part because they did not assume access to resources found beyond their own base. They passed rights and responsibilities between generations, as custodians of the environment, in the form of common property management systems and through family inheritance of land.

The Middle Senegal River Valley had interacted in diverse ways with societies and economies for centuries prior to the eve of the 20th century. The populations experienced episodes of famine, pestilence and social upheaval, and access to natural resources was very unequal within society. The most notable upheaval of the local resource use strategies and management systems experienced prior to colonial rule were several massive land redistribution programs. However, the relatively low population densities of humans and herds, low technological inputs and the enduring focus on subsistence production, rather than on expanded surplus production, helped to maintain long-term sustainability of the ecological systems in the region.

In this chapter the land tenure systems, local agricultural practices, herding and fishing strategies, and other resource use activities prevailing in the area at the turn of the century are examined. Some aspects of these strategies, rights and responsibilities still exist today, as will become clear in later chapters. The chapter serves as a basis for evaluating continuity and change and the contradictory tendencies in resource management and use in the Senegal River Valley in subsequent periods.

LAND DISTRIBUTION AND LAND CONTROL UNDER THE ALMAMATE

In all truth the history of the Fuuta is mingled with the history of its lands. Retracing the political events, for which this region was a theater, is to specify the origins of property ownership at the same time as explaining the customs that characterized the indigenous land tenure system.⁴

The origins of the local land holding patterns and territorial political system, elements of which remain in existence today, are found in the late Deeniyankooße regime (1512-1776), and were solidified under the Almamate state of Fuuta Toro that lasted from 1776 until French conquest in 1891. The first recorded program of land redistribution in Fuuta Toro occurred under Koli Tengella in the early sixteenth century, followed by actions by Satigi Sule Njai, a Deeniyanke ruler, who granted large holdings to various individuals and groups throughout the country in an effort to solidify his waning power. The last significant redistributions were made by Almaami Abdoul (1776-1806), when he commanded an extensive land redistribution program known as "the division of the Fuuta" (*feccere Fuuta*).⁵

⁴ Administrateur Vidal, "Etude sur la Tenure des Terres Indigènes au Fouta," 1924, p. 2. ANS 10 D 4-19.

⁵ The best sources on the specific land redistributions are two early twentieth century documents: Lieutenant Cheruy, "Rapport sur les droits de propriété des Colade dans le Chemama et le mode d'élections des chefs de terrains," appearing in the Supplément au Journal Officiel de l'Afrique Occidentale Française, nos. 52-4 (1911) and Administrateur Vidal, "Rapport sur l'étude de la tenure des terres indigènes au Fouta dans la Vallée du Sénégal," M.A.S. Bulletin 72 (1924).

These redistribution programs greatly affected the resource management systems in Fuuta

Toro. Johnson summarizes:

As a result of their donations, landholding underwent considerable change in the second half of the 18th century, obliterating former patterns of property rights and authority in parts of upper Fouta especially.... Since political and economic power in Fouta were tied to control of agricultural land, the changes in tenure had profound effects on the fortunes of recipients.⁶

No subsequent almaami would have such a drastic impact on land holding as Almaami

Abdoul, and his land redistribution program set the pattern for land tenure in Fuuta Toro until well into the colonial era.

The political leader used land distributions as a way to reward the faithful and his political supporters. "The Koran justifies the appropriation of arable lands by the new aristocracy, the *Torooße*: 'the land belongs to God who has confided its management to whom he wills (the almaami in this instance). From that time, invested with the management of the land directly by God, the almaami recuperated all of the Fuuta and in that manner repartitioned the domain."⁷ The land redistributions made by the Satigi and Almaami Abdoul represented a major shift in land control to members and supporters of the clerical party.⁸ The *Torooße* revolution also instituted Shari'a law in the country, which initiated a gradual transition toward an Islamic government. Imposition of Shari'a law had certain consequences for resource access and management rules in Fuuta Toro.

Throughout the history of the almamate state of Fuuta Toro there was constant vacillation between the attempt to centralize and the tendency to fragment and to isolate. The almaamis controlled very limited power, especially after the end of Almaami Abdoul's rule.

⁶ James Philip Johnson, "The Almamate of Futa Toro, 1770-1836: A Political History" (Ph.D. dissertation, University of Wisconsin-Madison, 1974), p. 155.

⁷ J.-P. Minvielle, *Paysans migrants du Fouta Toro* (Paris: ORSTOM, 1985), p. 71.

⁸ J. P. Johnson, "The Almamate of Futa Toro," p. 160.

Johnson argues that land ownership, along with kinship ties, client relationships, and taxing rights, ensured that the position of provincial leader, or *jaagode*, had a permanency that the post of *almaami* lacked.

In a concerted effort to augment and centralize his power, Almaami Abdoul manipulated the control of and access to land resources. Ngenaar, situated at the far eastern end of Fuuta Toro where the Deenianke dynasty retained enduring power, was subject to especially massive land redistribution efforts. This may have occurred, according to Johnson, because Abdoul Kader had more land and positions to distribute in upper Fuuta than in other regions. The exile of people and their abandonment of land during the revolution was most widespread in that region. In addition, Almaami Abdoul seized the land of families who had not fled but resisted Islamic control. On the other hand, along the river, and especially on the right bank of Ngenaar, lands stood vacant where people formerly had lived and farmed before the Moors drove them out. For one or a combination of these reasons, the Almaami was able to most thoroughly restructure patterns of land holding and office holding in Bossea and Ngenaar.⁹ Much of the land distributed by Almaami Abdoul was given out only as *bayti*;¹⁰ he thereby retained ultimate control of significant expanses of productive land in the name of the Islamic state. Distributing land as *bayti* granted him greater control over local authorities and secured a source of income for his government as well as a means of buying support or rewarding individuals and groups. The land distribution policy functioned to secure the patronage of Toroofe and other local elite to the Almaami. The Almaami was able

⁹ J. P. Johnson, "The Almamate of Futa Toro," p. 161. Johnson notes that seventeen of the thirty-three mosques constructed by the Almaami Abdul Kader were located in Ngenaar.

¹⁰ Land held in "the name of the crown" or the state. Johnson cites that on the left bank in Ngenaar-Bossea Province, Almaami Abdoul gave full property rights to only eighteen out of the sixty-two *kollade* he distributed. This meant, in theory, that the Almaami retained the right to reclaim these lands from their holders. See *ibid.*, p. 161.

to control the land owning class through the liability of *assakal*, the "tenth" given as a tithe, as well as other fees.¹¹ Conversely, the land owner's license to collect land fees, sanctioned by the Almaami, solidified the land owner's eminent right to the land. Land that was given as *bayti* became the new Almaami's property when the old lost power. In some cases Abdul and subsequent Almaamis gave the land in perpetuity, especially to ardent supporters and to those willing to occupy key defensive positions.¹² According to Johnson, the payment of *assakal*, and sharing of its receipts with the Almaami, occurred consistently only on *bayti* land. Johnson attributes this state of affairs to weakness of the state or the Almaami's approval of the situation, but concludes by stating: "Another possibility is that the *assakal* became principally a new source of revenue for landlords rather than an organized form of charity, and the beneficiaries were loath to allow the power of administering the new wealth slip from their hands."¹³

The expanse of land under the Almaami's control did not permit him to directly administer the total area so the land was sub-divided into territories, or *leydi*, that were distributed to local elites, often Torooße, who became the *jom leydi* (master of the land). The *jom leydi* held the preeminent rights to all land within the territorial boundaries. Rights to this land could be conceded to others, either as outright land grants without any demands on

¹¹ David Robinson, *Chiefs and clerics*, p. 16. *Assakal* refers to the religious tithe of ten percent of annual production demanded under Islamic law, destined for the poor or needy. Some sources claim that non-payment of *asaakal* resulted in the loss of one's rights to the land since failure to pay implied a lack of respect for Islamic law and only true believers can possess land according to the Koran. The *assakal* payment lost most of the associated charitable connotations, however, early in its existence in Futa Toro, where the payment became a type of land rent or tax. See J.-P. Minvielle, *Paysans migrants du Fouta Toro*, pp. 87-89 for an analysis of *asaakal*'s role as a religious tithe, alms for the poor and/or land rent.

¹² David Robinson, "The Islamic Revolution of Futa Toro," *The International Journal of African Historical Studies* VIII, 2 (1975), p. 199.

¹³ J. P. Johnson, "The Almamate of Futa Toro," p. 167.

the new holders, or under arrangements dictating payments to the *jom leydi*. Johnson comments on the manipulation of access to land resources to secure political and economic power: "By distributing the right to cultivate his lands a man could build up a loyal clientele ready to serve him out of both confidence and self-interest."¹⁴

The *jom leydi*, bound to the Almaami through obligations to pay land rents and religious tithes, were charged with putting the land under production. The *jom leydi* collected fees and payments from land users, or had them collected by the *jagaraaf* (tax collector). After turning them over to the Almaami each *jom leydi* was reimbursed a proportion of the total amount collected as restitution for their services and allegiance. Further down this hierarchy, the original land clearer obtained permission to clear and cultivate the land from the land master. These original land clearers could not be dispossessed of their land, unless required payments were left unpaid. These land owners¹⁵ charged land rents from land users, thus providing them with surplus resources needed for making the obligatory payments to the *jom leydi*.

Similar to the Almaami's land redistribution policy, the land master rewarded demonstrations of allegiances with land gifts and loyalties were honored with land grants. The *jom leydi* distributed uncultivated land within *leydi* boundaries to fellow inhabitants and to newcomers. Abandoned land or land lacking male inheritors reverted to the *jom leydi*'s control. The ruling lineage's interests were secured through maintenance of large land

¹⁴ Ibid., p. 262.

¹⁵ Use of the word "owner" in this context needs to be qualified. More precisely, the land holder retained use rights, the right to charge fees for use of the land, and transfer rights, including the right to transfer the land to other family members through inheritance. In this discussion the owner is either the *jom leydi* or the original land clearer. Ownership does not include usually the right to permanently alienate land. The land user/cultivator also may be the land owner, but the two often do not coincide.

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According to most sources, early almamate rule provided relatively greater political security and reduced the risks of invasion by employing a defensive settlement pattern. As the Almaamis attempted to settle people in strategic locations to protect borders, especially along the river, land grants were distributed to settlers as rewards and compensation. These new settlements, the increased security, and the land grants encouraged increased agricultural, herding and fishing activities and expansion into new productive zones, especially the floodplain.¹⁶ Cultivating the *waalo* became more possible with the increased security from aggressors, especially Moorish raiding, and development of a dual cropping strategy became more common in the Valley. Intensified land use, application of Shari'a (Islamic law) and field expansion in the floodplain contributed to the formation of complex land tenure rules in Fuuta Toro. Robinson notes, however, that Futanke ability to control the north bank steadily declined over the nineteenth century.¹⁷

Land was employed as an instrument of domination in the society and access to and distribution of land in the Fuuta was tightly bound to the power structures and social organization of the haal-Pulaar. Throughout the nineteenth century, the socio-political importance of a group could be measured by their control over land holdings in the *waalo*, the most valuable agro-ecological zone.

Torooße commanded the largest land holdings, concurring with their position as

¹⁶ This statement was made in J.-P. Minvielle, *Paysans migrants du Fouta Toro*, p. 72. The author provides no references or other evidence to support the claim of expanded *waalo* production. David Robinson makes a similar claim in his 1975 article, "The Islamic Revolution," p. 15. Moustapha Kane, in contrast, maintains that the complexity of rules, exploitative taxes, fragmentation of farm land, variation in the amount of flooding and Moorish raiding from the 18th century on caused Fuutankooße to retreat and cultivate only on the south bank *waalo*. See M. Kane, "A History of Fuuta Tooro," p. 28.

¹⁷ David W. Robinson, personal communication, July 6, 1992.

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political elite and with the Islamic law that allows only believers to hold land. Many of the land holders of the previous regime converted to Islam and assumed powerful positions in the new aristocracy under the Almamate system, becoming members of the *Torooße* class or religious elite in the society,¹⁸ and retaining their land holdings intact.

The *Subalße* controlled the river bank fields because of their location and economic association with the river. The *Seßße* played an important role in politics "as the backbone of the armies and political constituencies that guaranteed *Toroodo* and *Pullo* hegemony,"¹⁹ and acquired land in recognition of these services. *Fulße* cultivated millet in rain-fed *jeeri* fields but seldom cultivated *waalo* fields because they had few land holdings in the *waalo* after the *Deeniyankooße* lost power. The land the *Fulße* received from the *Almaami* incorporated very little floodplain, the majority of which was attributed to the *Torooße*. Members of the artisan castes seldom engaged in agriculture and laid claim to few, if any, land holdings.

Slave labor was employed by the local elites, ensuring the expansion of cultivation into the *waalo* and permitting surplus production and enlarging the reproductive capacity of the society. Although the slaves, *Maccuße*, provided much of the productive agricultural labor, they did not possess their own floodplain holdings or land in the other agro-ecological zones. Having experienced heavy population losses in the mid- to late-nineteenth century due

¹⁸ The new category of *Torooße* assumed the top position in the social hierarchy following the Islamic revolution, including noble *Fulße* and *Seßße*. The *Torooße* caste was open to all believers of Islam but primarily consisted of, most importantly, *Fulße* and, secondly, members of the *Seßße* caste and included most prior owners of large land domains. There was a constant process of *toorodization* over the nineteenth century, with the boundaries of the social group slowly tightening as their numbers grew and they sought to limit their ranks. *Seßße* lost their predominant role in society although they continued in the role of guarding the territory and collected land payments under the title of *jaagaraf*. As time progressed, the *Seßße* adopted the economic activities of other social groups, relying on hunting, fishing and cultivation for their subsistence. This addition of resource users had consequences for the existing groups, especially for the fishing people; this will be discussed in subsequent sections.

¹⁹ M. Kane, "A History of Fuuta Tooro," p. 32.

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to the Umarian emigration and severe cholera epidemics, the Futanke leaders "perceived the greatest French threat as the emancipation of slaves."²⁰ The powerful land holding chiefs of Fuuta Toro believed that significant losses of slave labor would destabilize agricultural activities in the region.

Land distribution between and within social groups was extremely uneven in nineteenth century Futanke society and earlier. The size of an agricultural household's land holdings was largely determined by political clout and the amount of labor the family controlled. A large household that also controlled servile labor was able to readily clear land, an essential step in acquiring new land holdings.²¹ Use of slave labor permitted a household to accumulate land holdings far superior to the land needed to meet household subsistence needs. Smaller households or lineages and those that retained less bonded labor cleared far less land, thus limiting their ability to expand their holdings.

Development of the Local Land Tenure Regime

An understanding of the complex land tenure system that originated during the Deeniyanke dynasty and was refined and solidified during the almamate is essential to any discussion of contemporary land tenure rules and access to natural resources in Fuuta Toro since the earlier system defines elements which endure into the present. The following discussion focuses on an overview of the tenure rules, the gap between the standard assumptions for the period and the changing realities, as well as the unanswered questions

²⁰ David W. Robinson, *Chiefs and Clerics*, pp. 113-14.

²¹ Two basic categories of land holding rights existed: the "right of cultivation" and the "right of ownership." Under the first, the original land clearer gains secure rights to the land with the status of "master of fire" or "master of the axe," entitling an individual or a family to cultivate the land or charge other users an array of land rents/payments for its use. The second category is paramount and stems from first occupancy (even if only in myth), acquisition by force, or attribution by the ruling regime.

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pertaining to the historical tenure system. The diverse tenure categories and the rights and payments associated with control of land are reviewed.

The existence of a hierarchy of land owners, holders and users distributed between various social classes creates a complexity within the local system that is difficult to clarify. In an attempt to elucidate this issue the four primary categories of land rights following Boutillier²² are outlined and commented on. The tenure categories with their associated rules, internal tensions, and changing realities are discussed from the most secure to the least secure.

In the first instance, according to Boutillier, an individual could be both the owner and user/cultivator of a particular tract of land. This includes the land holdings the *jom leydi*'s household members cultivated themselves. More importantly this category incorporated the fields cultivated by the original land clearers and the individuals or households receiving land grants from the *jom leydi*. Only *assakal* was required from this population, but even payment of *assakal* on such land holdings seems to have occurred only exceptionally. Johnson surmises that payment of *assakal* was rare because "the payment of *assakal* became principally a new source of revenue for landlords rather than an organized form of charity, and the beneficiaries were loath to allow the power of administering the new wealth to slip from their hands."²³

Boutillier's second category is very similar to the first, with the difference being that the two sets of rights were held within a family or lineage rather than by one individual. In this case the head of the lineage or smaller family unit assumes responsibility for management of the land, allowing other family members to cultivate portions of the land.

²² J. L. Boutillier, *et al.*, La Moyenne Vallée du Sénégal (Paris: Ministère de la Coopération, 1965), p. 115.

²³ J. P. Johnson, "The Almamate of Futa Toro," p. 167.

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The distinction between these first two categories may be spurious. The differentiation between the individual and lineage or family land holding rights may appear more explicit than the historical reality. Verifying the existence of separate individual rights as distinct from extended family rights around the turn of the century, remains difficult. Most informants describe the historical land tenure system as that of family ownership (*jowre*), with field use being divided between family members and inheritance passing to the entire family unit.²⁴

The difference Boutillier referred to is similar, however, to the distinction Vidal made in his 1924 study, where he discriminates between land that was acquired through clearing and occupation prior to Deeniyanke rule and land that was obtained from the Satigi.²⁵ According to Vidal, land cleared and occupied prior to the period of the Satigis was considered private property by the head of the family who administered it according to custom, "in every way reserving the free arrangement of payments or even the division of the common property shared between family members where every one is considered a property owner of the plot or plots first cleared by their ancestors and which they hold freely."²⁶ In contrast, Vidal found that the land grants made by Satigi Sule Njay, almost in their entirety, were considered collective family wealth (*jowre*). These holdings were "administered by the land chiefs, following intangible rules, who are elected from amongst the descendants of the oldest branch that formed the geneological core of the entire family. These land chiefs were compelled by the immutable obligations towards the members of the collective considered co-

²⁴ See for clarification, Youssouf Gueye, "Essai sur les causes et les conséquences de la micro-propriété au Fouta Toro," *Bulletin de l'IFAN* 19, série B, no. 1-2 (1957): 28-42.

²⁵ Admin. Vidal, "Etude," Chapter III.

²⁶ Ibid.

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In the third category only the right to cultivate can be claimed, and included the obligation to pay certain fees to the land owner and/or state authorities, either the Almaami or the provincial leader. These payments included a combination of *assakal*, *njoldi*, *cootigu* and secondarily entailed *nafoore*, *kawngal*, *dooftal*, *hoore kosam* and *rital*. Although the cultivator in this case was not the land owner, the land user typically possessed very secure rights to continue cultivation. These use rights were inheritable frequently and the cultivator could not be alienated with ease by the land owner if the required land payments were paid.

The first three of these payments are the most significant. *Assakal* refers to both the religious tithe of ten percent of the harvest and a land rent/tax paid to land owners. *Njoldi* refers to the annual payment to the land owner by the land user for the right to cultivate. This payment also was originally destined for the Almaami to be redistributed to the poor and disabled, but progressively the payment flowed to the rent collector (*jaagaraq*) or to the land owner. *Cootigu* is a "repurchase payment," which has to be made to the land owner to obtain the deceased's right to cultivate. This is similar to a transfer fee. *Cootigu* has a second meaning, referring to the total acquisition of the right to cultivate but for a very determined time period. The amount is paid at the beginning of the period and therefore requires surplus capital.

Additional obligations include: *nafoore*, which refers to the services and gifts given to the land owner by the cultivator; *kawngal* is the payment of fish the fisher gives to the owner of the land that borders the fishing waters; *dooftal* refers to the day of work owed the land owner by the cultivator; *hoore kosam* is the calabash of milk paid every Thursday to the land owner by the cultivator who owns animals; and *rital* refers to the share of any animal the

²⁷ Ibid.

[illegible]

<i>Asaakal</i>	Originally a religious tithe, paid by all cultivators and field owners destined for the <i>almaami</i> . One-tenth of harvest to be distributed to poor. Evolved into more of a "land rent" collected by land owners but not redistributed. Exists today.
<i>Njolndi</i>	Annual payment to the land owner by the land user for the right to cultivate. Paid at the beginning of the agricultural season. Exists today, but increasingly rare.
<i>Cottigu</i>	<i>Coggu</i> literally means sale, and refers to the most durable type of cessation of rights but for a limited and determined time period. The amount is paid at the beginning of the use period and therefore requires surplus capital. <i>Coggu</i> is repaid each time one of the two parties (<i>jom ngesa</i> and <i>jom leydi</i>) changes. New forms of <i>coggu</i> are developing in the perimeters and constitute outright sale of the plot.
<i>Rem-peccan</i>	Contractual sharecropping relationship arranged annually. Normally the harvest is divided in equal halves. In past it was common that the cultivator was given a small area in the field to work exclusively for personal consumption. Very common to the present, both in traditional and irrigated fields.
<i>Nafuore</i>	Services and gifts given to the land owner by the cultivator.
<i>Kaawngal</i>	Payment of fish the fisher gives to the owner of the land that borders the fishing waters.
<i>Dooftal</i>	Day of work owed the land owner by the cultivator.
<i>Hoore kosam</i>	Calabash of milk paid every Thursday to the land owner by the cultivator who owns animals.
<i>Yiyul</i>	Gift of meat the land user bestows on the land owner when an animal is slaughtered on that land.

Figure 12. Land Payments and Arrangements

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Land use rights of land users who had to clear or reclear the land were subdivided into several categories based on the labor required to prepare the field for cultivation. The cultivator retained free rights (i.e., paid no fees or payments to the land owner) to cultivate for three years or seven years based on the labor invested. If minimal clearing was required the land user began paying land fees immediately.

The last category of land users incorporates those whose right to cultivate was restricted to a determined time period with no possibility to inherit land. These cultivators entered into one of several contract relationships with the land owner. One arrangement required the land user to pay a set price for rights to cultivate a field for a determined number of years. This permitted an outsider to acquire temporary limited access (maximum ten years) to land by entering a lease contract, or *cootigu*. Another arrangement, which did not appear until late in the 1800s, was *rem-peccan*, or a sharecropping relationship.²⁸

Most sources note that a very significant aspect of the tenurial system that evolved in Fuuta Toro was the power wielded typically by the land user, the actual cultivator. Payment of the required fees severely limited the land owner's control of the land. The actual cultivator making the payments and working the land retained the effective and fundamental rights to the land. Minvielle summarizes:

The existence in the Fuuta of great land domains held in the name of the master of the land, should accordingly be understood in relation to the presence of a small holder peasantry entitled the master of cultivation, whose rights tend to become increasingly realized, to the detriment of the former.²⁹

²⁸ *Rem-peccan* is an important contractual sharecropping relationship. The harvest is divided into equal halves between the land owner and the cultivator. Disadvantageous for the cultivator, this arrangement is entered into only when the cultivator possesses nothing but his/her own labor.

²⁹ J.-P. Minvielle, Paysans migrants du Fouta Toro, p. 90.

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Once the land was cleared and cultivated and the necessary payments remitted, the property could be retained within the household through inheritance. At the time of the bequest a one-time payment was made to the *jom leydi* or other land owner for the household's continued rights to the deceased person's land holdings. Due to the severe labor shortages that were experienced in the latter-half of the century, large land owners' best interests were served, presumably, by allowing the land user to retain secure use rights while collecting land payments.

Inheritance rules evolved roughly according to Islamic law, dividing all the deceased person's material wealth, including land holdings, between the offspring. Local inheritance practices and Islamic rules diverged in several respects, however.

In theory women possessed legal rights to one-half of the inheritance of the males, but this entitlement was often denied her or forfeited by the women. The family's overriding interest was to keep land holdings within the domain of the household, hence the reluctance to give land to women who married outside. According to informants, female family members ceded their rights because of family pressures and the ability to gain access to fields through their husbands. Male relatives directly benefitted from a woman giving up her rightful inheritance and they often offered gifts to these women in exchange for their land rights.³⁰

The *waalo* land was transferred to the eldest male inheritor, who controlled and distributed field use rights to other family members until his death. This local form of inheritance contradicted Islamic estate rules which advocated field partition among inheritors. Pre-Islamic practices sanctioned the maintenance of the large family or lineage domains while Islamic rules fostered extensive fragmentation of land holdings as well as the segmentation of

³⁰ This information was repeated by a number of informants, throughout the study zone, in discussions on land inheritance.

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Land disputes in the Fuuta during the nineteenth century appear to have been common and often times violent. Most of the disputes revolved around field boundaries and inheritance issues but the ambiguities and complexities of the land tenure rules and regulations made regulating the system difficult. The *jom leydi* and members of the land holding class, primarily Torooße, judged the disputes according to their knowledge and interpretation of Shari'a. Their control of the litigation process implied that their rulings could protect personal land interests.

THE LOCAL AGRICULTURAL SYSTEM AND MANAGEMENT STRATEGIES

Cultivation was the single most important and universal activity in the region. The traditional agricultural system involved exploitation of several of the ecological zones in the region, especially the *waalo*, *jeeri* and *falo*. The agricultural management systems practiced in the Fuuta at the turn of the century were extensive land use systems whereby the seasonal uses of the fields were synchronized with the natural cycle of renewable resource availability with little or no alteration to the natural cycle through technical or mechanical inputs. Such extensive systems control productivity of the resource base through stratification of factors such as social status, season, location and expertise.³²

The most critical resource within the agricultural system was land. Fixed in space, land could be held securely from year to year and could be managed as a private, individualized resource. This distinguished cultivation from the other resource use systems,

³¹ See J.-P. Minvielle, *Paysans migrants du Fouta Toro*, pp. 68 and 79 and Youssouph Guèye, "Essai sur les causes et les conséquences de la micro-propriété au Fouta Toro," *Bulletin de l'IFAN*, série B, XIX, no. 1-2 (1957), pp. 28-42.

³² See Fikret Berkes, "Cooperation from the Perspective of Human Ecology" in *Common Property Resources: Ecology and community-based sustainable development*, pp. 70-88.

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such as fishing and herding, that were based on resources managed as common property. Practiced by many of the groups within the society, a tenure regime regulating access to and control of the land resources was necessary to protect the interests of the landed elite. Secure possession of land, inheritance rules, and rights of land holders to collect fees for land use were all components of the tenure regime associated with agricultural land in the Fuuta. The local land tenure system helped ensure continuance of the social differentiation within haal-Pulaar society, with the social elites, especially the Torooße, but also the Fulße and Seßße possessing most of the land. Taxes, rent, and access rules on *waalo* land encumbered farming in the floodplain. Furthermore, field fragmentation and variable flooding, as well as frequent raiding by Moors from the north, made this agricultural zone difficult to exploit. Robinson maintains that due to all the obstacles the Futankooße faced in cultivating the floodplain, they developed a tradition of migration to other parts of Senegambia, beginning long before French rule.³³

The village was bound to the local ecology through territorial units or *leydi*. Access to land and other natural resources was locally controlled through the *leydi* system, with each spatio-political unit ideally incorporating land in diverse biomes. Thus, the *leydi* consolidated much of the environmental diversity of the region into an eco-political territory. Schmitz depicts an idealized form of *leydi* with settlements of each of the three resource user communities existing in each *leydi*.³⁴ This prototype was not found in the study area. Most of the *leydi* incorporated only one village unit, with transhumant or temporary settlements of visiting herders and fishers within its borders.

³³ David W. Robinson, "The Islamic Revolution," p. 4.

³⁴ J. Schmitz, "Agriculture de Décrue, Unités Territoriales et Irrigation dans la Vallée du Sénégal," *Les Cahiers de la Recherche Développement* 12 (1986) and J. Schmitz, "L'état géomètre: les leydi des Peul du Fuuta Tooro (Sénégal) et du Maasina (Mali)," *Cahiers d'Etudes Africaines* 103/XXVI, no. 3 (1986), pp. 349-394.

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The village territory, or *leydi*, was managed or controlled by a central land manager and political authority (*jom leydi*), or a council of land managers, who determined the spatial and temporal movements within the local halio-agro-pastoral space of the territory. The seasonal movements within the *leydi* and between *leydi* followed the annual cycles of rain and flooding and were based on the complementary exploitation of ecologically and geographically distinct spaces. In some cases the size and relative attributes of each *leydi* were largely determined by the political prestige of the ruling families at the time the territorial distributions were made in the late 18th century under Almamate rule. Under the Almamate system the boundaries between fields of village were made more firm and explicit for purposes of taxation and political control. Each *leydi*, however, did not exist independently of the area surrounding it. The fishing populations moved along the river banks between *leydi* while the herders typically moved from *jeert* lands of one *leydi* into the *waalo* zones of various *leydi*.

The land managers attempted to control resource use by fixing dates that established a use calendar for the three principal socio-economic groups facilitating their co-existence. The territorial chiefs were also responsible for dispute resolution between members of a single resource use group and between members from different groups when these could not be settled at the family or lineage level. The *jom leydi*'s responsibilities pertaining to interterritorial relations and the resource rights extended to outsiders were of central importance because so many of the seasonal movements occurred between different *leydi*.

There is evidence that the *jom leydi* and other local authorities and large land holders played important roles in determining resource use, access and other management rules within *leydi* boundaries. The system found in nineteenth century Fuuta Toro was not as developed, however, as the centralized natural resource management strategy, or *dina* system, instituted

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by Seku Amadu in Macina. Political control in Fuuta Toro was far less centralized and individual *jom leydi*, politico-religious authorities and large land holders could act independently to serve their self-interests.

Land in the Senegal River Valley did not have equal agricultural value and the traditional land tenure rules varied according to the land type and the agricultural demand for it. Land that flooded regularly qualified as the best agricultural land because of the reduced risks and high productivity associated with cultivation in the floodplain. For these reasons, in addition to its limited extent, the *waalo* was the most tightly regulated land in the Valley and the rules that determined the rights and responsibilities associated with *waalo* land were rigidly defined. *Falo* fields, or riverbank lands, were also strictly controlled because of their high productivity and relative scarcity. The lands that never flood, the *jeeri* and *fonde*, constituted less desirable agriculture areas because of the high risks involved in rain-fed cultivation and the lower fertility of the soil. The land area in the *jeeri* was also much more expansive and all those seeking access to the zone could easily acquire land. These characteristics made *jeeri* and *fonde* land less valuable agriculturally and less tightly controlled, with fewer land payments required. The land belonged to whomever cleared and cultivated it. The *jeejegol* (the rarely flooded ecological zone between the *waalo* and *jeeri*) remained uncultivated under normal conditions and few rules developed around its use for agriculture.

The resilience of the agricultural system depended on a dual cropping cycle which took maximum advantage of the spatial and temporal diversity of the local ecology. Cultivators dominated the *waalo* lands as the floodplain dried out in October/November, harvesting in February/March. They produced sorghum, cowpeas, melons and calabashes. The small riverbank *falo* fields were highly significant within the annual agricultural cycle due

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to their productivity and because they were cultivated through most of the dry season, often lasting until the following rainy season. The *falo* fields constituted a type of garden, where corn, sweet potatoes, tomatoes, squashes, cowpeas and other crops were planted down the river bank as the river water receded.

When the rains arrived in June/July the agriculturalists returned to the *jeeri* to cultivate rain-fed crops, harvesting in October. Dryland crops included pearl millet, cowpeas, melons, and peanuts. Contrary to the closed access of the *waalo* and *falo* land with their rigorously defined tenure rules, the *jeeri* land within a village territory was readily available to most villagers, and even outsiders. Some cultivators from the Valley moved far from the primary village site towards the south to secure extensive fields in the sparsely populated *jeeri*. Vallier, in 1905, found a number of seasonal villages in the river valleys of the *jeeri* Sangre where cultivators from the Senegal River Valley had travelled as far as one hundred kilometers to find productive rain-fed land. Vallier and Monteil found signs in the *jeeri* of earlier abandoned villages of large populations and maintained that the number of such settlements grew between 1879 and 1904 when well-digging attracted people for seasonal cultivation.³⁵

The scattered clayey bottomed *bas-fond* in the *jeejegol* and *jeeri* in close proximity to the main village comprised sites of another, albeit limited, agricultural production system. Older women cultivated indigenous rice varieties in these fields and considered the sites their private land holdings retaining them within the family through inheritance between women. Other crops cultivated specifically by women included indigo, cotton and tobacco, planted in small separate holdings or on the edges of larger household fields.

³⁵ These accounts by Vallier and Monteil were cited in Christian Santoir, "L'Espace Pastoral dans la Vallée du Fleuve Sénégal" (Dakar: ORSTOM, 1979), pp. 36-37.

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The agriculturalists in Fuuta Toro were sedentary for the most part, although they moved between the ecological zones of seasonal agricultural activity. With no secure dry season water source away from the river, villagers from Seedo Abbas, Kaawal, SambaTouna, BokiSabbundu and NDulumaaji Demße moved closer to the *waalo* where they cultivated during the dry season.³⁶ The villagers often moved as a group, accompanied by the entire *hiinde*, or clan, on a fixed date. Some members of the community returned to the principal village to plant the *jeeri* fields with the onset of the first rains, while others remained in the *waalo* until the temporary lakes in the *jeejegol* and *jeeri* filled with rain water.

The agricultural system regulated more than just access to land holdings. Planting and harvest dates were communally set and interactions between cultivators and other resource use activities were organized to regulate the spatial and temporal distribution of activities. Harvest dates determined when all cultivators would harvest their floodplain and dryland fields according to a schedule set by the *jom leydi* or *jom kollade*.³⁷ This practice ensured that all cultivators of the zone would continue to protect the fields from birds, herds and other predators until the maximum number of fields matured. The fields on the richest soil and in the least risky low-lying positions matured last and were cultivated by the land owner. The harvest dates chosen assured the owner of field protection by all surrounding cultivators until the last crops matured. The zone was opened to herders once they completed harvest.

The haal-Pulaar cultivators, including the herders that planted dryland crops,

³⁶ This is information that was repeated in group interviews conducted in each of the villages cited.

³⁷ The *jom kollade* is the owner of a highly productive basin or low-lying area in the floodplain. The "owner" may be an individual or a family. The *jom kollade* often cultivated a portion of the land using family and servile labor, and others arranged to cultivate a portion of the remaining land. These land owning and land use relationships were discussed during numerous interviews.

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prohibited animals from entering the cultivated *jeerl* during the rainy season.³⁸ Only after the fields were harvested, usually completed on a date determined by the *jom leydl*, were the harvested areas opened to grazing. Although this system of seasonal closure did not eliminate conflicts between herders and cultivators, the land owners in the zone attempted to protect their investments through this spatial segregation of resource use activities.

The Ecological Consequences of Traditional Agricultural Practices

This study does not purport to have available the evidence necessary to determine the ecological effects and degree of environmental degradation of the 19th century agricultural system in the Senegal River Valley. Nor can we know the extent to which biophysical processes were initiated or altered during this period and whether these changes have led to degradation through time. However, the account of the social, political and economic dimensions of local society and knowledge about the agricultural system, coupled with contemporary studies on ecological processes, does permit formation of several scenarios.

The local society focused primarily on subsistence production and did so through complex interaction with their natural environment. The resource users' recognized and used multiple ecological zones for diverse agricultural practices. This diversity reduced the potential for environmental degradation because of the spatial and temporal cycles and rhythms of use. Population densities remained low enough (see Appendix VI) to allow people to have access to land in each of the cultivation zones. Furthermore, technology stayed simple, implying that the human impact on the environment was limited under an extensive land use system.

³⁸ This concurs with Jean Schmitz, who suggests that such rules regulating annual movements were respected widely; see J. Schmitz, "L'État géomètre." Local informants stated that rather than strict seasonal closure, cultivators often selected, on a cooperative and annual basis, one cultivation zone for protection against both herds and wild animals.

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This is not to say that the society was in complete balance or harmony with the biophysical environment and certainly the diverse resource use strategies caused ecological disturbances that likely triggered both immediate and delayed biophysical changes. However, the low population densities of humans and animals and the enduring focus on subsistence production, rather than expanded surplus production, limited the severity these disruptions could have on the environment.

Agricultural expansion became possible because of increased political security, during the late 1700s under Almaami Abdoul's rule, and again at the end of the nineteenth century with French pacification of the north bank. As noted earlier, this facilitated clearing and cultivation of new land in the *waalo* and on the north bank. The demand for agricultural surplus, primarily to supply the needs of the gum collectors and traders from Saint Louis, made agricultural expansion appealing but the population losses in the region during the same period probably limited severely the amount of expansion that was possible.

Evidence available from travel and administrative accounts suggests that increased land clearing reduced forest cover along the river.³⁹ Much of the forest clearing occurred, however, not because of increased cultivation, but because of wood fuel needs for steam boats traveling the river. As discussed in Chapter II, clearing the floodplain may cause changes to the microclimate, thereby reducing rainfall in the region, as well as alter the river's flow regime. Climatologists and others disagree on the exact nature of the effects of devegetation in the Sahel, but the possibility that serious negative impacts were triggered due to increased tree cutting along the Senegal River in the late 19th century is significant.

³⁹ See, for example, accounts by Col. Dodds, Matam, "Notice sur le Cercle" (1904), ANS 1G 292; Parfait Louis Monteil, "Un voyage d'exploration au Sénégal," published by Vincent Monteil in the Bulletin de l'IFAN, série B, XXX (3), p. 1220; M. Adams, Rapport Annuel (4 Mars 1912), ANS K 12 and a letter written by Y. Henry to Gov. Gen. Ponty, ANS 3R 33 (169).

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Cultivators regularly burned cleared trees and brush shortly before the rainy season to contribute nutrients to the soil through the ash. The trees cleared from agricultural land were not, therefore, transported back to the village. Wood supplies closer to the village were plentiful and the excessive labor required for cutting and hauling the wood to the village was neither warranted nor, in all likelihood, available.⁴⁰ For these reasons, increased field clearing probably did not lead to a decline in wood cutting performed to meet other household needs.

The effect of limited and/or insecure land tenure rights on management and use practices is the focus of continual debate. According to one perspective, some of the local arrangements found in Fuuta Toro at the end of the 19th century, such as limited temporary contractual arrangements and the right of land clearers to cultivate three or seven years without paying land fees, may have induced the land users to "mine" the land. The difficulty in applying this argument to the 19th century haal-Pulaar agriculturalists arises from the limited possibilities available to them for intensifying production or "mining" the land under the local production system. *Waal*o land was not tilled, double cropping was not possible, no new technology was introduced during this period, and the mixed cropping system remained intact with no large scale introduction of soil-damaging crops. While overcropping was possible theoretically no evidence suggests this occurred. Nor were there any possibilities for detrimental input substitutions since there were no inputs. Investments in erosion controls and fertilizer were not made by either land owners or land users. Thus, land users possessed few, if any, opportunities to adopt practices that would have led to short-term production gains while causing long-term land degradation.

⁴⁰ This is information provided by villagers, in discussions on past practices. There is no way to date this information but villagers maintain that it is only in the very recent years that they have begun transporting felled trees any great distances.

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Little within the local agricultural system, as it was practiced at the turn of the century, appears to have caused dramatic ecological changes and environmental degradation and some practices tended to protect the resource base. For example, the traditional dryland farming technique, incorporating neither plowing or hoeing, decreases evaporation and facilitates soil water storage.⁴¹ Within the agricultural system there were few explicit conservation strategies, even though some of the implicit rules, or mores of society, functioned to conserve land resources. For example, fallowing of *jeeri* fields helped restore soil fertility, thereby conserving and sustaining the quality of the land. Field fallowing was not regulated or enforced, however, but occurred because of the benefits the practice bestowed on the cultivators.

ON THE MOVE: PAST STRATEGIES OF THE Fulɓe

Preceding Almaamate rule and the development of the Toroodo class in Futanke society, the Fulɓe in and surrounding the Senegal River Valley were a significant social and political force. The pastoral Fulɓe society was not as complex or hierarchical as that of the haal-Pulaar, consisting primarily of a free class with a few leading lineages.⁴² The pastoralists were dispersed between small hamlets, grouping extended family members together.

The *ardo* held a political role in local Fulɓe society, but no one authority governed large groups of people. These authorities controlled people as well as access to grazing areas. Historically each independent group's movements were organized and directed by the *ardo*.

⁴¹ Paul Pélissier, "Competition and the Integration of Agriculture and Cattle Raising in Sahelian and Soudano-Sahelian Africa," Proceedings of an International Symposium on Rainfed Agriculture in Semi-Arid Regions, April 17-22, 1977, edited by Glen Cannell.

⁴² David Robinson, Chiefs and Clerics, p. 6.

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These individuals, who possessed supernatural powers, oriented herd movements away from dangers of raids and predators as well as towards well watered pasture. The *ardo's* power and role declined with the rise of the *Torooße* class.

As herders the Fulße only cultivated small rain-fed fields, although they often controlled sufficient labor to work larger fields for them. Their primary interest, however, was not in possessing land, but in maintaining access to the seasonally varying water and grazing resources. Stability between the physical environment and the herds was maintained through movement, flexible herd management strategies and the natural limiting factors of seasonal pasture and water shortages.

The Fulße employed an opportunistic strategy of herd maintenance, a common approach where rainfall and forage availability are highly variable. They increased the herd when they could, knowing that losses would occur. According to Sandford, density-dependent mortality is rare under this strategy.⁴³ The lack of mechanisms to control livestock numbers remains rational where individual livestock accumulation does not threaten the capacity of the resource base.⁴⁴ The stock numbers fluctuated with the environmental conditions, making efficient use of the resources and limiting herd increases.

The pastoralists in the region adapted to the climatic variability and the risks inherent in this semi-arid environment through a strategy of movement and diverse herd composition, among other means. The vastly changing spatial and temporal distribution of resource availability makes transhumant pastoralism a particularly appropriate adaptation to the

⁴³ Steven Sandford, "Pastoral strategies and desertification: opportunism and conservatism in dry lands," in Desertification and development: dryland ecology in social perspective, edited by B. Spooner and H. S. Mann (New York: Academic Press, 1982), pp. 61-80.

⁴⁴ J. Terrence McCabe, "Turkana Pastoralism: A Case Against the Tragedy of the Commons," Human Ecology 18, no. 1 (1990): 81-103.

environment.⁴⁵ Mobility diminishes ecological, climatic, and sanitary risks for the herders.

While this renewable resource use strategy often has been viewed with skepticism by outsiders, the logic and rationality of the production system has been developed fully in numerous studies.⁴⁶ In the following section I present an overview of the local pre-colonial pastoralist system in the Senegal River Valley, where herders managed the common property grasslands and more limited access water sources and fields through a complex set of rules and relationships. The resource management system maintained flexibility in resource use and access, key elements of a successful herding strategy in the Sahel.

Fulbe Settlement Strategies

Inhabitants of the region were mobile to varying degrees as movement was necessary for resource users to efficiently exploit their environment. The Fulbe distinguished themselves by the degree of their mobility and the length of their moves. Several principal seasonal patterns of movement existed for the Fulbe. The herders' movements can be divided between movements internal to the far *jeeri* or Sangre, movements between the *jeeri* and the *waalo*, and year-round settlement in the *waalo* or *jeejegol* involving only minor

⁴⁵ A common statement made by herders is: "Herders tend to adapt their livestock to the environment more than farmers who adapt the environment to their needs." See M. Diop, G. O. Livingston, and D. J. Campbell, "Farming Systems in Areas of Farmer-Herder Interaction in semiarid Africa: Towards an Appropriate Model for Investigation" in Farming Systems Research and Extension: Management and Methodology, edited by C. Butler Flora and M. Tomecek, Farming Systems Research Paper Series No. 11 (Manhattan, Kansas: Kansas State University, 1986), p. 413.

⁴⁶ See especially the many works by Jean Gallais, "Essai sur la situation actuelle des relations entre pasteurs et paysans dans le Sahel ouest-africain," in Etudes de géographie tropicale offertes à Pierre Gourou, pp. 300-313 (Paris: Mouton, 1972); Jean Gallais *et al.*, Stratégies pastorales et agricoles des Sahéliens durant la sécheresse 1969-1974, Travaux et Documents de Géographie Tropicale, n° 30 (Bordeaux: Centre D'Etudes de Géographie Tropicale, 1977; see also Marguerite Dupire, L'Organisation Sociale des Peul (Paris: Plon, 1970); and C. G. Widstrand, "The Rational of Nomad Economy" in Ambio 4: 146-153.

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displacements. The precise movement and settlement patterns and the decisions concerning the balance between cultivation and herding were formulated by individual households or extended families with the oldest male taking charge of the family's strategy.

Some herders remained in Sangre during both the rainy season and the dry to exploit the available pasture of this extensive zone. Fulbe moved their camps from dispersed rainy season sites to larger settlements closer to a permanent water source during the dry season. This transhumance pattern kept some herding families in one ecological zone throughout the year.

Another pattern of movement involved seasonal migrations between the *waalo* and the *jeeri*, the transhumance pattern most common for Fulbe *jeeri*⁴⁷ until the construction of bore wells during the colonial era.⁴⁸ The strategies based on transhumance movements between the *jeeri* and *waalo* were based on the exploitation of two complementary zones. Exploiting the *jeeri* in the rainy season and the *waalo* in the dry, the herders assured their herds green pasture and daily water throughout the entire year.

The *waalo-jeeri* movement pattern actually contains two distinct arrangements, one purely pastoral and the other that a combination of agro-pastoral strategies. Some of the herders who moved to the *waalo* during the dry season also cultivated floodplain fields; others moved to the *waalo* solely to exploit the water and grazing sources. Both these groups of pastoralists sought good rainy season grazing in the *jeeri* and approached the floodplain, camping in the *jeejegol*, when the temporary surface water sources in the *jeeri* disappeared. First the herds exploited the crop stubble on the rain-fed fields, moving later to graze the

⁴⁷ I divide the Fulbe into Fulbe *jeeri* and Fulbe *waalo*, separating them according to the location of their permanent camp sites, which in turn affects their movement patterns. The Fulbe *jeeri* reside predominantly in the drylands and the *waalo* Fulbe inhabit the floodplain.

⁴⁸ H. Barral, *Le Ferlo des forages* (Dakar: ORSTOM, 1982).

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grasses and trees close to the camp and in the *fonde*. After the *waalo* fields were harvested by the middle of the dry season the herds fed on the remaining stubble until the rains returned. The Fulße abandoned the *waalo* at the onset of the new rains, moving in search of the first grasses in the *jeeri*. The families who cultivated *waalo* land often split between two camps; one group remained in the *jeejegol* with the herds while several family members camped close to the *waalo* field.

By the turn of the century some herders spent the rainy season in the Valley, camping in the *jeejegol*, with some families living throughout the year in the *waalo*. This arrangement permitted the Fulße to cultivate within increasingly close proximity to their herds. Living in these zones reduced seasonal movements to a minimum although sometimes this strategy required the family and herds to divide between two different camps to meet both cultivation and grazing needs. The number of Fulße living in the *waalo* had expanded by the turn of the century with the reduced threat of Moorish raiding. The Fulße *waalo* lived semi-permanently in the floodplain and only occasionally abandoned these camps. According to Touré, even Fulße *waalo* vacated the floodplain and installed their herds in the *jeejegol* with the first rains, occupying the dry season camps just abandoned by the Fulße *jeeri*.⁴⁹ The Fulße *waalo* interviewed consistently claimed that their ancestors moved out of the floodplain only if the flooding was very significant. When the Fulße *waalo* did move to the *jeejegol* they cultivated rain-fed fields and grazed their animals on *jeeri* grasses. After harvest they returned to the *waalo* to cultivate recession fields if they had access to them. During big flood years the herds remained outside the *waalo* until after the harvest. In general the movements of the Fulße *waalo* were shorter and less frequent than the Fulße *jeeri*.

⁴⁹ Oussouby Touré, "Le zonage du Ferlo: Analyse des modes d'exploitation du milieu et de leur évolution" (Dakar: CSE, 1989).

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The *jeejegol* zone played a key role in the many of the Fulße herding systems. The zone was used intensively throughout the year by different herding groups following diverse strategies. In a subsequent section it will become clear that recent intensified use of the *jeejegol* under poorer climatic conditions has strongly affected the ecological stability in the zone. In the pre-colonial era a dynamic equilibrium between the resource base, the needs of the herds, and the other demands made on the zone's resources could have been maintained because populations of both herds and people did not grow rapidly, nor were there any altered uses made of the *jeejegol* resources.

Access To and Control Over Natural Resources

Movement was fundamental to the pastoral system in the region, but the movements were not unregulated. Herders entering another village or camp's territory required permission from the local *ardo* or family head to reside in the area. When resources were plentiful permission was rarely denied, but the village authority retained the right to deny long-term access to the territory's resources. Most herders had a host (*njatigi*) in the villages they regularly visited, a relationship that eased their entry. In exchange, the visiting pastoralist would pen the herd in the host's fields. Herders who had permanently settled in a village territory as an outsider retained stranger status but had relatively free access to the resources. Outsider status disadvantaged them, however, when disputes and conflicts occurred and when competition for resource access increased. Marrying a village woman granted the outsider Fullo more secure access to village agricultural, water and grazing resources.

One way that Fulße gained access to important grazing resources was through an exchange relationship that occurred between herders and farmers in the area. As mentioned

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above, the herds grazed on crop stubble, both in the *jeeri* and in the *waalo*. This provided benefits to both the pastoralists and the cultivators; but since fields were more plentiful than herds, pastoralists were in the advantageous position. Cultivators paid or gave gifts each season to Fulbe to ensure that they would graze their herds on the farmers' fields, especially the *jeeri* fields. One of the benefits of hosting a visiting herder was the guarantee of having herds stay on one's fields. The manure that accumulated in the field during a two to three week sojourn was highly significant for the maintenance of soil fertility.

The Fulbe pastoralists incorporated two principal forms of resource control. First, territorial control was established through the institution of the *leydi*, which allotted villages extensive domains that both insiders and outsiders recognized. Secondly, the Fulbe resource management system regulated access to and control over resources within their *leydi* through a set of rules and regulations, some of which employed spatial strategies. Both forms of control affected resource access and use by herders.

Prior to colonial control the Fulbe maintained socio-political control of their space, the *leydi*, which helped foster a sense of responsibility amongst the community members towards the resources within the territory. The *leydi* in the Fuuta structured the space and regulated access to natural resources including grazing resources. The original inhabitants of a *leydi* exerted primary rights to the resources. The management of the space maintained a dynamic equilibrium between agricultural and herding activities and contributed to limiting competition for access to pasture.³⁰

The role played by the Torooße of Fulbe origin in the control and management of the *leydi* in the pastoral zone remains unclear. Territorial control, and the correlated control of

³⁰ Cheikh Ba claims that the *leydi* never evolved into strongly organized or socio-politically coherent spaces for the Fulbe. See Ch. Ba, *Les Peul de Sénégal* (Dakar: Les Nouvelles Editions Africaines, 1986), p. 75.

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natural resources, may have been a motivation for Fulße "toroodization" under the Almamate. Clearly the *leydi* system and the control of grazing and water resources in Fuuta Toro never approached the complexity of the *dina* system of Seku Amadu in the Niger River Delta.⁵¹ The system that he developed closely regulated and structured the seasonal movements of pastoralists. The absence of such regulation in Fuuta Toro was due primarily to the weakness of the state after Almaami Abdul Kader.

Within the *leydi*, the herders grouped together in larger settlements for security reasons but also to protect the surrounding pasture from the excessive destruction that occurs with scattered settlement. The Fulße largely exploited their communal resources by social consensus, making joint decisions about herd movements. Consolidated settlements also equalized the herders' access to resources by putting them all at the same distance from the pasture.

Historically the Fulße enforced a separation between their herding and cultivation activities in the areas surrounding their camps and villages. During the Almamate period the herding populations living in the *jeeri* were not allowed to cultivate and graze in the locations of their choosing. Rather, the herders systematically alternated between using an area in their territory for grazing or using it for cultivation. They would cultivate one section for three years, grazing the animals in the remaining area, continually rotating through their territory. Coordination between the activities helped diminish the need for field protection against intruding animals and concentrated manure in a contiguous area when the herds grazed on field stubble.

The Fulße recognized limited private rights and claimed exclusive control of particular

⁵¹ See Marion Johnson, "The Economic Foundations of an Islamic Theocracy: The Case of Masina in *Journal of African History* 17 (1976).

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areas within the territory even though most pasture was open to all herders. To limit competition over access to pasture and water resources close to settlements, residents claimed exclusive rights to well defined and limited areas. Most of these traditional management practices were instituted to regulate the relationships between different resource user groups, particularly between the pastoralists and cultivators; but the restrictions also controlled some interactions between fellow Fulbe. According to Touré, such exclusive rights helped to instill a sense of responsibility toward resource use within the territory. He states:

Each *jey* is subdivided into a number of sectors (*horum*) that form the territory associated with the rainy season camps.... All the *horum* belonging to the same zone are contiguous, thus realizing a mesh where the density is such that the totality of the utilized space is monopolized. (Barral 1982). The prohibitions ruled on the matters of land use and grazing zones ensure the regular users of property rights....³²

Closely related family members lived in recognized sub-territorial spaces, known as *horum*, within the larger territory. *Horum* were restricted spaces surrounding Fulbe encampments, water sources and wood lands. The location of the *horum* shifted with the seasonal movements and settlement of the herders and were not constant and determined spaces.³³ Certain wooded areas used for fruit and tree product collection could be seasonally protected by the Fulbe inhabiting the area through the institution of *horum*. The spatial relativity of resource control conforms to the fact that land itself has little value for the herder, while the water and grasses produced on the land, but having no fixed locality, possess great value. Most Fulbe informants maintain that the *horum* were minimal in size, usually delimiting modest reserves around the encampment for the small animals that were

³² Oussouby Touré, "Le zonage du Ferlo," pp. 9-10.

³³ The Fulbe did not recognize exclusionary usufruct rights to trees inside the *horum*, which were seasonal and shifting spatial units. This stands in contrast to the Turkana, for example, who traditionally maintained inheritable individual usufruct rights to trees. See Edmund G. C. Barrow, "Usufruct Rights to Trees: The Role of Ekwar in Dryland Central Turkana, Kenya," *Human Ecology* 18, no. 2 (1990): 163-176.

unable to walk long distances. The aim was to reserve enough pasture to secure sufficient grazing for the household herd without encroaching on the fields or camp of neighboring herders.

Other researchers have determined that *horum* was an extensively practiced strategy instituted by Fulɓe to control access to natural resources.⁵⁴ Juul maintains that these restrictions were established primarily to avoid the need to fence cultivated fields rather than towards enforcement of priority rights to pasture.⁵⁵ *Horum* may have existed primarily to regulate the use of space between two distinct resource uses – cultivation and pastoralism. The regulations gave regular users exclusive rights over resources by limiting the ability for newcomers or outsiders to settle in denoted areas. Herders also controlled water zones by prohibiting cultivation and settlements in close proximity to water sources regularly used for human and animal consumption. Designated paths leading to principal water sources, which could extend for many kilometers, were protected and cultivation was strictly prohibited in these areas. Colonial agents maintain that the local resource management system involving *horum* fell into disuse at the time of El Hadj Omar's emigration eastward towards Nioro.⁵⁶ However, most accounts by Fulɓe indicate that the decline of these management rules and the disappearance of *horum* began with early colonial rule, largely vanishing by the late colonial and early independence eras. The factors attributing to this demise and the effects of the weakening of this system will be discussed in the following chapter.

⁵⁴ See Kristine Juul, "Problèmes Fonciers et Aménagement Territorial en Zone Agro-Pastorale: Le Cas de l'Arrondissement de Barkedji" (Dakar: CSE, 1991); Oussouby Touré, "Les sociétés peul du Ferlo: continuité, changements, menaces," and H. Barral, Le Ferlo des forages.

⁵⁵ Kristine Juul, "Pastoral Tenure Systems in Senegal – A Discussion of Pastoral Management and Exclusion Rights," (CSE: Dakar, n.d.).

⁵⁶ Elevage en A.O.F., 1904-1913. ANS R 20.

Managing Common Property Grazing Resources

A discussion of grazing on open pasture immediately evokes images of Garrett Hardin's "tragedy of the commons."⁵⁷ Although nothing as elaborate as the *dina* system in the Niger River Delta region evolved in Fuuta Toro, the grazing resources were not left to open access and were managed by the resident Fulbe through a variety of strategies.⁵⁸ As noted above, some of these strategies involved territorial controls, others entailed seasonal "privatization" of certain spaces. Many of the rules and regulations were temporally and/or spatially relative, remaining enforced for a season or in association with a temporary camp. More commonly, the herders maintained free access to pasture but controlled access rights to all water sources that were improved or constructed with human labor.⁵⁹

Insiders and outsiders were recognized, and the outsiders could be either other fellow herders or cultivators competing for resource access. The Fulbe developed rights and regulations within their management system that specifically governed interactions with cultivators, whether the cultivators be their Fulbe neighbors or the Torooße, Seßße and Subalße living in the Senegal River Valley. One way the herders addressed the competition between different resource use activities (especially cultivation and herding) was by designating zones on a seasonal basis for specific uses. Maintaining interaction with the different social groups and resource users was vital to the pastoral Fulbe. They exchanged milk, animals, skins and other collected products for grain, cloth, and various material items

⁵⁷ See Garrett Hardin, "The Tragedy of the Commons," Science 162 (1968): 1243-48.

⁵⁸ For a discussion of the *dina* system, see Richard Moorehead, "Changes Taking Place in Common-Property Resource Management in the Inland Niger Delta of Mali," in Common Property Resources: Ecology and community-based sustainable development, pp. 256-272.

⁵⁹ Similar regulations existed among East African herders. See P. H. Gulliver, The Family Herds: A study of two pastoral tribes in East Africa (London: Routledge and Keegan Paul, 1955) and P. Spencer, Nomads in Alliances: Symbiosis and Growth Among the Rendille and Samburu of Kenya (London: Oxford University Press, 1973).

to meet their daily needs. Relations between groups could be cooperative, competitive or symbiotic but rarely were they separated in space or time for more than a season.

Territorial claims and privatization of space were never predominant characteristics of the Fulbe resource management strategies. More or less open access to expansive areas, to ensure maximum availability of resources that shift in space and time, was extremely important to herders. The pastoralist's capital rested in animals, not in land, thus ownership or control of a limited and fixed land area in this fluctuating physical environment provided little security for animal owners. Central to their resource management strategy was preserving access to diverse ecological zones to ensure adequate grazing and water for their herds throughout the year. Little within the traditional grazing strategies effectively distributed grazing pressure evenly throughout the region.

CONTROLLING THE CATCH: MANAGING THE TRADITIONAL FISHING RESOURCES

The fish, in contrast, are personally appropriated by the action of fishing. Fish are considered a revenue: the fruit of the waters. There are no scruples about consuming them because they have less the character of capital than one of harvest.⁶⁰

In the nineteenth century fishing constituted one of the main components of the diversified Fuuta economy. Similar to the herding economy in Fuuta Toro, fishing resources were managed as common pool resources and jointly used by community members. The common property system developed as a rational response to resource management needs and provided a set of rules and norms for regulating individual use of fishing resources. Maintaining joint rights of access to fishing waters and regulating equipment use yielded a more or less equitable distribution of access to resources and a system of cooperation among

⁶⁰ J.-P. Grosmaire, Rapport de Pêche Fluviale (Saint-Louis, June 1956), p. 1.

participants. "By institutionalizing a degree of fairness in the face of random allocation, common-use rights may contribute to social stability at the same time they promote efficient adaptation to changing resource availability."⁶¹ Under the common property system used for managing fishing grounds in Fuuta Toro during most of the 19th century, there was little potential possibility for an individual user to subtract from the welfare of other users. Shortly before the turn of the century, however, distribution of access to and use of fishing resources began to become skewed as the pattern and level of use by certain individuals changed.

Historical management of local fishing activities incorporated notions of joint use, the right to equitable access, and explicit resource conservation. There are two associated reasons for the Subalŕe to define rights of equal access within their resource use system. The first reason for managing fishing resources for equal access and equal opportunity is related to the Futanke social organization. The Subalŕe constitute a distinct and separate group within haal-Pulaar society and form the monopoly user group of fishing resources. The Subalŕe alone used and controlled the fishing resources implying that only "within group" resource use required managing. The homogeneity and affinity within the resource user group may have promoted equity objectives. Second, the nature of the resource lends itself to be managed as common property. Unlike land which can be held by an individual, exclusive use rights to fishing resources cannot be assigned easily. With group interests in mind, the management system defined and limited the individual's use rights and treated group members as co-equals in their license to use the resource.

This section attempts to describe and analyze local fishing practices that existed near the turn of the century, and examines the resource access and use rules associated with

⁶¹ C. Ford Runge, "Common Property and Collective Action" in Making the Commons Work: Theory, Practice, and Policy, edited by Daniel W. Bromley (San Francisco: Institute for Contemporary Studies, 1992), p. 33.

fishing. Examining the historical fishing management practices reveals the development of an articulated local management system that resulted from the local physical and social environment. In subsequent chapters the evolution and final demise of the fishing economy discloses the breakdown of a common property management system in the face of internal and external changes.

The lack of dated information on the fishing economy for the period considered in this chapter presents several methodological problems. Lack of dates implies that the situation described here cannot be established as a late 19th century pattern, much less a pattern that can be generalized to the pre-colonial era. Most of the material on the local resource management systems was collected through extensive interviews with older members of important fishing families. Although they did not assign dates, these informants did distinguish between the pre-colonial period, or the "time of the Almaamis" and subsequent periods. Once again the lack of detail tends, at times, to portray a static, idealized image of the local fishing community. Systems of controlled access and regulation typically develop in response to resource decline or shortages, however, so it is likely that resource fluctuation or decline was apparent to the fishing peoples of the Senegal River Valley long before the turn of the century. Furthermore, very significant changes had begun to occur in the fishing economy prior to French administrative rule, which are well recorded in the oral histories of the population.

Examining the historical fishing economy is significant to the study of natural resource management systems in Fuuta Toro because of the integral roles that fishing and the fishing people have played in the evolution of the physical and social environment in the region. Their resource use patterns and management systems affected, and were affected by, the actions and conditions of other resource user groups. Not only was each person who

fished connected to others within the group through a common property management system, the fishing community functioned, at times cooperatively and other times competitively, within a wider society of resource users.

While this section treats an historical situation that no longer exists today, considering the fishing management system is important to this study. This dissertation attempts to record and analyze the historical roots of environmental degradation in the region. As one of the main resource use systems in the Valley, one that essentially has disappeared over the century because of the demise of the resource base, the local system of rules and rights that surrounded the exploitation of the fishing grounds is a significant segment of the story.

Fishing in the Middle Senegal River historically was a primary economic activity for the fishing caste of the haal-Pulaar, the Subalße; and a secondary activity for others, especially Seßße and Maccuße.⁶² Two different systems of freshwater fishing existed at the turn of the century: the Subalße predominantly worked the Senegal River and the larger tributaries and the others relied on seasonal catches in the backwaters of the floodplain. Backwater and river fishing, controlled by different social groups, functioned under different management systems. Typically these two systems were spatially separated and followed different seasonal patterns. These two systems will be discussed in turn.

The Management Strategies of the Subalße Fishing Specialists

The Subalße, or fishing people, lived along the Senegal River and secondary waterways such as the Jammel. The Subalße, a group composed of some of the earliest settlers in the region, was composed of fishing peoples of diverse origins that had immigrated to the region over many decades. Many river edge villages were homogeneous, incorporating

⁶² In 1962 the people who fished constituted approximately twenty percent of the population of the Valley, according to J.-L. Boutillier, *et al.*, La Moyenne Vallée du Sénégal.

only Subalße, although others, such as Wuduru, contained mixed populations including members from the different classes of commoners and artisan castes. In villages dominated by Subalße, the primary resource manager, or *jaaltaado*, who was central to Subalße social organization, also filled the local political leadership role. In socially mixed villages the *jaaltaado* would be involved in managing and controlling the watercourses and fishing grounds as well as serving as leader and representative for the fishing people of the village. Robinson maintains that as a group, the Subalße remained "relatively aloof from political questions."⁶³ Indeed, there is little evidence to indicate that Subalße were involved in important posts in Fuuta state or provincial government.

The Subalße, although believers in Islam, maintained a certain independence from Islamic teachings and the pre-eminence of Islam that was so central to many other villages in Fuuta Toro in the nineteenth century. The Subalße retained a special connection to the supernatural world, especially through their knowledge of and power over the water spirits that dwelled throughout Fuuta's floodplains and waterways.

Over the generations the fishing populations developed a set of rules and regulations to manage their physical resource base, and to settle conflicts within their fishing community and confrontations with outside resource users. The fishers exhibited a keen sense of knowledge about their resources and the need to manage them for reasons of resource protection as well as social order. The main types of internal regulation included seasonal closures of fishing zones, control of fishing methods and equipment use, and required involvement in communal activities. Supernatural beliefs functioned as resource conservation techniques; prohibiting and controlling access to and use of certain resources helped sustain fish populations. In particular, a few of the very deepest pools in the river and creeks were

⁶³ D. Robinson, *Chiefs and Clerics*, p. 7.

never fished because they were filled with dangerous spirits. In ecological terms, these pools were significant in the life cycle of the fish; by protecting these habitats fish populations were allowed to regenerate. It remains unclear whether the closure of these deep pools, and other equally ecologically sound management practices, were instituted only after a decline in fish populations was noticed or the Subalfe understood fishing ecology to the degree that these rules were established *a priori* to ensure that declines would not occur.

The *jaaltaado*, or leader of the fishing community, was an adult male who acquired his role because he "knew the waters" in the sense of occult or supernatural knowledge. This position was an elected post but candidate eligibility was limited to individuals who were both from the founding lineage and possessed occult knowledge. These conditions implied that the oldest male of the qualifying lineage did not necessarily obtain the post. Associating supernatural forces with the resource manager elevated the manager's prestige and power in the community. Violating the resource use rules not only brought social condemnation but implied disfavor with the supernatural world. The duties of the *jaaltaado* included making decisions about community fishing activities, ensuring that the management rules were followed, controlling water spirits, and regulating the river crossings of herds.

Specifically the *jaaltaado* regulated access to the fishing grounds, determined fishing seasons, prohibited certain equipment and techniques, designated and guarded sanctuaries for fish reproduction and maturation, organized collective activities, directed the cooperative hunts of river animals (primarily hippopotami and crocodiles) and conferred with neighboring *jaaltaaße* (pl.) about regional issues affecting fishing practices. The *jaaltaaße* along the Senegal River, in council with village elders, closed sections of the river,⁶⁴ especially deep pools where the fish congregated during the dry season. Informants claimed that such strict

⁶⁴ This practice of closing river zones to fishing is called *sokre*.

closures occurred only on the Senegal River, not on the Jammel.

The *jaaltaaße* determined the date when fishing the deep pools for the season should commence, where the fishing would begin and how it would progress.⁶⁵ During the rainy season no restrictions on fishing existed for either the Senegal River or Jammel. Closing sections of the river after the rainy season, for three to six months, allowed the fish to reproduce and mature into acceptable size. The *jaaltaaße* opened river sections systematically from upstream to downstream as the season progressed. The entire length of the river was divided into zones or territories which constituted the domains of individual *jaaltaaße* who acknowledged the rights of one another and conferred with each other on seasonal dates and other fishing matters.⁶⁶

The fishing calendar included a principal fishing season from January to May when the fish were in the main channels of the river and side channels as the flood waters receded. Parts of the river were closed to fishing during this period to allow the fish to gather in the deep pools. In April the deep pools were exploited according to local regulations. During May and June fishing yields declined as the end of the season drew near. Around July, as the waters began to mount fishing intensified, especially near the inlets of the backwaters. Smaller equipment combinations replaced large nets during the months that the river was rising. From August to October, the period of high waters, extensive fishing took place throughout the zone; but catches remained limited because the fish were dispersed throughout

⁶⁵ Declaring a fishing season is a widely applied method of regulation. See S. V. Ciracy-Wanthurp and R. C. Bishop, "'Common Property' as a Concept in Natural Resources Policy."

⁶⁶ As noted earlier, the information for this section was gathered through extensive interviews with notable elders who fished and played key roles in the fishing communities. Precise dates for this information are unavailable although the informants insisted that they were describing practices that had existed for generations even if they had all but disappeared today. The earliest colonial documentation on Senegal River fishing customs cite the existence of similar local management strategies and resource use rules.

the floodplain. Beginning in October and lasting through December, fishing focused on points of passage as fish reclaimed the deep principal channels as the waters receded, at which time river fishing resumed in earnest.

When the political situation and the absence of Moorish raiding permitted, the full-time fishers were transhumant or migratory in their fishing and settlement patterns, and at the turn of the present century some fishing families were traveling long distances from their villages of origin. Congregation in a village site left the Subalße too densely settled both for fishing and for marketing their catch. Spreading out along the banks of the river gave them access to more secluded fishing spots and markets for their catches in nearby villages. The active fishing families dwelled outside of their village of origin for seven to eight months of the year, returning only during the rainy season.

A fishing family could settle anywhere along the banks of the Senegal river and Jammel in the territory regulated by their *jaaltaado* if they did not destroy cultivated fields. Fishing people who left their home territory were expected to secure permission from the *jaaltaado* of the new territory, who was free to deny authorization, although permission was rarely refused. Visitor fishers were allowed to utilize only the equipment types employed by the resident fishers. Visitors were forbidden at all times to use the *dulinge*, a long line of fish hooks left continually in the water, whose presence prohibited the use of drag nets in the area thus unfairly limiting the residents' ability to fish the river.

Historically the Subalße cultivated little land and the existing family land holdings, primarily *falo* fields, were farmed by older members of the family or entrusted to someone else to cultivate through a contract relationship. The stricter occupational divisions between groups began to diminish prior to the end of the century, when fishers became more inclined to cultivate small holdings and own some animals; this evolution progressed in relation to the

changes that occurred in the local fishing management system discussed below.

The types of conflicts that occurred between individuals or fishing communities involved a number of issues. First, reserved fishing spots or protected zones were contested by others. The river or tributary fishers came into conflict with backwater fishers when they fished too close to the backwater inlets at critical times when the fish were migrating out of the main channel into the floodplain. The fishers also clashed with cultivators over field destruction. As new equipment became available, differences in the quality and type of equipment caused clashes between fishers, especially with the introduction of the *gubal* net.⁶⁷

The Effect of Equipment Changes

The *gubal* net appears to have arrived from the east, brought in by Somono fishing people from Macina beginning in the 1880s.⁶⁸ This net and other fishing equipment was first introduced in the upriver Bakel region but spread quickly throughout the Senegal River Valley, and was integrated into the repertoire of fishing equipment used by the Subalbe throughout the study zone.⁶⁹

⁶⁷ For several detailed cases of fishing conflicts, see file on fishing for the Podor region, Cercle de Podor, "Incidents sur le fleuve à propos de la pêche, 1948-1956." ANS 11 D 1-870.

⁶⁸ There is evidence that some Fuutanke Subalbe abandoned fishing to the Somono who arrived in the Senegal River Valley with superior equipment, including the *gubal* nets. Matam's commandant noted in 1904: "Ne pouvant rivaliser avec les somono, les suubalBe s'adonnent à la culture et considèrent désormais la pêche comme un gagne-pain insuffisant" adding "les suubalBe ayant de l'aisance renoncent complètement à la pêche." See "Notice sur Matam par son commandant de cercle en 1904." ANS 1G 292. It appears that the Somono left the Middle Niger Delta because of competition for fishing resources. The use of the *gubal* in the Middle Delta had detrimental effects on the resource base, causing Somono to leave in search of under-exploited fish resources. The Senegal River Valley suited their needs.

⁶⁹ R. Cremoux, Etude de la Pêche dans les Eaux Fluviales du Nord Sénégal (Richard-Toll, Senegal: Service des Eaux et Forêts, October 1961).

Technical changes set in motion social processes that destroyed long-standing institutional arrangements. The *gubal* net was the cause of great conflict within the fishing community largely because it led to the development of a new category of fishing activity – fishing as a commercial enterprise. The *gubal* was often owned by one individual who then hired additional labor (four to twenty individuals) to assist with working the huge net. The *gubal* led to greater individualization within the fishing economy at the same time the technique required the labor of many people, who were hired by the net owners.

Informants maintained that preceding the introduction of improved equipment in the late 19th century, the local community did not recognize as much need for regulation since they did not foresee a possibility of over-exploiting fish populations. The fishing community's decision to self-regulate exploitation by seasonally protecting the deep pools occurred only after fishers noticed marked declines in fish stocks. This is often true of most natural resource management systems – if the resource remains abundant and if it is difficult to exclude potential resource users the resource will go unregulated. Declining fish yields by the turn of the century encouraged the local residents to increase their protection of the resource base.

Fish Harvesting In the Backwaters

Backwater or floodplain fishing has been regulated for generations also. Very different from the sites of river fishing, many of these fishing grounds were considered the domain of individuals, families, or villages. Fishing rights to the backwaters were attached to land rights, although secondary access rights were conveyable separate from land. Basically, the owner of the land retained proprietary status of the fishing that occurred on the submerged land but residence in a village territory extended the right to partake in the fishing activities in

the territory.

These backwater zones were protected and managed by individuals, or *mawße ndiyam*, chosen to carry out these duties. These resource managers were different from the Subalße *jaaltaaße*, playing a more circumscribed role in local society. The Seßße, their *mawße ndiyam*, and land owners of the backwater pools and tributaries possessed a number of precise rules about managing the seasonal fishing resources. The purpose of the regulations was to insure access to the resources by group members and to protect the fishing resources from exploitation by "outsiders." The floodplain provided temporary, seasonal fishing grounds where fish were harvested and, as such, was not a site of year-round regulation as were the permanent channels of the Senegal and Jammel Rivers. The fishing season for these backwaters was relatively short in duration but very intensive while it lasted. The bodies of water were fished in a progressive fashion from the smallest to the largest until the season's end.

Most of the backwater fishing sites were owned or controlled by Torooße because they controlled the land over which the water flowed. Since they were the primary possessors of land they also commanded rights to the fishing. A number of the ponds in NDulumaaji Demße and other village territories were held communally by all resident villagers. The practice of village communities claiming exclusive rights to certain pools started prior to French administration of the region and continued into the twentieth century.⁷⁰ These common property ponds were situated on unappropriated village land that had not been cleared or cultivated previously.

During the 1800s and into the early 20th century the Torooße fished along with the

⁷⁰ This is the information confirmed by numerous informants, including the "master of the water" of NDulumaaji Dembe.

Seßbe and Maccuße, and even assumed the role of *jaagaraf*, or fee collector, for fishing rights.⁷¹ The Toroobe abandoned fishing as they became more involved in Islamic studies and teachings and local politics.⁷² Once they relinquished fishing the Toroobe selected *mawße ndiyam*, or managers, from amongst the Seßbe, who in turn choose *jaagaraf* from the Maccudo caste. As the Toroobe were still involved in fishing activities, the Subalße also fished the backwaters during the height of the season.

The *jom ndiyam*, or "owner of the water", was an inherited title belonging to the family holding the rights to the land where the fishing site was situated. Each *jom ndiyam* selected an overseer (*mawdo ndiyam*) to manage the fishing site. Distinct overseers could be chosen to manage each individually held water body and yet another to manage the communal lakes. Often the Seßbe, who managed the common property fishing grounds, selected the same *mawdo ndiyam* as selected by the *jom ndiyam*, who also tended to jointly select one manager. The *mawdo ndiyam* commanded power and prestige from holding this position and gained payment and privileges for the duties preformed. Management of the communally held lakes did not require a *jaagaraf* because no fees were collected for its use, but the private holders did select *jaagaraaße* (pl.) to collect the *kawngal*, the portion of the catch owed to the land owners. The *jaagaraf* also assumed responsibility to summon the fishers to meetings related to closures and openings of the fishing zones.

The responsibilities of the overseer involved protecting the floodplain fishing zones by organizing rotations of guards to monitor the inlets when water was entering the floodplain once it had been closed off. The Subalße were strictly prohibited from setting nets at or in

⁷¹ This information was supported by a number of interviewees from NDulumaaji Dembe, but I have no dates for when the Toroobe stopped fishing.

⁷² The Sebbe speak of this transition with disdain, claiming that the Toroobe often deny their fishing history in an act of superiority.

close proximity to the inlets of any floodplain fishing zones. Fishing was not restricted in the floodplain during the rainy season when the waters had not yet stagnated and the *Subalße* were free to exploit the extensive zone at this time. Just prior to the water's recession, the *mawdo ndiyam* organized and directed the installment of the barricades at the inlets of the backwaters to trap the fish in the floodplain. The *mawße ndiyam* set closing dates for the inlets and for the opening of the fishing season at each site, which varied according to the size and depth of the water body. The overseer organized the fishing rotations, settled disputes, punished infractors, controlled equipment use and supervised the division of individual catches to ensure that proper payments were made to the *jom ndiyam* and others. Many of the backwater fishers also hunted so some of the floodplain sites were managed for optimal hunting as well as fishing. The backwater fishers traded very few or none of the fish they caught.

Equipment restrictions for all fishers applied to particular backwater sites, with the heaviest restrictions ordered in the best fishing waters. The community organized a hierarchy of equipment allowances, with some types of line and net use allowed before others. Primarily this implied the prohibition of the *cambil*, a large fixed net. The *jowli*, *douru*, and *dulinge* were the equipment used most commonly by the *Seßße* and *Maccuße*. Most fishing sites were opened uniquely to individual nets for the first three days. After which time other equipment was permitted, particularly the *jowli* and the *dulinge*. Visitor fishers could employ only the level of gear used by the resident fishers.

Self-Regulation and Between Group Restrictions of Fishers

The fishing resources in the Senegal River Valley were managed as common property under two strategies dominated by distinct social groups and governing different geographical

zones, the Senegal River and main tributaries versus the floodplain. Common property in these instances was a social institution, with a specified set of rights to access and use shared equally and exclusively by defined groups. Contrary to the claims of the colonial administration, exploitation of fish resources in the Senegal River Valley did not constitute an open access system in the pre-colonial era.

The preceding discussion of management strategies employed by the Subalɓe and backwater fishers reveals complex systems organized to control within-group and between-group behavior in relation to a common property resource. Both categories of fishing people defined the resource users' rights and responsibilities in relationship to the resource and between fellow resource users. The Subalɓe and backwater fishers had clear notions of insiders and outsiders and the restrictions that accompanied these designations. Outsiders were classified spatially, as those coming from outside of a village or fishing territory. Outsiders also could be defined according to social group differentiations, as when the Seɓɓe and Maccuɓe eventually determined that all Subalɓe were outsiders for purposes of backwater fishing during the dry season. The classifications and insider-outsider designations evolved in response to changes in social relations and the availability of the resource. Stricter definitions evolved when the resource supply was threatened.

The within group rules functioned to guarantee access to the renewable fish resources to all group members. Controlling temporal, spatial and technological aspects of the fishing economy provided a number of mechanisms for managing the resources. Territoriality functioned as a partial solution to the open access dilemma of common property resources. The fishing territories distributed between the *jaaltaaɓe* redefined the boundaries of the commons by carving out smaller commons within the larger domain.

Some of the rules and regulations governing within group exploitation of fishing

resources by the Subalße served a conservationist role, particularly the seasonal closure of deep pools.⁷³ These rules attempted to control harvesting capacities to prohibit stock declines. Beginning in the late 19th century the Subalße showed concern over the detrimental effect of the new *gubal* net and the effect of the declining respect of local rules on fish stocks. The backwater fishers had no corresponding conservationist efforts as part of their management strategy and simply harvested all the fish trapped at their fishing sites. The floodplain fishers managed the zone with the aim to protect their resources from being exploited by others.

Fishing activities did not depend very much on interaction with other resource users, as did, for example, pastoralism and agriculture. One point of intersection occurred between backwater fishers and land owners, whose property the water inundated. As discussed above, the land owners dominated this relationship and controlled aspects of the fishing system even though they may not have been involved with the actual fishing. The primacy of the land owners' rights, extending to control of part of the fishing resources, serves to confirm the strength of the land owners' claims in the floodplain. Rules concerning herd crossings also regulated interactions between Subalße and other resource users. Assistance from the *jaaltaado* and payment for the services were considered essential for assuring a safe crossing, thus corroborating the Subalße's dominance in the river ecological zone.

Technological and equipment regulations received primary attention within the traditional management strategies. The resource users developed an hierarchy of equipment types, ordered according to efficiency. While few tools were prohibited outrightly at all times and in all places, the users strictly regulated when and where and in what order these

⁷³ See Part I of The Question of the Commons: The culture and ecology of communal resources, edited by B. J. McCay and J. M. Acheson (Tucson, AZ: The University of Arizona Press, 1987), pp. 37-170 for a discussion on whether traditional resource users managed resources as conservationists or were only interested in efficiency.

materials could be used. As will become very clear in the next chapter, technological changes contributed directly to the breakdown of the Subalße management system and precipitated overexploitation of the fishing resources.⁷⁴

MAINTAINING FLEXIBILITY: THE LOCAL RESOURCE MANAGEMENT STRATEGIES

The indigenous resource users combined multiple resource use activities in a variety of spatial, temporal and social configurations to maintain flexibility in a physical environment where risks were high. Occupational specialization existed and yet no activity or group designation completely shut others out. Territoriality and privatization of some resources, especially land, created unequal access. Rights and responsibilities based on social categories such as caste, gender and age created further inequalities. Yet common property resource systems functioned to ensure equity of access of some important resources to all group members.

The inequalities within the system and the hierarchical organization of society created complex resource management strategies. The strategies, however, were applied flexibly within groups and between groups and group boundaries remained permeable to some extent. Furthermore, the diverse resource users in the Senegal River Valley were not self-contained, self-sufficient groups but constantly interacted with each other — both in cooperation and competition.

⁷⁴ Other recent studies on fishing management systems attribute changes in technology as a major cause for the demise of the common property management strategies. See J. M. Acheson, "The Lobster Fiefs Revisited: Economic and Ecological Effects of Territoriality in Maine Lobster Fishing" in The Question of the Commons: The culture and ecology of communal resources, edited by B. J. McCay and J. M. Acheson (Tucson, AZ: The University of Arizona Press, 1987), pp. 195-216; and B. J. McCay, "The Culture of the Commoners: Historical Observations on Old and New World Fisheries" in The Question of the Commons, pp. 195-216.

Toward the end of the 18th century the level of violence in Fuuta Toro was extremely elevated, with environmental and human crises comparable to what the region's population has experienced in the latter half of the 20th century. The turmoil and tensions of the period produced the significant attempt for change which was the *Toroofe* revolution of the 1770s.

The 1850s through the 1870s were not prosperous times in Fuuta Toro. Robinson notes that between 1858 and 1880, poor harvests, famine and cattle disease are reported for all but six years.⁷⁵ Population losses affected agricultural and other production systems in the region. Harvest during the last twenty years of the nineteenth century, however, were not as poor and resource use activities once again expanded in the floodplain.

Minor population growth of humans and herds (due to repeated population losses), low technological inputs, and only minor drought episodes in the last twenty years of the 19th century permitted the society to exploit the natural resources without major perturbations. The human-environment dynamic in Fuuta Toro was distinguished by its reproducibility.

After French conquest and with the establishment of administrative rule, the local populations were confronted with social, economic and political changes that affected their resource use strategies. In the following chapter the impact of these transformations on resource management, and the effects of attempting state control and administration of local natural resources and their users are addressed.

⁷⁵ D. Robinson, *Chiefs and Clerics*, p. 113.

CHAPTER V

COLONIAL NATURAL RESOURCE PROGRAMS AND POLICIES AND CONSEQUENCES FOR THE LOCAL SOCIETY AND THE ENVIRONMENT

INTRODUCTION

Colonial rule affected local resource management strategies directly and indirectly. The French saw natural resources in Africa as savage, with neither owner nor manager. The emphasis on surplus extraction put cultivators under pressure. The required tax payments led many to migrate out in search of wage labor opportunities. Abolition of locally practiced slavery altered the social relationships and affected labor relationships. The administration sought to destroy the social elite's position *vis à vis* land. Colonial constructions of "customary tenure" forced African resource tenure systems into invented models to serve the administration's purposes. The colonizers viewed pastoralism in opposition to civilization and sought to abolish the resource use system as it existed in the region. The extensive grazing practiced in the Sahel was incomprehensible to the French, both in economic and environmental terms. Furthermore, driven by the conviction that indigenous resource users were causing massive environmental destruction through overfishing, overgrazing, deforestation and bush fires, the French instituted restrictive access and use policies and claimed state ownership of water, forests and grazing lands. The colonial ideology on natural resource management in Senegal developed out of French economic doctrines and ethnographic beliefs, which shaped French comprehension and evaluation of resource use and management (or lack thereof) in local society.

The colonial administrators often expressed open contempt for the indigenous resource use systems. Many times the French failed to recognize that the local resource users had well developed systems for managing land and common property pasture, forest and fish resources. In such cases, interventions and schemes simply were insensitive to local social relationships and management systems. In other cases, where the French acknowledged traditional management systems, colonial policies directly attempted to dismantle or restructure rural social relationships, including the power that traditional authorities had over land and local resource management. French administrative rule weakened the political basis and legitimacy of local social and political leaders, which affected their ability to manage natural resources.

Many local inhabitants actively resisted, and some then fled,¹ colonial military rule in the region in the 1890s. When the colonial administrators were finally established in posts along the river, they were confronted with further and continual local opposition to their plans of change for the region. Not all local inhabitants resisted or rejected French rule, however. Many informants maintain that the population preferred the colonial regime to that of the Almaamis. Some refer to the French as their liberators, and remember the French, in contrast to Abdoul Bokar, as rulers who respected the property rights of the local inhabitants.² Furthermore, the elimination of raiding that resulted from the pacification associated with French rule affected resource use for all resource user groups. Cultivators, herders and fishers could, once again, cross the river more easily, to exploit the land, grazing and water resources of a much larger area.

¹ See David W. Robinson, *Chiefs and Clerics*, for rich and detailed accounts of haal-Pulaar resistance to French military rule in Fouta Toro. John Hanson's historical work on Umarian migration is also of interest.

² These sentiments were repeated frequently in interviews with people of every rank and class in the local society. Similar remarks are found in the *Fond Robinson*. See, for example, Fond Robinson, Cassette Touré (received from David Robinson, personal archives).

The creation of Mauritania as a distinct colonial entity, between 1904 and 1913, caused numerous resource use disputes. One central purpose in establishing separate administrative control of the north bank was to restrict the exploitation of land on that bank by those living on the south bank for purposes of the colonial administration's tax collection controls.³ This policy drastically upset the land use patterns that had evolved in the region. Establishment of French control of the north bank initially renewed sufficient calm and stability to encourage the expansion of south bank cultivators, pastoralists and fishing people across the river. Once Mauritania attained separate colonial administrative status, the new openness of the zone dwindled in the face of this new boundary dividing the space.

Contradictory Visions: Economic Development or Environmental Conservation

The administration's conflicting policies and attitudes toward local resource use systems reveal some of the contradictions of colonialism. In the words of Comaroff and Comaroff: "If the colonizers formed a single block, it was one fractured by internal difference - and by diverging images of empire locked in 'socio-ideological' struggle."⁴ Aspects of their agenda induced greater exploitation of natural resources and others were aimed at protecting and preserving the resource base from destruction. The contradictory policies of intensive exploitation and rigid protection of resources arose from the different programs and ideologies pursued simultaneously by the French. The official policy was not determined merely by the need for metropolitan capital but also derived from ideas about improvement and development of "backward" places and people. Encouragement, often coercion, to increase local production of resources stemmed from the race to increase

³ M. Kane, "The History of Fuuta Tooro, 1890s-1920s," p. 174.

⁴ J. Comaroff and J. Comaroff, Ethnography and the Historical Imagination, p. 273.

production and exports and the goal to make the colony a financially self-sustaining entity.

The objectification of nature and the separation between nature and society that existed in French thinking, stemming either from the Romantic conception of nature or the scientific conception,⁵ was transported to Senegal and local knowledge and understanding of the natural resources was discredited.

The conservationist policies instituted early in the century in the Senegal River Valley, advocated by those propelled by the scientific/technological conception of nature, were pursued at the insistence of those holding direct commercial interests in the area. The *Afrique Occidentale Française* (A.O.F.) branch of the *Union Coloniale Française*, a commercial pressure group, sought policies to stop deforestation and soil erosion. These interest groups sought to ensure continual availability of resources for their commercial pursuits.

Due in part to the burgeoning of scientific forestry, botany and agronomy, international concern over environmental degradation culminated in the 1930s. Beinart explains the foundations of the conservationist perspective to development in Africa: "Conservationism was a set of ideas -- perhaps becoming an ideology, of doom and resurrection -- generated by the closing of the frontier and a conviction that settlers could no longer mine the land and move on. Its propagators were those who saw the future of capitalist agrarian development as dependent on rational planning and the application of technology...."⁶ Clearly the compulsion to protect the natural resources in an area, stemming primarily from a current ideology, may or may not have anything to do with the actual state

⁵ See Stephanie Pincetl, "Some Origins of French Environmentalism: An Exploration," *Forest and Conservation History* 37 (April 1993): 80-89 for an interesting discussion of the development of French environmental ideology.

⁶ William Beinart, "Soil Erosion, Conservationism and Ideas about Development: a Southern African Exploration, 1900-1960," *Journal of Southern African Studies* 11, No. 1 (Oct. 1984): 52-83.

of affairs on the ground. The French colonial officials evaluating the physical environmental situation in the Senegal River Valley were influenced by the domestic and international conservationist discourse. Recent research suggests that reports on environmental degradation in the 1930s and earlier were exaggerated, based on international concern and ideological conviction and not on the construction of localized histories of ecological change.⁷

The contradictions arose not only from the continual changes in and multiple objectives of metropolitan policy, but also resulted from the individual ideas of the local French administrators concerned with carrying out agricultural schemes and interventions. Some local administrators became zealous advocates of conservationist policies, stemming from a Romantic conception of nature, while serving in field posts. Individual administrators interpreted, bent and even disregarded colonial regulations as they deemed necessary.

The contradictions and complexities of colonial rule, along with the prior existence of various local practices that affected the physical environment, determine that colonialism cannot be viewed as the sole and inherent cause of environmental degradation in Africa, but one in a set of causative influences.⁸ This chapter examines the role that the French colonial administration had in influencing local natural resource use and management.

French Colonial Administrative Structures and Their Relation to Resource Management

The French subdivided the region into a hierarchy of spatial units for administrative purposes. The administrative apparatus established in the Senegal River region was functioning by the 1920s. The three levels of administrative circumscriptions – the circle, subdivision and canton, along with various territorial and federal agencies, were involved in

⁷ Ibid.

⁸ P. Blaikie and H. Brookfield, Land Degradation and Society, p. 102.

various ways with natural resource management. One objective in designing the colonial administration was to combine "customary" practices with the French bureaucratic system.

The canton incorporated a vast territory but was defined in a way so as to be ethnically homogeneous. The French favored the selection of members of ruling families to fill the *chefs de canton* posts in an attempt to install individuals who served both as colonial administrators and representatives of the ethnic collective. The aim was to diminish the chasm between the administration and the population and to establish a *porte-parole* for the rural populations.⁹ By favoring members of noble families, the new administrative system supported the old structure.

The colonial tax policy affected all resource users and had the largest impact of all policies effected in the region. The demand for cash payment of taxes levied on people, animals and land was resisted by members from all segments of society. Tax collection had a direct impact on resource use and management in that it placed an enormous pressure on local inhabitants to produce more agricultural products, capture greater quantities of fish, and/or increase herd sizes to permit greater offtake.

As discussed above, by the 1930s the colony's agricultural archives revealed a preoccupation with soil erosion and the call to preserve natural resources. The spread of the conservationist ideology triggered the mushrooming of agricultural departments and other state agencies designed to alter indigenous production practices. Earlier in the century, the administration established agencies to increase production of cash crops. By the 1930s state agencies were established specifically to assure protection and conservation of the colony's natural resources. These agencies drew on experiences from around the world, especially from the United States. Under the presidency of Theodore Roosevelt (1900-1908) and again

⁹ See François Zucarelli, "De la chefferie traditionnelle au canton: évolution du canton colonial au Sénégal: 1855-1960," *Cahiers d'Etudes Africaines* XIII, no. 50 (1973): 213-238.

in the late 1920s, federal interventions were taken to protect natural resources. This set an international precedent and influenced colonial administrative policies in Africa.

Most of the administration's attentions, including their conservationist policies, were focused on the peanut basin south of the Senegal River Valley. Fuuta Toro, especially upriver near Matam, received sporadic attention and the administration's capacity and motivation to intervene in the region remained limited throughout much of the colonial era.

During these decades of change the local resource management systems were confronted with varying types and degrees of transformations and local groups differed in their capacities to cope with and adjust to the alterations occurring. As Beinart points out: "Although there is considerable evidence of self-regulatory practices in land use in pre-colonial African societies, it cannot necessarily be assumed that peasant communities in the colonial period, their old systems of authority eroded and faced with new constraints in their battle for survival, had the capacity to regulate themselves."¹⁰ This chapter evaluates the impact of French colonial agendas and policies for the local resource management systems in the study area. At times, official policies and agendas that failed to have the planned effect nevertheless altered the interactions between local resource user groups and between the various segments of society. The multiplicity of changes led to substantial modifications of earlier patterns of social control, which in turn affected local resource use and management.

PRODUCING FOR SURPLUS: COLONIAL AGRICULTURAL POLICIES

The use of the waters of Senegal, the diverse rivers and lakes would produce marvelous results. The country would be transformed into an immense garden exporting its products throughout the entire world. It is evidently the great project for the future and for centuries to come.¹¹

¹⁰ W. Beinart, "Soil Erosion, Conservation and Ideas about Development," p. 82.

¹¹ See "Agriculture en Sénégal." ANS R 3.

The French had great hopes for the possibilities of agricultural development in the Senegal River Valley and often voiced their astonishment and disbelief at the ineptitude of the local population.¹² They also disparaged their own inability to transform the Senegal River Valley.¹³

The decline of the gum trade required the French to devise a new economic plan and encourage new developments in Senegal by the 1820s. Development of the river region became the focus of many an administrator's vision for the colony. The administration was worried above all by the monolithic nature of Senegal's agricultural system and economy. They recognized the vulnerability of such a system and sought to diversify production through the development of the Senegal River Valley. By 1823 they had established the Agricultural Society of Senegal which was charged with research and agricultural development. The local population did not fail to notice that the administration's interests in agricultural research only extended as far as its own interests, while failing to address local production concerns.¹⁴

By the time the French had established administrative control in the Matam region they had dispelled many of their earlier images of the Senegal River Valley as the ideal location for a settler plantation economy and as the bread basket of their colonies. This more informed sense of reality did not signify that the administrators and agents of the colony had forsaken all their aspirations for the Senegal River Valley. They soon determined that the agricultural producers in the region should supply food to the labor force producing export-

¹² Y. Henry, "Étude Agrologique du Sénégal (Région du Fleuve), 1915-1917," p. 20. ANS R 15.

¹³ Cercle du Matam, "Rapports mensuels d'ensemble," 1913. ANS 2G 13 (51).

¹⁴ A letter was sent by the Union Generale des Originaires de la Vallée du Fleuve to the Gov. General, 28 August 1949, Matam. ANS 3R 35 (169).

oriented peanuts and for the growing urban populations.¹⁵

Beginning in the 19th century and lasting into the present century, the local populations supplied traders with millet destined for the gum collectors. The system of exchange was based on a barter system, to the advantage of the traders who could gain both on the purchase and sale of millet. The colonial administration endeavored to monetize this exchange relationship, and the entire economy, as well as cut out the lucrative role of the traders.¹⁶ By the early 1900s cultivators in the Matam Circle were supplying urban centers and peanut producers in Cayor and Baol, causing millet exports from the Valley to rise over 300% between 1907 and 1910, but such exchanges did not become monetized until the authorities accepted nothing but cash for tax payments.¹⁷ Even with such a policy, those who had other means to pay their taxes did not sell their grain.¹⁸

Monetizing grain exchanges did not create a thriving grain market, however. The prices local producers received for their grain often dropped so low that they had little incentive to produce for sale. The government began regulating the market by setting grain prices. These controls failed to regulate the vast seasonal and spatial fluctuations in prices but

¹⁵ Millet sales were mentioned frequently in the Matam Cercle monthly and trimesterly reports, see ANS 2G 14-46, 2G 15-35, 2G 16-33, 2G 18-27 and 2G 34-69. See also J. Johnson, "The Almamate of Futa Toro," p. 75; L. M. Wragge, "L'implantation des maisons de commerce au Sénégal et la réaction du commerce africain 1885-1930," unpublished manuscript, n.d. and Cassette Toure, al-hajj Iba, Bowel Sarr et Ibrahama Seriba Thioube, 12/3/68, *Fonds Robinson* for other references to the sale of millet produced in the Senegal River Valley to other regions in the colony.

¹⁶ Notice sur Matam par son commandant de cercle, 1904. ANS 1G 292.

¹⁷ J.-P. Minvielle, *Paysans migrants du Fouta Toro*, p. 55.

¹⁸ Cercle de Matam, Rapport mensuels d'ensemble 1917. ANS 2G 17-30.

local producers ultimately had no choice but to sell their grain for tax money.¹⁹

The colonial regime demanded that the cultivators in the Senegal River Valley produce greater grain surpluses. Failing to increase production adequately through monetization of exchanges and by demanding taxes, they encouraged surplus production by extending the land area under cultivation. The French favored and actively encouraged local expansion of agricultural lands in the Valley throughout their rule.²⁰ Along with increasing the total area under production, the administration's agenda involved intensifying food crop production on a portion of that land, through improved cultivation methods, mechanization, and fertilizer applications. The administration envisioned that surplus land could then be cultivated for cash crop production. The local administrators endorsed creating fields in all of the local agro-ecological zones but preferred that the cultivators focus on the more productive and secure *waalo* fields.

Pressures for surplus production provoked imbalances in the agricultural system; these imbalances and demands affected the social system, as well as the biophysical environment. The local agricultural system in the region was aimed at subsistence production and the additional pressures quickly led to disruptions of the local agro-ecology. As the local population faced the need to produce surpluses and the need for cash, they marketed more of their grain.²¹ The question of whether the marketed grain came from increased local

¹⁹ Many local informants recounted that their households sold grain during the colonial era, primarily to acquire cash for taxes.

²⁰ See Rapport annuel d'ensemble, 1908 (ANS 2G 8-46); Rapport d'ensemble mensuels, 1912 (ANS 2G 12); Rapport trimestral d'ensemble, 1915 (ANS 2G 15-35); Rapport trimestral d'ensemble, 1916 (ANS 2G 16-33).

²¹ This view is supported by the findings reported by Chastanet for the Bakel region. See Monique Chastanet, "Strategies de Survie et Politique Coloniale Pendant la Famine de 1903 dans la Vallée du Sénégal," (Paris: ORSTOM, 1988).

production or from selling a larger percentage of their household reserves remains unanswered.

A number of other factors affected the functioning of the local agricultural system during the colonial era. Land tenure reforms, loss of labor to out-migration, emphasis on new crops, imposition of new resource management institutions, the drive to irrigate – all induced changes in the local agricultural system. Each of these will be addressed below with an additional section summarizing the transformations in the *waalo-falo-jeeri* system during the colonial era. The ecological consequences of the colonial agricultural policies in the region are treated in a final section.

Confronting Local Land Tenure: The Legislation and Local Realities

Local land tenure in the Fuuta immediately presented itself as problematic for the French administration and they struggled with the issue throughout their rule. Whereas the administrators identified, and endeavored to abolish, the existence of communal property throughout West Africa, they recognized that the individualized property regime in the Senegal River Valley was distinctive. Regional legislation that the French promulgated to address their concerns about land rights – primarily established to encourage the formation of private, individual holdings – was not what the administration deemed necessary for Fuuta Toro. The administration encouraged the development of private holdings in other regions but they sought to eliminate the control over large private land holdings of the haal-Pulaar in Fuuta Toro. In the Senegal River Valley, the administration vacillated between advocating individualized tenure and resistance toward the traditional Futanke land holders.

Prior to their conquest of the Middle Senegal River Valley and the establishment of the colonial bureaucracy in the region the French had created a set of laws and policies to

regulate land tenure throughout their West African colonies. First, the colonial regime transferred eminent domain (of crown or *bayti* lands) from local control to the Metropole. Second, they proposed codification of land holdings, whereby land would be awarded to local land users rather than land owners, through land registration and land titles. Lastly, authorities enforced suppression of land rents and payments, which theoretically disappeared with the application of eminent domain. The Code Civil, applied throughout French West Africa in 1830, did not recognize the existence of local land tenure. These rulings were only sporadically applied in any locality and the impact of such decrees varied widely.

Colonial authorities commonly constructed "customary laws," often finding, and criticizing, communal tenure. In the Senegal River Valley, however, the colonial authorities found that individuals had well defined holding rights over cultivated land. While communality implied lack of modernity to the colonial authorities,²² the existence of individual holdings presented its own set of problems. Expropriation of these individual rights introduced far greater legal and political problems for the administration than communal property. The French feared the power of individualized rights, disdaining the "feudal" regime they saw in the Fuuta. The French found too little private land ownership in most local societies, but found too much, and in the "wrong" form, in Fuuta Toro. "With hindsight, one can see that these were constructions of a reality projected by the colonialists themselves, who persistently tried to squeeze African landholding systems into a model that set private and individual in opposition to communal and group."²³

²² See Martin Chanock, "A Peculiar Sharpness: An Essay on Property in the History of Customary Law in Colonial Africa," Journal of African History 32 (1991), p. 70. Chanock argues that colonial administrations 'invented' communal tenure, thus impeding the development of individual tenure. The tendencies were somewhat different in the Fouta, where the French recognized and fought against individualized tenure.

²³ P. Peters, "Embedded Systems," p. 179.

The administration ordered a number of extensive studies on the land tenure system of the haal-Pulaar of Fuuta Toro. The first of such inquiries was undertaken by Lieutenant P. Cheruy in 1911. This was followed with studies by Vidal (1924 and 1935), Gaden (1935) and Kane (1935).²⁴ Land tenure in Fuuta Toro was the subject of far more inquiries than the tenure systems of other regions in French West Africa. This bears witness to the fact that the administration had an overriding concern with the land tenure regime of Fuuta Toro. In attempting to decipher and break down the indigenous land holding system they sought to establish control over the local power structure.

The decree of 23 October 1904 claimed state ownership of "toutes les terres vacantes et sans maîtres" without clarifying the ambiguities of this term. In response to the confusion caused by the earlier ruling, a decree in 1906 (July 24) nominally recognized local land rights. In part this recognition of traditional land rights was emphasized by government authorities in an effort to obtain the collaboration of the principal indigenous chiefs. One reason the administration wanted to gain ownership over tracts of land in Fuuta Toro was for purposes of redistribution. Similar to previous regimes, the French used land distributions to favor and reward supporters. Their policy in the region included claiming land abandoned by those following El Hadj Omar Tall to Niore as *vacantes et sans maître*.

In Fuuta Toro the French sought to eliminate local land fees and taxes very early on.²⁵ The administration offered three principal lines of reasoning for eradicating the

²⁴ Lieutenant P. Cheruy, "Rapport sur les droits de propriété des *colade* dans le Chamama et le mode d'élection des chefs de terrains," Supplément au Journal Officiel 52-4 (1911); Administrator M. Vidal, "Etude sur la tenure des terres indigènes au Fouta dans la Vallée du Sénégal," M.A.S. Bulletin 72 (Saint-Louis, Senegal, 1924) and "Etude sur la tenure des terres indigènes au Fouta," Bulletin du CEHSAOF (1935): 415-448; Henri Gaden, "Du régime des terres de la vallée du Sénégal au Fouta, antérieurement à l'occupation française," Bulletin du CEHSAOF (1935): 403-414 and Abdou Salam Kane, "Du régime des terres chez les populations du Fouta sénégalais," Bulletin du CEHSAOF (1935): 449-461.

²⁵ See M. Kane, "The History of Fuuta Tooro, 1890s-1920s," pp. 130-133.

indigenous land fee system. First, eliminating the fees would liberate the small holder cultivator, freeing him or her to cultivate surplus for the colony. Second, abolishing the land payments would enable the administration to reduce the independence of the local power base. Third, freeing land users from indigenous payments allowed the colonial administration to levy land taxes on the local population. They reasoned that the cultivators could not support both systems.

The French argued that *njoldi* and *assakal* should be abolished because these fees inhibited the development of small holders who would bring about greater agricultural production than was possible when the land was so unevenly distributed within the population. In the words of Vidal, land payments were "disappearing ever so slowly, in spite of the interventions by the indigenous tribunal to create a form of small holdership, to be progressively consolidated (in the indigenous sense), disengaged from all payments or servitude to others, true parasites...."²⁶ Others saw the eradication of the traditional system as a necessary step in establishing property rights for newly liberated slaves. The administration was convinced that freeing the land users from exploitative and abusive indigenous payments would turn them into vital, surplus producing cultivators.

Abolition of local land control and the fee system were meant to undermine the traditional power base in the region and destroy the control wielded by local land holders. "In abolishing land rights, the administration could more easily turn the chiefs into salaried employees, and thereby reinforce its control over them."²⁷ Once again, Vidal expresses the administration's various concerns and strong emotions concerning the indigenous land tenure

²⁶ M. Vidal, "Etude" (1924).

²⁷ M. Kane, "The History of Fuuta Tooro, 1890s-1920s," p. 133. In 1903 the *Gouverneur* suppressed the collection by province and canton chiefs of *assakal* on *bayti* land. The French replaced these fees with fixed payments to the indigenous administrators.

system:

....We realized that the situation for the cultivators, on whom there are great pressures already, and on whom we impose for our own benefit, is deserving of our complete service and that our duty is to abolish, without further ado, the oppressive feudal regime under which we have retained them until the present at the profit of a caste that, to say the least, endures our domination with great difficulty, if not completely abhorring it.... We have the power to protect our cultivators of the Fouta with whom our association is indispensable...they constitute the grand majority of the inhabitants of the country in contrast to the exorbitant abuses and shocking inequalities of the sort of which they are victims of in the hands of an oligarchy....²⁸

Cheikh Musa Kamara, in a letter to the head of the Political Bureau, maintained that in spite of all the French efforts to eliminate the local land payments, French policies actually caused repurchase and rent payments for land to increase. He writes:

These two customary payments were raised above what was collected according to custom in the past, and especially if the property owner is a civil servant paid by the French authorities, sometimes violent and coercive practices, sometimes other unjust means are imposed on the peasants to force them to pay these very elevated taxes. If the peasants find themselves unable to pay, to acquit them of their taxes due, these civil servants usurp the peasants' lands.²⁹

Local administrators puzzled over the possible repercussions of land registration. Some were adamant that land registration would favor the land owners,³⁰ while others believed that land registration would be the best policy for the majority of land users.³¹ The Matam Circle commandant feared instituting land registration because he believed it would perpetuate what the administration defined as a feudal system. He argued that land registration would consolidate and solidify all land holdings in the hands of five percent of the

²⁸ M. Vidal, "Etude" (1924).

²⁹ Letter from Cheikh Moussa Kamara à Mr. le Chef du Bureau Politique, Saint-Louis. Matam Salde Correspondance, 1924-1934. ANS 11D 1-783.

³⁰ Cercle du Matam, Rapport annuel d'ensemble, 1908. ANS 2G 8 D-46.

³¹ Cercle de Matam, Rapport d'ensemble, 1910. ANS 2G 10-45.

Futanke who owned land in 1899.³² Although such a statistic is highly suspect, it reveals the administration's uneasiness with what they considered to be the highly skewed and detrimental pattern of land holding in the Valley. The only two recorded requests for land registration in the Matam Circle were made by *notables* in the first part of 1932. Throughout colonial rule the administration's aim consisted of abolishing a system that they viewed as a heavy burden to the cultivators, an impeding force on the development of small holder production, a restraint on their grip on power and a detriment to their tax collection efforts.³³

During French rule local land elites struggled to maintain control over their land holdings and ability to collect fees, but the colonial decrees and policies slowly eroded some elements of the local tenure regime instituted during the Almamate. Many informants maintained that colonial authorities recognized, respected and legitimized individual holdings of the actual land users rather than land owners, causing traditional land payments to dwindle. Cultivators felt that their stakes in the land grew more secure, and over time they witnessed the need to pay *assakal* and other land payments diminish. The opinion of many corresponds to the words of one informant: "the idea of private property commenced with the whites and ended with the whites."³⁴ Other sources indicate that the decline of land fees occurred only very slowly throughout the colonial era, pointing out that elements of the pre-colonial land payment system remain today.

Not only was the Fuuta land question the topic of numerous studies, references to land issues and land disputes regularly made their way into monthly, quarterly and annual Matam Circle reports. Land disputes within families and between families, over inheritance, field

³² M. Kane, "The History of Fuuta Tooro, 1890s-1920s," p. 132.

³³ J. LeRoy, "Matam," *Monographies d'Afrique Noire* (Saint-Louis, 1958), p.30.

³⁴ Interview with clan chief Caangan, NDulumaaji Dembe, 12 August 1990.

boundaries and rights of use, gained central importance early on in the Commandant's annual reports. Disputes also occurred between neighboring villages and across new administrative boundaries. Already in 1908 questions about land holdings and land distributions were considered the most significant administrative issues in the region.³⁵

As discussed in the previous chapter, during the eighteenth century under Almaami Abdoul the Futanke ability to control the north bank and farm the land was expanded. This opportunity probably declined steadily over the century but was renewed in the late nineteenth century with French pacification of the Moors on the north bank. The possibility to exploit the north bank was virtually eliminated under French policies in the early twentieth century, however, when Mauritania was given separate administrative status. The border fragmented land holdings and disrupted the land use system by placing an individual's land holdings under two jurisdictions. Many people living in rainy season villages on the south bank had cultivated *waalo* land on the north bank.³⁶ French colonial authorities, and the indigenous colonial assistants, Moors and haal-Pulaar alike, barred those south of the river from crossing to cultivate their lands.

The land issues that plagued the administration from the beginning of their rule in the region were never fully resolved. Just as the administration wanted to destroy the land holding elite but could not afford to alienate it completely, elements of the indigenous land tenure system were weakened and altered, but no dimension of the local system was completely obliterated under French rule.

³⁵ Cercle de Matam, Rapport annuel d'ensemble, 1908 (ANS 2G 8-46) and Cercle de Matam, Rapport trimestriel d'ensemble, 1909 (ANS 2G 9-48).

³⁶ See A. Lericollais and Y. Diallo, "Peuplement et Cultures de Saison Sèche dans la Vallée du Sénégal" (Paris: ORSTOM, 1980); Jean Schmitz, "Anthropologie Historique de Quelques Villages et Territoires de la Région de Matam," Mission Report for IDA (May 1989) and Jean Schmitz, "L'État géomètre: les *leydi* des Peul du Fuuta Tooro (Sénégal) et du Maasina (Mali)," Cahiers d'Études africaines 103 (1986): 349-394.

Unresolved land tenure questions kept the Agricultural Commission, in 1951, from initiating a national project on environmental protection and conservation that would have classified and reserved large expanses of land. Questions of tenure and the meaning of *terres vacantes et sans maître* and other ownership questions had never been reconciled, therefore the commission refused to classify the colony's territory.

Such classification would have severely limited the rights of usage for herding, cultivation, hunting and fishing, prohibiting entrance into large areas. Although the commission favored environmental protection they considered the project to be unacceptably detrimental to the local society's resource needs.³⁷ Once again the administration volleyed between environmental conservation and economic development.

Insistence on Irrigation

We have often said that, thanks to the Nile, Egypt was a long oasis created in the Eastern Sahara. On the western coast, the Senegal River plays the same role in the same environment, the same work should be completed.³⁸

The lack of indigenous water control or irrigation development in the Senegal River Valley exasperated colonial administrators. This failure to harness water flowing through parched land was incomprehensible to them. Only a few lone voices opposed plans to irrigate the Valley.³⁹

³⁷ Untitled document (22 Oct. 1951) from file "Protection de la Nature Reglementation: textes et projets des testes, 1937-1955," Direction générale des Services économiques Inspection générale des Eaux et Forêts, 1933-1955. ANS 3R 71 (169).

³⁸ Capitaine de Genie Mathy, "Utilisation du 'Sénégal' comme fleuve d'irrigation," extract of a report written in 1904-1905, quoted in Y. Henry, "Étude Agrologique du Sénégal" (1915-1917). ANS R 15.

³⁹ At least one administrator strongly opposed the development plans for the Senegal River, maintaining: "nous avons vu naître récemment une théorie qui imposant la culture permanente du sol comme un dogme, nous propose de transformer ces fleuves....Théories doublement erronés d'abord, parceque l'irrigation permanente est condamnée partout dans le monde, ensuite

While no irrigation development took place in the study area during the colonial era, it remains important to examine the administration's strong emphasis on and commitment to irrigation in the Valley because of the agenda's indirect impacts on the population. Irrigation research and development in the Senegal River Valley diverted investment and research away from traditional production systems. A brief history of colonial irrigation policy, experimentation and expectations for the Senegal River Valley are traced in this section.⁴⁰ The emphasis on irrigation throughout the colonial era foretells what was to become the single agricultural strategy in the region by the 1970s.

Studies of the river's flow and development possibilities, conducted primarily for improving navigational purposes, began in the early nineteenth century. The French explored the river region's potential for serving their economic interests, first as part of the cash crop sector and later as a component of the subsistence sector.

As early as 1817 Governor Schmaltz stated that he would transform the Senegal River Valley into a vast agricultural zone and assigned a high priority to development of the river region. In 1821, under Governor Roger, an experimental irrigated garden was initiated at present-day Richard Toll. After Roger's departure in 1826 all of the agricultural activities in Richard Toll were liquidated and the forsaken project was not reactivated until 1856 when

parceque un régularisation de cette nature, sauf en cas exceptionnels, est techniquement impraticable, financièrement trop onéreux, économiquement sans avantage." Ingénieur des Travaux Publics, "Les irrigations et la Culture du Cotonnier dans la Vallée du Sénégal" (Kayes, 30 mars 1922). ANS 1R 74 (158).

⁴⁰ This brief account simply summarizes the main trends in the colonial irrigation policy. For more extensive reviews of this history consult Paul Mathieu, "Agriculture Irriguée, Reforme Foncière et Strategies Paysannes dans la Vallée du Fleuve Sénégal, 1960-1985," Thèse (Fondation Universitaire Luxembourgeoise, 1987); J.-P. Minvielle, Paysans migrants du Fouta Toro; Christophe Nuttall, "Occupation de l'Espace, Mutation et Développement dans la Moyenne Vallée du Fleuve Sénégal. Cas de l'Arrondissement d'Ouro-Sogui, Department de Matam, Sénégal," Thèse (Université de Rouen, 1989) and Sidy M. Seck, "Irrigation et aménagements de l'espace dans la Moyenne Vallée du Sénégal," Thèse de 3e cycle (Université de Saint-Etienne, 1981), 3 vols.

Faidherbe attempted to rekindle interest in irrigation. Faidherbe's gardener, Lecard, recognized that the *waalo* lands, where the local inhabitants cultivated annually, were the most productive in the colony. Mathy restated this conviction in 1904, but it was not until the 1910s that administrators, alarmed by poor floods, began seriously promoting the idea of damming the Senegal River for irrigated agriculture. Mathy and Auguier promoted a series of projects and studies for the region. Mathy's plans reinvigorated the technicians' dreams of revolutionizing the agricultural system in the Valley through water flow control. Belime, in 1918, remained a minor voice when he judged these developments impossible.

The first dam construction plans focused on the creation of a structure at Taouey, near the Lac de Guiers, to prevent salt water intrusion. Henry opposed such highly technical solutions, viewing them as problematic on multiple levels. He preferred the construction of an extensive canal system, to aid in controlled field submersion.⁴¹ In 1926, Auguier proposed building a dam at Gouina. The first time an upriver dam project at Kayes was promoted, in 1928, visions of extensive navigation, electrification, and irrigation intensified. Cost to the colony remained the sole deterrent.

By 1922 the administration recognized that they could not justify the costs of irrigation without the development of export crop production in the region. Despite some concerns about the economic and technical viability of developing the Senegal River for irrigation the plans did not fade. The strategies and project plans vacillated between major dam construction, at the highly technological end, to more conservative schemes using earthen dikes and canal structures. The *Mission d'Aménagement du fleuve Sénégal* (M.A.S.), created in the 1930s, became the first in a series of formal institutions created to promote development of the Senegal River Valley.

⁴¹ Y. Henry, "Rapport sur l'aménagement des bassins d'inondation Taouey lac de Guiers et les observations à faire sur le régime des eaux," 1917. ANS P 408.

M.A.S., attached to the *Service des Travaux Publiques*, began irrigated rice and river flow regime studies for the Senegal River Valley in 1936 but by 1945 had suspended this orientation because the Metropole's attentions turned toward cotton production and focused its development objectives uniquely on the Senegal River Delta. The Peltier-Delisle Project, elaborated in 1945, planned for the development of 50,000 hectares of the Delta region over ten years. Concurrently in 1945 the French developed Richard Toll for mechanized rice production, and in 1949 a colony of local laborers was installed to produce rice. By 1953 only 1,500 hectares had been irrigated employing controlled submersion.

The research station and indigenous agricultural colonization program at Guédé, established in 1939, was part of an M.A.S. project experimenting with gravitational irrigation, protection of dikes, controlled submersion, and indigenous colonization. The settlement failed miserably, with administrators unable to convince the local population they had been moved into the area to become permanent residents. Project officials cited incompetent labor as one reason for the project's failure, but technical, climatic, and organizational reasons were also noted. Hardy noted: "...the presence of populations attached to their techniques, to their customs, to their property rights, were an obstacle for the realization of large agricultural enterprises."⁴²

Local land tenure was recognized early on as a formidable problem facing irrigation developments in the Valley. Early on the French abandoned their vision of the Senegal River Valley as a European settler region, largely due to land tenure issues. Acquiescing to the difficulties, one administrator stated: "For the installation of large European exploitations, it would be best to envision these for other countries where indigenous rights would be non-

⁴² G. Hardy, *La mise en valeur du Sénégal* (Paris: Larose, 1921).

existent."⁴³ The *waalo*, the ecological zone most suited to irrigation, was the land held securely by the local population.⁴⁴ The French asserted that irrigation development would transform the *waalo* into a much more productive zone, thereby facilitating the redistribution of land holdings, consequently ridding the local society of the large land owners.

Enormous effort and financial resources went into scheming on how to irrigate the Senegal River Valley and Delta. For a multiplicity of human and technical reasons the colonial administration never achieved their plans for the region. The dreams did not die, however, and the idea of irrigating the vast floodplain was never too far from the top of the colonial administration's agenda.

The Lack of Labor

Lack of agricultural labor in the colony was of overriding concern to the administration.⁴⁵ Once again the colonial administrators were faced with conflicting desires: the need for cheap labor for the public and capitalist sectors and the demand for increased local agricultural production. The French maintained that the lack of local labor in the Valley stemmed from two sources: the administration's benevolent act of abolishing local slavery⁴⁶

⁴³ Service de l'Agriculture, Rapport d'ensemble, 1919. ANS 2G 19-1.

⁴⁴ Service de l'Agriculture, Rapport d'ensemble, 1919. ANS 2G 19-1.

⁴⁵ The administration was not without contradictions in its attitude toward the labor shortages in the colony and the desire for increased grain production in the Valley. On the one hand, the administration wanted the population to remain in the Valley, to increase agricultural production and expand the area under cultivation. On the other hand, their central interest in expanding peanut production led the French to recruit, mobilize and sometimes coerce labor to leave the Senegal River Valley to work in the peanut basin. See Léon Gerraud, La crise de la main-d'oeuvre aux colonies (Saint-Louis, 1928), p. 23.

⁴⁶ Cercle du Matam, Rapport mensuels d'ensemble, 1919. ANS 2G 19-22.

and the attraction of wage labor opportunities in other regions of Senegal.⁴⁷ A shortage of cultivators created dire consequences for the colonial administration seeking to raise agricultural production in the region.

The abolition of slavery, rising needs for cash, the fear of recruitment and the desire for more lucrative payoffs than those provided by local grain production are all issues that provoked widespread out-migration. Severe droughts, occurring in 1903, 1914, 1926, and 1941-44 also pushed people out of the region. The specific effects of this trend for local production remain unclear, however.

Robinson notes the interdependence of the emancipation of slaves and emigration to Niore, causing significant population losses prior to direct French rule: "Both phenomena struck to the heart of productivity and cohesion of Abdul's domain. The emancipation tended to trigger emigration, making Futa, as it were, bleed at both ends."⁴⁸ By the late 1890s as many as 20,000 Umarians had returned to Fuuta Toro, at least partially countering the population losses.⁴⁹

One reason that it is difficult to estimate the effect of abolishing slavery is due to the inconsistency with which the French applied their policy. Once again the contradictions and shifting nature of colonial policy are apparent in examining the administration's handling of the slavery issue. The French sent conflicting and ambiguous signals to slaves, slave owners and sellers.⁵⁰

⁴⁷ E. Belime, "Rapport: Possibilités d'Aménagement offertes par la Vallée du Fleuve Sénégal," M.A.S. Bulletin 31 (1922), p. 42.

⁴⁸ D. Robinson, Chiefs and Clerics, pp. 172-173.

⁴⁹ David Robinson, The Umarian Emigration, p. 262.

⁵⁰ Richard Roberts and Suzanne Miers, "The End of Slavery in Africa," in The End of Slavery in Africa, pp. 3-68, edited by Suzanne Miers and Richard Roberts (Madison, WI: The University of Wisconsin Press, 1990).

Some colonial administrators supported emancipation for humanitarian reasons, and yet most feared losing control over an important labor force. While the aim of many administrators was to cause minimal social, political and economic disruption so that local society would remain productive, the desire to break down the landholder's power in Futa Toro encouraged the administration to support emancipation.

Out of their fear of labor shortages, the French not only hesitated to enforce the law, at times they were instrumental in returning fleeing slaves to their masters. According to Roberts and Miers, colonial administrators "dealt selectively with fugitive slaves, in practice freeing those of their enemies and returning those of their allies."⁵¹ Gouverneur William Ponty initially opposed swift emancipation for fear of destroying the economy. By 1908 he was of the opinion that freeing slaves "was economically desirable in order to create a mobile labor force for development along capitalist lines."⁵²

Most commentaries by colonial administrators concerning the effect of the abolishment of slavery felt that it disrupted local society.⁵³ Many reported that landholders lost their secure source of labor, obliging many former slave holders to work in the fields themselves for the first time. According to Roberts and Miers: "French administrators welcomed this addition to the productive labor force of men who had formerly been engaged in war, politics, and trade....In many cases the end of slavery led to increased exploitation of family labor: wives, children and junior kin became the new 'captive labor' of the household heads."⁵⁴

Matam Circle witnessed the creation of new villages or *villages de liberté* early in the

⁵¹ Ibid., p. 14.

⁵² Ibid., p. 26.

⁵³ Cercle du Matam, Rapport mensuels d'ensemble, 1919. ANS 2G 19-22.

⁵⁴ R. Roberts and S. Miers, "The End of Slavery in Africa," p. 41.

century due to the emancipation of slaves.⁵⁵ One administrator maintained, however, that "once they acquire their freedom a lot of them move to Cayor and Bawol which they considered richer territories where it is easier to make a living."⁵⁶ Moitt maintains that large numbers of slaves left Kayes and moved through Fuuta Toro on their way to the Peanut Basin. Concerning the Senegal River Valley slaves he specifies: "In the quest to become a *navétane*, some freed slaves from the Senegal River circles appeared to have foregone the *village de liberté* all together."⁵⁷ The large numbers of slaves identified in the 1904 census is indicative of the massive population movement between the upper Senegal River and the peanut fields. If, however, a good number of the locally freed slaves and others who arrived from further up river settled in the region, abolition of slavery did not necessarily cause a loss of labor in the circle.

The labor issue received extensive attention from regional administrators who advocated forcing the local population to remain in place.⁵⁸ Palmide de Raffin, the *Commandant* of Matam in 1915, went so far as to pursue a policy of forcing people to cultivate more land to combat the labor shortage problem.⁵⁹ Raffin also requested that the Thiès-Kayes railroad administrators count the men from the Matam Circle working on the railroad, suspecting that many men left the Circle out of fear of recruitment rather than to

⁵⁵ Cercle du Matam, Rapport trimestriel d'ensemble, 1909. ANS 2G 09-48.

⁵⁶ Cercle du Podor, February 22, 1904 (ANS K 18) cited in Bernard Moitt, "Slavery and Emancipation in Senegal's Peanut Basin: The Nineteenth and Twentieth Centuries," The International Journal of African Historical Studies 22, no. 1 (1989), p. 47.

⁵⁷ B. Moitt, "Slavery and Emancipation in Senegal's Peanut Basin," p. 47.

⁵⁸ Cercle du Matam, "Rapports de tournées de l'administrateur et du commis des affaires indigènes, 1894-1917," 1917. ANS 2D 10/9 (7).

⁵⁹ Cercle du Matam, Rapport trimestriel d'ensemble, 1915. ANS 2G 15-35.

secure wage employment.⁶⁰ A 1923 administrative report related that one-half of the villagers were gone due to out-migration.

There was little consensus among administrators, however, concerning the impact of the out-migrating labor force on agricultural production. Some maintained that vast areas went uncultivated because of the loss of population. In 1958 Ly, writing in a document entitled "The Drama of the Senegal River Valley: Region without young labor," maintained that less than one-half of all floodplain fields were being cultivated due to the lack of labor.⁶¹ In contrast, others argued that the Futanke left only after they had prepared the land for cultivation, leaving other family members to complete the season.⁶²

The expanded cultivation of the *waalo* that had occurred with increased security from Moorish raiding around the turn of the century⁶³ may have been curtailed because of the lack of sufficient labor. While there is little to suggest that large tracts of land that had been cultivated were abandoned because of out-migration, it is reasonable to assume that no massive expansion of land clearing and cultivation occurred during the early colonial period.⁶⁴ Some *waalo* land went uncultivated because the administration prohibited those cultivators who had installed themselves on the right bank (to avoid higher taxes) to cross

⁶⁰ Cercle du Matam, Rapport mensuels, 1916. ANS 2G 16-33.

⁶¹ Bocar Ly, "Le Drame de la Vallée du Fleuve Sénégal: Région sans jeunesse laborieuse" in "Bilan des Études Socio-Économiques dans la Vallée du Sénégal," edited by J.C. Daumas, *M.A.S. Bulletin* 128 (June 1961).

⁶² Cercle du Matam, Rapport du cercle, 1929. ANS 2G 29.

⁶³ M. Kane, "The History of Fuuta Tooro, 1890s-1920s."

⁶⁴ Evidence that counters this generalization are statements made by Fulße informants. According to the informants, herders increasingly left the *waalo* and moved north into Mauritania in the 1940s because of field expansion in the *waalo* and scarcity of space for grazing.

over to cultivate their fields on the left bank.⁶⁵

According to some informants the historical out-migration from their villages to the peanut basin did not cause a decline in *waalo* production; while others contradicted this position.⁶⁶ These divergent opinions may be due to the differential effects out-migration would have on households based on the demographic structure of the household, the numbers of slaves that had been associated with the household, the size of the household's land holdings and its access to other sources of labor.⁶⁷

Concern over out-migration did emerge from the local population. Late in the colonial era, the *Union Générale des Originaires de la Vallée du Fleuve* wrote the Governor General of Senegal contesting the out-migration of Futanke and urged economic development of the Fuuta to keep people in the region.⁶⁸

Sharecropping, or *rem-peccan*, came into existence after slavery was abolished and as out-migration became widespread. This implies that the former slave labor remaining in the region entered sharecropping arrangements. Sharecropping presented one of the few alternatives open to freed slaves since the land tenure system had not been altered in a way that allowed them free access to land resources.

While out-migration certainly resulted in a loss of labor, some of which would have

⁶⁵ See Matam Correspondance, 1934. ANS 11D 1-783.

⁶⁶ This position is supported by information and local opinions cited in local administrative reports. For an example, see Cercle du Matam, Rapport trimestriel d'ensemble, 1915. ANS 2G 15-35.

⁶⁷ Paul Péliissier argues that the loss of slave labor was detrimental especially to the Fulbe. The ex-slaves experienced population growths higher than Fulbe and became very involved in extensive agriculture. The negative impact on herding was two-fold, involving the loss of space and the loss of labor. See Paul Péliissier, "Competition and the Integration of Agriculture and Cattle Raising in Sahelian and Soudano-Sahelian Africa."

⁶⁸ Letter from Union Générale des Originaires de la Vallée du Fleuve to the Gov. Gen., 28 August 1949. ANS 3R 35 (169).

been involved in agricultural production, other economic and social trends occurred that generated increased participation in cultivation by those remaining in the region. During the colonial era members of social groups that did not historically practice extensive cultivation began to farm more land. First, the greater reliance of heretofore less active family members has already been mentioned. Informants maintain that greater numbers of women cultivated fields during the colonial era than today, but this information does not clarify whether their activity in the colonial era amounted to an increase from the pre-colonial period. Secondly, Torooße, Subalße, Fulße and other social groups combined their traditional economic activities with greater agricultural work.⁶⁹

Village populations did not begin to grow until the end of the colonial era so natural population growth had little effect on the amount of land being cultivated. Eventually the use of plows, introduced by the state, partially replaced the labor deficit produced by out-migration.⁷⁰

The Crop Choice

After World War I the French expanded their efforts to exploit the natural resources of their African colonies. The "Plan Saurret" emerged following numerous scientific missions sent to A.O.F. in 1918-1919 to determine the quantity and quality of natural resources in the colonies. The *Service de l'Utilisation des Produits Coloniaux* was founded to promote exports

⁶⁹ Many informants conferred on this point, relating that agricultural activities by those who had previously practiced little cultivation have expanded progressively since the beginning of this century.

⁷⁰ A study in Mali by Casse *et al.* (1965) reported that the quantity of cultivated land more than doubled with the use of plows and draught animals. Cited in R. L. McCown, G. Haaland, and C. deHaan, "The Interactions Between Cultivation and Livestock Production in Semi-Arid Africa," *Ecological Studies* 34 (1979), p. 305.

and represented the *Union Coloniale Française* following the war.⁷¹

A number of crops were encouraged by the French for increased production in the Senegal River Valley. While the idea of irrigated rice was never abandoned, the administration also supported and encouraged production of peanuts, manioc, millet, beans, sisal and cotton.

Cotton was embraced by the administration as the cash crop that would pull the Senegal and Niger River regions into the global economy and end France's dependence on imported cotton from the United States.⁷² Although cotton had been cultivated locally prior to French encouragement, production was low and totally absorbed by local textile production. Colonial administrators also believed that cotton production would help retain labor in the region. Seeds were routinely distributed to village chiefs in an effort to promote cash crop production in the Fuuta.⁷³

Cultivators in the Valley did not quickly or easily abandon cereal crop production in favor of cotton cultivation or any other crop the colonial authorities promoted. They continued to favor crop production for subsistence, in part because of the risks associated with non-food crops and reliance on an unfamiliar and poorly functioning market that did not adequately reward their efforts.⁷⁴

By 1924, however, there was some decline in cereal production in favor of production

⁷¹ Mark Schoonmaker Freudenberger, "The Great Gum Gamble: A Planning Perspective on Environmental Change in Northern Senegal" (Ph.D. dissertation, University of California, 1991).

⁷² Y. Younes, "Mission d'Études d'Irrigation des Vallées du Sénégal et du Niger, Cinquième rapport" (1 juin 1916), p. 14. ANS P 408.

⁷³ The daughter of a former village chief of NDulumaaji Demße remembers that her father often received cotton seeds from the colonial authorities in the 1930s. Interview with Kadja Dem, 23 April 1991. See also Cercle du Matam, Rapport d'ensemble annuel, 1919. ANS 2G 25-19.

⁷⁴ Service de l'Agriculture, Rapport annuel, 1945. ANS 2G 45-43 (1).

of cotton. A subsidized cotton gin was installed in Matam in 1925 and the government offered free or highly subsidized processing to the local producers in an effort to further stimulate cotton production. In 1929 the administrators tallied 2,400 hectares planted in cotton, but complained of the slow progress in expanding cotton production in the region. The local administration opposed the plans to install an experimental station for millet near Matam, fearing this would deter cotton production.⁷⁵

Cotton yields continued to increase in the Matam Circle into the 1930s but these increases were consumed locally for the most part since the market price, even with subsidies, was never very attractive to local producers. Facing the world wide economic depression in the early 1930s, the colonial administration quickly altered its approach to local production. They had encouraged agricultural production by subsidizing prices that they could not sustain.⁷⁶ By 1933 the French could no longer buy the cotton produced in the region because the price was unacceptably high in comparison with the world market price.

Older informants clearly recall the evolution of cotton production during their generation. Cotton cultivation greatly increased in the 1920s through the 1930s, being virtually non-existent in the study villages prior to this period. The availability of imported cotton on local markets waxed and waned in relation to world economic and regional political conditions. Rapid and final decline in local cotton production occurred after WWII and prior to independence, when cheap imported cloth became widely available in the region. Local inhabitants maintain that cotton cultivation declined in correlation with the increased out-migration of villagers who purchased cheaper machine fabricated cloth with cash they had earned outside the region.

⁷⁵ Service de l'Agriculture et des Forêts, Rapport d'ensemble annuel, 1925. ANS 2G 25-29.

⁷⁶ Cercle du Matam, Rapport économique annuel, 1933. ANS 2G 33-76.

When cotton production was on the rise, the crop was planted on *fonde* fields, on the higher banks of *falo* fields and more rarely on *waalo* land. The administration discouraged cotton production on *waalo* land which was highly valued for grain crop production.⁷⁷

Monocropped, an uncommon practice within the traditional system, cotton fields failed to mimic the natural system and were more susceptible to pests. Planting in single stands offered poor ground cover, especially early in the season when the likelihood of soil erosion was the highest. Cotton, a soil-exhausting crop, could have had increased degrading consequences although no sources maintain that cotton production in the Fuuta significantly affected soil fertility.

The Role of Providence Societies and Other Imposed Local Institutions

As their name indicates, they are meant to guard against the legendary improvidence of the indigenous people. This improvidence appears, however, to be of a more recent date and issues from, above all, the sudden encounter of the indigenous people with modern economic forms.⁷⁸

Prior to French administrative control, monetization, taxation, introduction of the market economy and abusive credit relationships between traders and local producers, the indigenous populations possessed adequate foresight to store surpluses to cover food needs during hunger seasons and crisis periods. The above quote reveals that at least some administrators recognized the recent nature of the local population's failure to keep grain stocks and the external causes for their negligence. Colonial rule had created a problem and was attempting a solution through the creation of Indigenous Providence Societies.

Informants speaking about the Societies during the colonial era clearly held the view that the

⁷⁷ E. Belime, "Rapport: Possibilités d'Aménagement offertes par la Vallée du fleuve Sénégal" *M.A.S. Bulletin* 31 (1922).

⁷⁸ Service de l'Agriculture, Rapport sur la Campagne agricole, 1932. ANS 2G 32-188.

institution had been created for the benefit of the administration and not that of the local population.

The official view was that local producers required government assistance to manage their resources. Between World War I and II membership in the Society was mandatory. Some administrators maintained that they simply were adapting traditional African social institutions to the contemporary setting.⁷⁹ Within each regional office the organization was presided over by the Circle's commandant and included the canton chiefs and selected local elders, creating the colonial version of the "village council."

The *Société d'Indigène Provenance* (SIP), instituted in the Matam area in 1911, was designed to construct granaries and collect village grain contributions (twelve kilograms of millet per household) to store for episodes of grain deficit. The colony's previous remedy to seasonal food deficits was to extend costly food credits at the beginning of the rainy season.

By the mid-1920s the agenda established for the local SIP included stocking selected seeds, constructing storage facilities, well digging, intensification of food crop production, the destruction of large predators, birds and locusts,⁸⁰ and the extension of cotton production. The SIP also supported efforts by local members to oppose the low prices set by the traders by allowing them to organize the sale of their agricultural produce through other conduits. Entrepreneurs and traders opposed such state involvement in the market.

From 1947 to 1952 the Society entered a more liberal period, whereby the cooperatives were recognized as independent of the administration. The consequential cooperative versions of the institution differed little from the original. Local inhabitants were still obliged to pay mandatory dues and the colonial authorities maintained control of the

⁷⁹ Pierre Laville, Associations Rurales et Socialisme Contractuel en Afrique Noire. Étude de cas: Le Sénégal (Paris: Cujas, 1972).

⁸⁰ Service de l'Agriculture, Rapport annuel, 1940. ANS 2G 40-50.

credit, production and commercialization programs for agricultural crops.⁸¹ Throughout the institution's history the local inhabitants viewed the SIP as a costly institution which did little or nothing for them.⁸²

In a separate effort, the administration created the Council of Notables in the late 1920s. Selected elders met several times a year with colonial bureaucrats to set the program for agricultural activity in the Circle. This was the administration's means of co-opting local power holders and an attempt at communicating its agenda effectively to the population. In the words of one official: "The Council of Notables has become a true organization of propaganda and defender of the circle's interests."⁸³ The sons of chiefs and interpreters were selected to complete short courses at regional agricultural stations, constituting yet another way the colonial administration promoted their agricultural agenda.

Interaction Between the Biophysical Environment and the Agricultural Production System

Throughout the colonial era, climate and inappropriate indigenous agricultural practices received the blame for famine conditions in the Fuuta. While the impact of climatic fluctuations on local production cannot be ignored, Chastanet argues that colonial rule accentuated the society's vulnerabilities and rendered obsolete their survival strategies.⁸⁴ The exodus of labor, changed social relations, altered relations of production and numerous

⁸¹ This information is taken from Valy-Charles Diarassouba, L'Évolution des Structures Agricoles du Sénégal: Destruction et réstructuration de l'économie rurale (Paris: Cujas, 1968).

⁸² Letter from Union Générale des Originaires de la Vallée du Fleuve to the Gov. Gen. ANS 3R 35 (169).

⁸³ Circle du Matam, Rapport politique annuel, 1934. ANS 2G 34-92.

⁸⁴ M. Chastanet, "Stratégies de Survie et Politique Coloniale," p. 10. Although this material deals specifically with the Soninke in the Bakel region, the social changes experienced throughout the region were similar.

abuses by the French and indigenous colonial authorities all affected the communities in the region. Forced labor and fiscal pressures occurred throughout the region. Commercial activity along the river also declined during these tumultuous years; the loss of the gum trade at the turn of the century was especially detrimental to the economic vitality of the area.

With the decline of the gum trade, other commercial activities diminished.⁸⁵ Failing to understand the disruptions and chaos the local inhabitants were experiencing, many colonial authorities believed that the peasants did nothing to reduce the risk of climatic variability. As a result, colonial administrators opposed instituting a food aid policy in hopes of forcing the development of local commercial activity and an increase in agricultural production.⁸⁶

The administration encouraged greater use of advanced tools for cultivation but the technology used in the local agricultural production system continued much as it had before, relying on few inputs or extensive alterations of the physical environment. Evidence indicates that some cultivators began to employ simple water control techniques such as canal and dike construction to increase field flooding. Cultivators wanting to apply these procedures sought permission from colonial authorities as early as 1917, demonstrating their recognition of changing power structures in the region. Authorities readily granted permission for these projects, favoring extended production.

Many informants maintain that the members of the society became increasingly self-oriented, which affected agricultural practices. One manifestation of decreased social cohesion was that by the 1940s cultivators no longer respected the communal harvest date set by the *jom leydi* or *jom caatngol*. According to informants, a decline of this practice caused a

⁸⁵ Circle du Matam, Rapport politique, 1904. ANS 2G 4.

⁸⁶ Circle du Matam, Rapport trimestriel d'ensemble, 1915. ANS 2G 15-35. Monique Chastanet concurs with this finding, see M. Chastanet, "Stratégies de Survie et Politique Coloniale," p. 20.

decline in yields because of the demise of collective field protection. In this case the administration actually advocated reinstating the local management strategy, requiring by law the simultaneous harvest of the entire region.

The growing individualization of concerns and strategies explains the incidence of some of the land disputes in the region. Increasingly, family members refused to manage their lands as collective family property (*jowre*), and sought individual holdings. In theory, individualized land holdings tend to diminish the flexibility and range of choices open to a household because of their more restricted and limited nature. This shift toward fragmented nuclear family holdings of smaller units did not have many noticeable effects on the crops grown or the agricultural technologies used in the Fuuta.

One of the few technical changes made to the local agricultural production system was the introduction of the plow. Draft driven plows used for soil tilling and weeding were introduced by colonial agricultural agents to diminish the impact of the labor deficit in the region. Use of this equipment extended the land area an individual could cultivate, but affected only the *jeeri* because *waalo* soils were too heavy to cultivate mechanically. The agricultural officers viewed the failure to mechanically till the soil prior to planting as a grave detriment to the production system. Under normal rainfall conditions tilling these sandy soils did not have noticeable negative affects, but in rain deficit years the tilled soils were more prone to eolian erosion and greater loss of soil moisture.⁸⁷ Erosion of the top soil sets in motion long term negative impacts on soil fertility and land quality. Losses of soil moisture can lead to immediate yield declines and may have more lasting effects on soil erosion, fertility and vegetative cover.

⁸⁷ See F. Fournier, "Research on soil erosion in Africa" African Soils 12 (1967): 53-96. This finding was confirmed by many of the villagers questioned about the impact of different tilling techniques.

The administration's efforts to reduce the field destruction caused by predators was highly effective. Arming cultivators with guns and supplying ammunition, in addition to furnishing the villagers with poisons, succeeded in virtually eliminating the larger predators inhabiting the area. By the 1940s their numbers had declined and by the 1950s many of the larger species had virtually disappeared. The last of the great hunters are now old men who recall the dwindling animal populations, citing increased and more effective hunting and loss of habitat due to expanded land clearing as the two major causes for their disappearance.

Wells were constructed in the villages in the study region in the 1950s. With a year-round water source at the principal village site, inhabitants stopped moving to the *waalo* during the dry season. This change in settlement patterns of the agriculturalists had little effect on their management system, however. Local residents continued to cultivate the *waalo* as they had in the past, but fewer if any members of the family lived at the field site.

Few other alterations or inputs to the agricultural system, either to conserve the physical resources or to increase their immediate return, occurred during the colonial era. On the whole, local schemes that altered the physical environment remained minor and little environmental degradation can be ascribed to them.

Concern over Soil

The concern about erosion, conservation and land degradation in both the French and British colonial thinking evolved rapidly during the inter-war years. The particular political and economic circumstances that opened opportunities for these scientific issues to be addressed are rooted in events and developments occurring in Europe and the United States.

The first references to soil degradation in Senegal began to appear in the mid-1940s, shortly following the time that the issue of soil degradation had begun receiving international

attention. Agricultural agents advocated that all feasible soil conservation methods be employed on any newly cleared lands.⁸⁸ Soil conservation became a dominant environmental policy in the colony in the 1940s and 1950s, at the same time the British concerns over soil erosion mounted in their East and South African colonies.⁸⁹

Recognition of erosion as a major and general problem was remarkably sudden and uniform....It is difficult to escape the conclusion that officials were looking at the African areas with new eyes and that their response was moulded by a set of ideas which constructed the problem of erosion in a specific way and generalized it.⁹⁰

Soil degradation in the peanut basin was the administration's primary concern but they also claimed that there was excessive damage occurring along the Senegal River. Irregular water flows and increased sediment loads were blamed on deforestation and erosion taking place throughout the Senegal River Valley but even more significantly in the Guinean highlands.

The problems were seen as essentially technical, but the degradational processes were considered out of control and beyond the local populations' ability to solve. Unilateral action by the state increasingly linked technical interventions with broader attempts to restructure rural social relationships. The welfare of forests and soils was the new justification that materialized to rationalize continued and increased intervention in local society.⁹¹ Beinart argues that the similarity of approach and timing of interventions in very different regions of Africa indicates that the influence came from outside of the continent.⁹²

⁸⁸ Bellouard, 1945 studies reported in "Les Dégénération des Sol en A.O.F., 1945-1956." ANS 3R 58.

⁸⁹ Assemblée de l'Union Française, "Proposition," 1952. ANS 3R 58.

⁹⁰ W. Beinart, "Soil Erosion, Conservationism and Ideas about Development."

⁹¹ Ibid.

⁹² Ibid.

The zealous concern over soil degradation corresponds to the administration's declaration of an agricultural crisis in Senegal between 1945 and 1953. Pastoralism was at the top of the list of causes of soil degradation. The *Conseil Supérieur de la Protection de la Nature aux Colonies*, created by decree in 1945, was charged with designating lands that should be classified and reserved. The colonial agency assigned to soil conservation had a mandate to assure the protection of the patrimony against the destructive practices of the indigenous populations. Once again the colonial authorities refused to recognize external (i.e., their own) effects on land use and land degradation, blaming only local practices and local social systems. As was noted above, the conservationist agenda conflicted with other demands the colonial administration placed on rural society and rural resources.

STOPPING THE MOVEMENT – PASTORALISM AND THE COLONIAL PROGRAM

We are in the Black world. No rational herding system; no selection; one keeps the cattle until they die of old age...⁹³

Since the first years of the 20th century the pastoral domain has been spatially restrained and constricted and the pastoral production system has been affronted with multiple imposed changes. The spatial restrictions were combined with increased herd sizes and greater cattle owning by non-Fulbe. Cattle numbers increased by five-fold in the Sahel during the twentieth century preceding the 1968 drought.⁹⁴ The colonial policies and laws toward the herders functioned to turn regulated and sustainable systems into open-access situations. These changes affected the ways in which the herders interacted with their environment, with each other and with outsiders.

⁹³ Louis Papy, "La Vallée du Sénégal: Agriculture traditionnelle et riziculture mécanisée," *Les Cahiers d'Outre-Mer* 16 (1951), p. 305.

⁹⁴ J. Gallais, "La Situation de l'élevage bovin et le problème des éleveurs en Afrique occidentale et centrale," *Les Cahiers d'Outre-Mer* 32, no. 126 (1979), p. 118.

The colonial administrators maintained a general, and profound, suspicion of pastoralists. This was current among colonial authorities throughout Africa, and greatly determined the policies and programs aimed at the herding populations. Their frequent movements, solitary comportment, and avoidance of contact with authorities were all suspect practices that troubled the French.

The colonial authorities had many biases against the Fulbe and their resource use strategies, some of which are evident in the environmental determinist sentiments expressed in a 1918 administrative report:

To study the Fulbe of this province we come to admit that the temperament, the character of the people issues from the land in which they live. Like the Ferlo, arid and deserted, Samba Elfeky's administration lacks generous sentiments and is rebellious of our actions. It is insensitive to the Administration's benevolent counsel and is set on not obeying the administrative prescriptions....These Fulbe are secretive, independent, lazy and backward.⁹⁵

The herding populations presented management problems for the colonial administrators from the very start because the French refused to understand the production system or acknowledge its suitable adaptation to the physical environment. The bureaucrats were easily exasperated with these people who moved "at whim" and who failed to efficiently exploit the natural resources in their midst. One after another, policies and decrees were enacted to eradicate the pastoralists' movements, with varying degrees of success.

Commercialization of domestic animal production was on the administration's agenda from the outset. Meat was needed by the Metropole and they had great hopes of creating an efficient meat producing industry in Senegal. State agents reported enthusiastically that the export of beef had quadrupled in quantity between 1911 and 1912.⁹⁶ Large cattle markets

⁹⁵ Cercle du Matam, Rapport mensuels d'ensemble, 1918. ANS 2G 18-27.

⁹⁶ Service Zootechnique, Rapport d'ensemble 1912. ANS 2G 12-8.

were established in Louga, Kébémér and Mbakke to move the animals to the edges of the Ferlo. During the war years the French clearly perceived the importance of the colony's animal industry. The Metropole desperately needed the meat and also the animal hides for their war efforts. Herders in the region recall being forced to sell their animals for minuscule prices during the war years and at other times of state need. Even normal market transactions often disfavored the herders, who chose frequently to opt out of the market under such conditions.

One of the earliest ways, beginning already in 1890, that the colonial government interacted with the pastoral economy was through animal health control. The administration instituted a strict practice of quarantining herds that carried disease and introduced a severe penalty for defying these orders. By 1904 the forerunner of the *Service d'Elevage* was created, the *Service Zootechnique et de Epizooties*, which solely concerned itself with veterinary matters. Introduction of veterinary medicine had a drastic effect on animal populations in the region. Herd numbers expanded steadily as preventative and curative health practices were widely instituted.⁹⁷ The growing herds very likely increased the ratio of UBTs per hectare, adding pressure on the grazing resources.

The first animal taxes were collected in the Matam administrative district in 1920. Unlike agricultural produce and agricultural land, which were never directly taxed, the capital of the Fulbe was heavily taxed. The notion behind the taxation policy was two-fold. First, by taxing herds the pastoralists would be forced to enter the market economy; and second, by incorporating the herders into the administrative system they would settle down. Shortly after the implementation of taxes, however, the local administrator noted that "this tax...is creating

⁹⁷ These data were assembled from Matam *Cercle* reports from 1912 to 1960, ANS series 2G.

some uneasiness" amongst the herders,⁹⁸ a sentiment that surely underestimates the population's reaction to this new tax. All accounts concur that taxation increased herder movements rather than curtailed them.

Collecting taxes from the herders proved to be a constant and continual aggravation for the administrators. Many herders attempted to escape control by moving out of an area, either heading southward deeper into the Ferlo where administrative control was minimal or nonexistent, or north across the river into Mauritania where tax policies treated herders less stringently. "Between Mauritania and Senegal there exists a back and forth flow of indigenous herders who traverse the river under the pretext of searching for better pasture for their herds. The real reason is that they believe that they are soon to be taken census of and they are totally avoiding control so as not to pay taxes for themselves and on their animals."⁹⁹ The administration attempted to inhibit such movements, and warned the Fulbe moving out of the region that they had nothing to gain by changing administrative districts because they would be taxed wherever they were. Not only were the herders moving to escape taxes, they also fled from military recruitment and forced labor duty. Moreover, Mauritania had richer and more expansive pasture, thus providing better grazing for the fleeing herders. Herders moved to the north bank in response to ecological conditions, with increased migration corresponding to the 1912-1914 and 1940-43 drought periods. Movement to the north bank led to increased conflict between cultivators and herders, some of which ended in violence.

A lively exchange of letters took place from 1930 to 1932 over the issue of Fulbe originating from Matam, living (illegally) in Mauritania. The authorities in Matam, irate over

⁹⁸ Cercle du Matam, Rapport mensuels d'ensemble, 1920. ANS 2G 20-20.

⁹⁹ Cercle du Matam, Rapport general annuel, 1929, p. 8. ANS 2G 29-96.

the loss of tax monies and incensed by the herders' ability to avoid colonial control, sought the return of a number of Fulbe residing over the border.¹⁰⁰ Although the herders were required to carry "laissez-passez de transhumance" papers they usually escaped close monitoring. Contentions between the administrations of Mauritania and Senegal became increasingly pronounced over this issue as Senegal lost tax revenues while Mauritania gained them.¹⁰¹

The most direct attempt to settle the herders and expand the animal industry occurred through the introduction of wells in the Ferlo. Actually the initial impetus to build wells was to improve the routes used by herders in getting cattle from the river region to market. Only somewhat later were the authorities interested in well construction as a strategy to settle pastoralists. According to the colonial interpretation of the production system, the presence of year-round water sources in the *jeeri* would eliminate the need to move.¹⁰² While the administration argued that well construction would end the herders' problems, what they actually hoped to end were their own administrative problems.

Between 1901-1912 a working brigade dug wells throughout Senegal, but only a few were located in the Ferlo. The Hubert mission investigated the underground aquifers in the Ferlo in 1925 but little well development took place in the region until after WWII. Upon discovery of the Maestrichienne aquifer in 1938, the first bore holes were created in 1939. A hydrologic plan, outlining the construction of twenty-three bore wells for the Ferlo, was instituted between 1947 and 1957. Until the 1950s most of the herds continued to be watered

¹⁰⁰ See the file "Matam/Salde: Correspondance" for the details of these letters. ANS 11D 1 (783).

¹⁰¹ See also document n° 1390 (1931), Letter from Le Quer, Adminstrateur Commandant le Cercle de Matam à Mr. le Résident de MBout. ANS 11D 1-783.

¹⁰² Cercle du Matam, Rapport mensuels d'ensemble, 1919. ANS 2G 19-22.

during the dry season at the Senegal River. Once the wells and bore wells were constructed in the *jeeri* the competition increased between herders and cultivators for access to and control over the surrounding spaces. After well and bore hole construction *jeeri* herders frequented the *jeejegol* and *waalo* less often. Only herders who continued to cultivate floodplain fields moved into the *waalo* for part of the year.

As one element of their policy to sedentarize the herders, administrators favored protecting certain areas of spontaneous forage in proximity of secure water sources to improve pasture conditions through regulated use. The authorities envisioned rotating herds through fenced or guarded areas on a fixed cycle of five years, although these plans never came to fruition. The Pastoralist Service also attempted to increase efficiency within the traditional system by encouraging the harvest and storage of forage reserves. They recognized the need to create new habits and to change the mores of the Fulße society. They hoped to initiate this process through the introduction of forage storage practices, reserved grazing and well construction.

Shifting Movements and Settlement Patterns

Herder settlement and encampment patterns altered during French rule for a number of reasons. The decline in raiding by Moors allowed the Fulße herders to move more freely into the *waalo* and to the north bank. Reduced risks owing to the decline of predators allowed herders to settle in separated units eliminating the need to congregate for security reasons. The impact of taxation and recruiting policies on herder movements were noted above. A deterioration of the pastoralist management system also accounts for some shifts in movement and settlement patterns.

Herders were no longer compelled to congregate in larger settlements for mutual

protection and resource management; instead they choose to settle in dispersed, single family camps. This strategy expanded in relation to the scarcity of grazing. Dispersed settlement permitted a family to be close to the fields they cultivated and to have an exclusive grazing area, thereby optimizing the exploitation of pasture. As herd sizes increased separation was an important way for herders to improve their access to grazing. The negative side to dispersed settlement, and the reason it was prohibited in the past, was that it increased degradation of the pasture due to greater trampling.

The earliest Fulße *waalo* villages in the study area were established shortly before 1918, at which time four encampments existed.¹⁰³ In the 1930s, during a second wave of migration, many Fulße settled in the *waalo*. Throughout the 1930s and 1940s increasing numbers of Fulße left *jeeri* villages to inhabit the floodplain between the Jammel and the Senegal River. Some of these families remain in the zone today, while others continued northward crossing the river into Mauritania. Informants recounted that large numbers of herders began moving north of the Senegal River in the early 1940s. The reason given for the movements was that the immediate *waalo* zone had become too densely populated with field cultivation. By the late 1950s and early 1960s many Fulße had left their settlements in the *waalo* and moved to Mauritania, leaving relatively few herders in the immediate zone. This corresponds to more humid years when *waalo* cultivation may have consumed most of the land.

The 1953 construction of the bore hole in the near-*jeeri* village of Seddo Abaas led to a decline in numbers of herders bringing animals into the *waalo* on an annual transhumance

¹⁰³ This information was acquired through numerous interview with Fulße *waalo*, and the findings are supported by C. Cabrol, "Populations Peules et Sarakholé de la subdivision de Mbout (Mauritanie)," *Notes Africaines* 2-4 (1954) and C. Santoir, "Le Repli Peul en Mauritanie a l'Ouest de l'Assaba" (Dakar: ORSTOM, 1991).

cycle; instead they remained in the *jeeri* throughout the year. While the 1950s saw a decline in the use of the *waalo* by Fulße *jeeri*, herders originating from the Podor region arrived in the *waalo* zone, claiming that the pasture in their home zone had deteriorated.

By 1940 the authorities remarked on the expanding numbers of pastoralists involved in agriculture. Concurrently, greater numbers of agriculturalists kept small herds of animals. The clear horizontal divisions between groups and economic activities were diminishing. The need for local residents to produce more surplus for tax payments and, to a lesser extent, to satisfy growing individual consumer needs, encouraged them to diversify into other resource activities.

Controlling Access to and Use of Grazing Resources

From the outset French administrators assumed, in contrast with reality, that the pasture lands were open to all herders, with no self-regulation of resource access and use.¹⁰⁴ In reaction, they quickly established that open access pasture had to be replaced with regulated access in association with closed or restricted grazing areas. Authorities placed classified forests off limits to herds and the government created sylvo-pastoral zones in the Ferlo to control the pastoralists' movements and access to resources. Restrictions on movement and access to the diverse ecological zones in the Valley affected two fundamental components of the pastoralist resource use strategy. At the same time herds were growing, the areas open to them were dwindling. This situation led to increased use of the remaining grazing areas, degradation of the land, a greater frequency of conflicts between herders and cultivators and a decline in social cohesion amongst Fulße as individualized strategies due to increased competition for access gained prominence.

¹⁰⁴ Cercle du Matam, Notice sur le Cercle, 1904, p. 10. ANS 1G 292.

Even though it was widely recognized that most of the land clearing in the Senegal River Valley occurred because of extension of agricultural lands, authorities aimed to decrease deforestation by regulating herding, not agriculture. This position evolved out of the colonial administration's rejection of local herding practices. The drive to regulate pastoral activity stemmed from a belief that the local production system was inefficient and wasteful.

Forestry agents favored limiting herd movements to specific zones, and argued that degraded zones should be closed to grazing until regeneration was complete.¹⁰⁵ When classified forests were established in the Valley, principally in the 1950s, often herders were strictly prohibited from entering the restricted areas. Such restrictions posed grave problems for the herders who depended on these zones during part of their annual herding cycle.

The authorities consistently reduced the space available to herders, sometimes directly and at other times as a consequence of other policy. Expanding areas of cultivation, especially pushing peanut production into the Ferlo, eliminated valuable grazing areas. Grosmaire maintained that all areal extensions of cultivation were made at the detriment of the sylvo-pastoral zone.¹⁰⁶ The "Congrès de l'Union des Peulhs," meeting in 1957, demanded that the authorities stop the invasion by cultivators into their traditional grazing territories,¹⁰⁷ but the Fulbe held little sway over government policy, especially relative to the peanut industry.

Acknowledging that Reserves had no place in traditional pastoral management of the region, Grosmaire saw no other way to protect the herders against constant encroachment by

¹⁰⁵ This policy affected both agriculture and pasture land. See, for example, Rapport Annuel 1945. ANS 2G 45-43.

¹⁰⁶ J. P. Grosmaire, "Éléments de Politique Sylvo-Pastorale" (Saint-Louis: Inspection Régional Forestière du Fleuve, 1957), p.13.

¹⁰⁷ See Boucar Boydo Ka, "Congrès de l'Union des Peulhs: Rapport d'ensemble." ANS 10D 4 (41).

cultivators. He also claimed that these Reserves would protect the herders against themselves by curtailing overexploitation of resources: "The most difficult thing is to defend the collectivity of herders against itself."¹⁰⁸ While the designation of sylvo-pastoral zones and Reserves was advocated by some to protect pastoralism, such arrangements only became necessary because of the spatial marginalization of pastoralism in the colony and the failure to recognize local practices as basically sound and viable. The creation of segregated sylvo-pastoral zones aimed to spatially separate herding and cultivation where in the past they had been interlinked.

The water access paths (*lappi*) throughout the study area fell into disuse in the 1920s and 1930s. As agriculturalists expanded their fields they ignored the boundaries of these reserved corridors. Many of the local political leaders continued to respect the social obligations that existed between the different resource user groups. Village chiefs took initiatives to renew recognition of the paths by fining those cultivating in the areas. Herders that chose to fight the loss of these paths usually won their disputes. Many herders chose not to fight, however, fearing that the resident agricultural populations would simply expel them from their territory. The access routes regained recognition in the late 1930s and early 1940s, until recently when once again their existence is being threatened.

The colonial agents viewed many herding practices as detrimental to the environment and pursued means to end them. They attempted to end customs such as debranching trees and bush fires by imposing heavy fines. These attempts to regulate local resource management practices were largely unsuccessful because they failed to address real problems and made unacceptable demands on the local population. Debranching was totally banned even though many administrators recognized that lopping branches only temporarily affected

¹⁰⁸ J. P. Grosmaire, "Éléments de Politique Sylvo-Pastorale," p.82.

tree growth if performed correctly. Most trees recover, as many as 85-90%, from correctly executed debranching.¹⁰⁹

Colonial administrative hierarchies relegated the Fulɓe to the bottom, often subordinating them to the control of sedentary haal-Pulaar who were assigned positions of canton chief and other state agents.¹¹⁰ Marginalized in this way by outside powers, the Fulɓe failed to maintain strong internal social cohesion. Their lack of a coherent socio-political territorial base prior to colonial rule disadvantaged them because of the emphasis on territorial organization by the colonial administration. The Fulɓe were dominated by the French and, more directly, by sedentary Torooɓe and Seɓɓe, who then subjected them to harsh treatment. In an effort to maintain some social cohesion the Fulɓe opposed government efforts to eliminate the position of *arɗo*, which was viewed as another attack on the vitality of Fulɓe society.

Confronted with the construction of bore wells, collection of taxes, conscription, sedentarization policies, classification of forests and Reserves and other state interventions the common property resource management system of the Fulɓe deteriorated. Fulɓe in the study area claimed that individualization of resource use strategies became extremely widespread already in the first half of the 20th century. Emphasis on individual household strategies led to more of an open access system of resource use. The state attempted to institute resource use and access restrictions, but due to the inappropriate nature of most of their actions and their general lack of control and capability of monitoring, their effectiveness remained limited.

¹⁰⁹ P. Foury, "Rapport du Service des Eaux et Forêts," p. 136. See M. Etessay for arguments against all debranching, in "Lutte contre la deforestation." ANS 3R 3 (169).

¹¹⁰ Ch. Ba, Les Peul du Senegal, p.75.

Altered Effects on the Environment

Data for evaluating environmental change that occurred during the colonial era is rare. Colonial reports noting environmental degradation provide scant and biased information for the period. No studies or investigations were conducted during this period to confirm or dispel the widely held view that herders were causing widespread degradation. Research conducted subsequently establishes that many of the practices that so troubled the colonial authorities, such as debranching, do not cause degradation if properly conducted.

Sedentarization and congregation of animals and people along certain corridors and at particular nodes ruptured the dynamic equilibrium between herds and the natural environment that earlier resource management strategies had maintained through dispersion. Areas around bore holes and villages, and along primary transportation axes, began to show evidence of overuse and abuse during the late colonial era even under the more humid conditions of the 1950s.

Trampling increased during the colonial era because of animal concentrations around bore wells and the increase in a dispersed settlement pattern throughout the zone. Disrespect for the traditional animal paths also increased trampling. The effects of trampling have been shown to cause permanent destruction to grazing resources, changing species composition and soil characteristics.¹¹¹

Setting bush fires was another practice that caused colonial authorities to proclaim environmental devastation. According to Cheikh Ba, under higher grazing pressures bush fires have a degrading effect on vegetation: "Early fires seem to be a stabilizing factor in the functioning of the traditional pastoral system. But as soon as overstocking and intensified use

¹¹¹ Penning de Wries and Djiteye, La productivité des pâturages sahéliens: une étude des sols, des végétations et de l'exploitation de cette ressource naturelle (Wageningen: Centre for Agricultural Publishing and Documentation, 1982).

of the grazing land develops simultaneously, the early fires can have detrimental effects."¹¹² Colonial policy was enforced with great difficulty in the vast herding zones and abuses by forest guards were common. Many villagers recounted being forced arbitrarily to pay fines for bush fires.

With the decline of wild carnivores due to the successful colonial program to shoot and poison the wildlife, the herders feared the woodlands less, opening up new tracts to herders. "Herding extended into these areas resulting in widespread removal of protective understory and seedlings. As this occurred, wildlife habitat was further decreased."¹¹³ Grazing in the forest areas also affected the diversity and regeneration of trees and the understory.

Herd increases due to improved veterinary care in conjunction with low destocking rates because of a lack of development of a regional or national animal industry. The Fulbe were interested in retaining these swelling herds since selling the animals yielded such a low price in the market and because the animals served a multitude of social and economic functions within their society. Larger herds moving in more restricted spaces affected the quality and quantity of forage available per animal. Sedentarization led to the under-exploitation of extensive grazing areas while simultaneously provoking overexploitation in proximity to settlements and water sources. Evidence shows that as the herders moved less regularly they lost their ability to adapt quickly to perilous conditions.

Herders do not recall any lengthy crisis that was not (more or less) successfully countered by moving until the devastating and prolonged series of drought years beginning in 1968. Preceding independence the seasonal degradation resulting from inadequate rainfall

¹¹² Ch. Ba, Les Peuls du Sénégal, p. 117.

¹¹³ J. A. Gritzner, The West African Sahel, p. 65.

simply caused the herders to alter their patterns of movement. Informants could not recall the loss of particular types of vegetation during the late colonial period, nor did they remember permanent declines in the resource base.¹¹⁴

Throughout the colonial era herd numbers in the study area waxed and waned, determined largely by the occurrence of epidemics and shifting climatic conditions. In 1937 huge losses were recorded throughout the Matam district. Drought was not a factor, but local residents maintain disease ravaged herds at this time. Between 1938-1948 the numbers of animals in the region once again swelled. A period of good rains and newly distributed veterinary care allowed for rapid herd reproduction. Again disease devastated the herds in 1947, killing huge numbers of animals. Herd size continued to fluctuate between 1948 and 1968 with occasional losses and but overall gradual increases.

For all the evils the colonial administration found with the local pastoral system they did not complain of overstocking. According to a 1938 study, Minot found that normal stocking rates in the Valley were extremely conservative, corresponding to the carrying capacity of the forage at the worst time in the annual cycle.¹¹⁵ Fulbe herders, however, noted that growing herds placed greater demands on the grazing resources. This caused pastoralists in the zone to leave, moving north of the Senegal River to graze in the more expansive pastures of Mauritania. Those remaining in the area exploited the grasses, bushes and trees to the degree where degradation was noticed even during wetter years.

¹¹⁴ Memories, of course, often fail to retain such detailed pieces of information, especially since such extreme environmental degradation has occurred in a subsequent period, beginning in the late 1960s.

¹¹⁵ A. Minot, "Note au sujet des terres et des cultures de la Vallée du Sénégal," M.A.S. Bulletin 74 (1938).

DISINTEGRATION OF THE LOCAL FISHING MANAGEMENT SYSTEM

The increasing inequality that resulted primarily from equipment changes had dynamic destabilizing effects that were ultimately very destructive of the resource base. As the fishing community became more heterogeneous, coordination became more difficult and common property rules were more difficult to maintain.

Colonial rule added to the radical changes occurring in the fishing economy by making the river and backwaters common goods, to be administered by the state through its agencies, largely ignoring local management and local authorities. According to the administration: "As far as rights to the rivers, there is only the right of use and not of ownership, which implies that the State is the proprietor of the fishing resource base."¹¹⁶ The marginalization of the local management system, coupled with the impact of new gear, increased individualization in the society; the state's usurpation of local authority led to rapid disruptions in the fishing economy and limited the impact of the local management system.

The colonial administrators varied in their interpretations of the traditional fishing economy along the Senegal River. Some recognized the reality of a strong traditional management system while many others failed to see any internal regulation.¹¹⁷ One administrator deplored: "The absence of customary rules gives way to total liberty; a mercantile pillage of the resource base is inevitable."¹¹⁸

Generally the French believed that the resource base required strict regulation and throughout the colonial era administrators made various attempts which met with little

¹¹⁶ R. Cremoux, "Rapport de Pêche Fluviale sur le Fleuve Sénégal" (Richard-Toll, Senegal: M.A.S., 1959), p. 68.

¹¹⁷ One administrator stated in an annual report: "Il n'y a pas un corps de métier avec coutumes et traditions...." See Service des Eaux et Forêts, Rapport annuel, 1955. ANS 2G 55-21.

¹¹⁸ R. Cremoux, "Rapport de Pêche," p. 70.

success, in part because they did not take into account the existing local management system. Those administrators who recognized the existence of local rules and regulations comprehended the difficulty of standardizing a new system for the entire colony because of the local specificity of many rules.¹¹⁹ The traditional practices evolved in reaction to the social and economic transformations occurring in the region. This section outlines and evaluates the impacts of colonial regulation and numerous other changes on the fishing economy in the region.

Conflict Within the Fishing Communities

Two principal areas of contention and division existed in the Subalße fishing population during the colonial era. The fishing peoples on opposite banks of the Senegal River continually battled over fishing rules and regulations. The opposition between fishing people in Mauritania and those in Senegal began when Senegal River fishing began to be regulated by two separate colonial administrations. Fishing disputes constituted yet another way the new border affected resource use and management. The second major area of strife occurred between those continuing to fish according to tradition and the people pursuing lucrative *gußal* fishing.¹²⁰ As was discussed in Chapter IV, this category of conflict had begun by the turn of the century when new equipment arrived in the region.

Traditional fishing people accused the larger scale fishers of ignoring local rules. The

¹¹⁹ This opinion was expressed in a letter from Gouv. P. I. of Mauritanie to M. le Gouv. Gen. de l'A.O.F. ANS 4R 13-26.

¹²⁰ The *gußal* fishing was more oriented toward commercialization. This does not mean that fish was being exported out of the region, but that fewer fishing people controlled the local market. Data reported on in 1970 shows that 90% of the fish were consumed within the family or traded locally and only 10% was exported from the region. République du Sénégal, Conseil Economique et Social, "Etude sur la Pêche Fluviale au Sénégal" (Dakar, Novembre/Decembre 1970), p. 58.

gußal net fishers, by employing more efficient fishing equipment, placed the artisanal fishers at a disadvantage. The French administration stepped in to mediate these conflicts and remedy the situation through regulation.

Changes also affected floodplain fishing practices. In the early twentieth century those who owned land surrounding fishing zones began to assert more powerful claims on their rights to control the management of and access to fishing. The colonial policy acknowledging and solidifying personal property rights appears to have strengthened the land holders' assertions over their control of fishing rights. In a case between Abdou Salam Kan, the canton chief of Damga, and the wider community, the latter party maintained that the lake on the right bank that Kan claimed exclusive rights to in 1938 had been communally fished for generations. Kan asserted that land ownership gave him the right to control fishing in the lake.¹²¹ The canton chief invited Subalße, using *gußal* nets, to harvest the lake. The locals, adhering to tradition, rejected Kan's claims and contended that the outsiders did not have the rights to exploit resources in the manner permitted by Kan.¹²² Local tradition granted Kan a portion of the catch but prohibited him from assuming any other powers to regulate the fishing zone.

In another case, the villagers of Koundel completely closed their principal fishing lake to all outsiders in the early 1950s. This caused numerous fights between "outsiders" who had traditionally fished the lake and the people of Koundel. According to informants, this was the first attempt in the study area of a village claiming exclusive rights to a body of water for

¹²¹ Abdou Salam Kan's relationship with the colonial authorities assured him perpetual receipt of land payments for extensive fields in Maghama. See David Robinson, "Un historien et anthropologue sénégalais: Sheikh Musa Kamara" *Cahiers d'Études africaines* 109, XXVIII-I (1989), p. 97. Kan was the subject of more than one land/resource rights conflict.

¹²² A letter written by Gouv. Dumas in Mauritania to the Gouv. Gen. de l'A.O.F. (Saint-Louis, 20 août 1938). ANS 4R 13-26.

fishing purposes. The informants of NDulumaaji Demße claim that the Water and Forestry Service sided against Koundel in this conflict recognizing the traditional pattern of access. In this case relying on legislation proved unhelpful in solving the dispute. The *Arrêté n° 4582 of 2.8.55, article 5* prohibited fishing in a lake without express authorization of the owner(s). The order validated traditional fishing rules but also ordered the authorization from the owner, which was not a traditional rule. This blend of new and old led to ambiguities and contradictions in interpretation of the law.

The Mounting Effects of New Gear

From 1937 to 1954 only two *gußal* nets were owned by residents in the study area, the owners of one resided in M'Bahkna and the owners of the second resided in Cubalil. Their numbers increased until finally in the early 1960s M'Bahkna residents possessed four nets and Cubalil villagers owned six. *Gußal* net fishers from other communities have fished the zone since the early part of this century and their numbers increased steadily.

Over time the commercial nets became longer, wider and with a diminished mesh size. The nets equaled the size of many of the deepest pools and fishing people began to drag the entire width and depth of these pools during the dry season. Thus, the *gußal* net owners began to "harvest" the river and its tributaries in the way that had occurred traditionally only in the seasonal floodplain waters.

Concerned villagers sought to resolve differences between the old method of fishing, which involved fixing smaller nets in a semi-circle with both net ends attached to one side of the river bank, and the new method of stringing a huge net, using the *gußal*, from one bank to the other. To settle these conflicts the local communities created new regulations, designating particular zones open to the new form of fishing and reserving other zones for the

traditional method. Eventually villagers attempted to close their entire fishing zone to all outsiders using *guḥal* nets. The local resource users actively tried to manage the transformations occurring in their economy but they were often unable to affect much change.

With the introduction of the *guḥal*, the new net owners assumed many roles similar to those of the traditional *jaaltaado*, if the *jaaltaado* was not a *guḥal* net owner. The *guḥal* owners gave guidance and direction to the other fishers and, as net numbers increased, regulated where the *guḥal* fishers should fish. This leader was not elected nor chosen by the people. The position was inherited within the families that originally owned a *guḥal* net in the community. Similar to the *jaaltaado*, this person possessed occult knowledge about the river and gave council to all *guḥal* fishers. The new primary importance attributed to the *guḥal* owner diminished the role of the *jaaltaado* and divided authority within the fishing communities. According to informants the *jaaltaado* often did not become *guḥal* net fishers out of respect for traditional fishing practices. The *guḥal* owners often were related to the traditional leaders, however, causing divisions between family members.

The introduction of large, purchased nets led to greater class differentiation within the fishing community. Some artisanal fishers gave up their nets to work for the *guḥal* owners. *Guḥal* net fishing, although pursued for the profit of an individual, was accomplished only with joint labor working the huge net. These assistants evolved into wage laborers for the net owner. As fishing became controlled more and more by big net owners, other Subalḥe invested more time and energy in cultivation.

Local versus State Regulation

The fishing people who continued to respect the local rules had no way to enforce them since their traditional management system was not sanctioned by the colonial legal code.

Throughout the colonial era the fishing populations often attempted to self-regulate group behavior and to bring about justice independently of the state system, efforts which often ended in violence. Fishing people disregarded local traditions as the economy and society experienced a multitude of changes and the state began to take control of regulating the fishing economy.

The colonial administration's belated attention to and regulation of the river fishing populations indicates that the French did not consider fishing to be a significant economic activity. The impact of social, economic and political changes during the colonial era had indirect effects on the local fishing economy, while official regulation had less impact.

The first steps the colonial administration took to control the fishing production system occurred in 1934 when they prohibited the use of explosives and toxic substances in the waters fished.¹²³ There is some evidence that near the turn of the century there was sporadic use of poisons made out of vegetative matter to stun fish.¹²⁴ No informants admitted to practicing such techniques.

By the 1940s the Water and Forestry Service regularly received complaints about declining fishing yields, reporting these grievances in their annual reports. Madier estimated an average capture of eighty tons of fish per month with a *gußal* net in the region of Gaé in 1948, and Cremoux's study reported a decline with an average of sixty-three tons in 1961 for the same region.¹²⁵ The lack of good statistics makes analysis difficult but the rapid increase of large and improved equipment appears to have caused a decline in fish stocks. Informants commonly asserted that the use of *gußal* nets caused widespread overexploitation

¹²³ *Arrêté général 1988 du 29 juillet 1934.*

¹²⁴ J. P. Grosmaire, "Rapport de Pêche Fluviale," p. 18.

¹²⁵ R. Cremoux, "Etude de la Pêche dans les Eaux Fluviales du Nord Sénégal," p. 257.

of the fish resources.

Regulation of fishing in the Matam region began in earnest in 1940 with legislation enacted to control fishing in public domain waters.¹²⁶ The new legislation also established equipment regulations such as minimal mesh sizes and maximum net lengths and prohibited fishing people from blocking the entire width of the river with a net.

The 1940 local legislation, in part, attempted to eliminate disputes between fishing people of opposite banks of the river. The Water and Forestry Service regulated the type and dimensions of the fishing materials permitted in the zone for both banks of the river, seeking to eliminate discrepancies between Mauritania and Senegal. In their efforts to control conflicts, agency authorities in the region even designated locations for placement of individual nets. The Senegalese fishers maintained that such rules were applied inconsistently — to the detriment of the Senegalese.¹²⁷

During the colonial era the administration failed to develop a coherent program for regulating fishing in the Senegal River Valley, however. The Governor of Senegal did not believe that purely local regulation of fishing could solve the multitude of violent conflicts occurring in the late 1940s. Many others favored local administration and regulation because of the immense variety of conditions, practices, and needs. Generations of self-regulation of fish resources did not facilitate the local population's acceptance of outside state control.

The administration's ambiguities concerning regulation of the fishing economy manifested themselves in the unclear legislation it enacted. The 1955 legislation concerning

¹²⁶ The legislation, *Arrêté local du 4 Mai 1940*, regulated fishing in the Matam Circle only.

¹²⁷ Abdou Salam Kan, Letter to the Commendant of the Matam Circle. Matam, Correspondances du Commendant de Cercle, 1939-1956. ANS 11D 1 (786).

fishing in the Senegal River¹²⁸ was open to several alternative legal interpretations. First, the legislation could have been read to mean that all fishing in the public domain was unregulated, thereby absolving traditional fishing rules. Another explanation of the law could have been that it preserved traditional rules since the legislation did not expressly abrogate them. A third interpretation could assume some limited restriction of fishing in reserves while virtually annulling all other state and traditional regulation. Such vagueness left the state agents free to interpret the legislation arbitrarily and the local fishing people uncertain about the regulations. According to numerous informants, the local fishing people continued to recognize their traditional management system throughout the colonial era. They admitted to increased violations, however, as respect for traditional authority deteriorated and transformations in the fishing economy rendered the traditional management system increasingly obsolete.

The Water and Forestry Service designated a series of classified reserves along the Senegal River in the 1950s, all of which were deep pools where the fish congregated during the dry season. The fishing people along the river had been protecting these same pools prior to official regulation of the Matam zone, with all the *jaaltaaße* of the region agreeing to close and open deep pools at scheduled times during the season. Many local residents viewed state involvement in fishing regulations as simply a way for authorities to extract fines and dues from the fishers and not as a means to manage or conserve resources.

Not For Lack of Rules....

During the colonial era the local fishing resources were not being effectively managed either through traditional structures or by state regulation and policy. The local management

¹²⁸ *Arrêté n° 4582 du 2.8.55, Réglementant l'exercice de la pêche.* This is the legislation that came out of a decree project paper and that was applied in the Koundel ruling recounted above.

strategy that had distributed rights and responsibilities under one set of economic, social and technological circumstances could not respond quickly enough to the changes taking place. The state regulations were ineffective because they failed equally to work with local management strategies or replace them. Fishing people with more efficient equipment placed greater demands on the common pool fishing resources to the detriment of the community as a whole. Although some of the traditional rules and authorities continued to be respected by a segment of the fishing population, common property management systems cannot survive under such partial application. In effect the system became one of open access. The "tragedy of the commons," in the form of free-riding and over-capitalization, began occurring with respect to fishing resources. The decline of the impulse amongst local users to conserve the reproducibility of the fish population stemmed, in part, from the social upheaval that was experienced by community members, thus diminishing social cohesion. The rapid social, economic, political and – very significant in the case of the fishing economy – technical changes drove resource users to exploit the fishing resources without limit.

COLONIAL POLICIES TOWARD LOCAL FOREST RESOURCES

Deforestation in the Senegal Valley was the earliest major environmental concern during the colonial era. Once again, however, the administration was faced with conflicting objectives – the crusade to conserve forest resources as well as satisfy the growing demand for wood resources in an expanding economy. To manage the forest resources the administration isolated forest resource use from other resource use activities, a separation that local inhabitants did not share. While administrators advocated land clearing for purposes of extending agricultural production, they also decried the negative consequences of deforestation. Colonial agents claimed that the loss of forest cover in the Valley precipitated

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soil erosion, reduced water retention during the seasonal flood, increased water velocity and caused a decline in local and regional rainfall.¹²⁹

The French first regulated forest resource use along the banks of the Senegal River in the 1890s. These early efforts were directed, in fact, at owners and operators of river trade steamboats, to regulate their tree cutting used for fueling their boats.¹³⁰ Somewhat later Mr. Alba blamed the wood shortages on the Thiès-Kayes railroad needs.¹³¹ But the administration more often blamed the local population for their inappropriate and destructive forest resource use practices. Adam, who was commissioned by the colony to investigate the situation, cited expanding cultivation as the main cause of deforestation in the Valley.¹³² Field clearing and pastoral practices were only partial causes of deforestation, and tree cutting for fueling steamboats and the railroad accounted for much of the deforestation of the era. The authorities were far more wont, however, to view local practices with much greater trepidation and failed to recognize local management systems.¹³³

The French imported their conception of the forest as a national resource rather than viewing the forests as local resources to meet local and regional needs. In its attempts to manage and control access to the forests, the administration replaced the existing common

¹²⁹ Y. Henry, "Rapport sur l'aménagement des bassins d'inondation." ANS P 408 and Y. Henry, "Altération du régime des crues." ANS R 15.

¹³⁰ Circulaires were issued 19 June 1894 and again 12 February 1897; both edicts concerned tree cutting in the River region. A third edict, recorded in the Journal Officiel du Sénégal, 10 novembre 1898, p. 412, was a memo informing merchants of priority wood cutting zones and the need for authorization to cut.

¹³¹ See Mission Alba au Sénégal. ANS 3R 50 (169).

¹³² M. Adam, "Rapports," 1912, p. 20. ANS R 12.

¹³³ This tendency remains to the present day, see the recent publication by Claire Bernard, "Les Débuts de la Politique de Reboisement dans la Vallée du Fleuve Sénégal (1920-1945)," Revue française d'histoire d'outre-mer LXXX, no. 298 (1993): 49-82.

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property system and failed to recognize multiple users.¹³⁴ Pincetl claims: "The forest became an element of France's infrastructure, like a bridge or a road, and at the service of the state's general political and economic policies."¹³⁵

In a comprehensive effort to respond to these concerns, the government implemented a forest code in 1900.¹³⁶ Taxes were fixed on wood cutting and charcoal production in a decree issued on 24 February 1908.¹³⁷ Gaden advocated for privatization of forest resources early in the century, preceding the contemporary debate over the appropriate tenure regime for managing tree resources. During the drought years of 1910-1914 the major export firms began to lobby the colonial government to establish adequate means to conserve forested areas.¹³⁸ The extensive removal of trees was believed to cause rapid siltation and river bank erosion, both of which ruined river transport. By 1917 authorization was required to cut *Acacia nilotica* for fueling river boats.¹³⁹ In 1918 the *Prosopis dulcis* was introduced in Senegal as a quick growing tree to be planted by peasants throughout the country. During that same year the Commandant of Matam suggested that the villagers plant tree lots near their villages. This policy was approved at the regional level and the Agricultural Service

¹³⁴ S. Pincetl recounts how a similar transition had occurred much earlier in France, see S. Pincetl, "Some Origins of French Environmentalism," p. 82.

¹³⁵ Ibid., p. 83.

¹³⁶ See *Décret relatif au régime forestier du Sénégal et Dependances*, 20 juillet 1900, *Journal Officiel* (1900), p. 736.

¹³⁷ M. Adam, "Rapports," p. 20.

¹³⁸ Letter from the Union Coloniale Française to Gov. Gen. William Ponty in response to the *Arrêté creant deux reserves forestières au Sénégal*, 15 février 1913, which established two forest reserves near Matam. ANS 3R 33 (169).

¹³⁹ Cercle du Matam, Rapport mensuel. ANS 2G 17-30.

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sent 30,000 seedlings to Matam.¹⁴⁰

The numerous rules and regulations that the administration enacted to curtail deforestation required vast amounts of human capital to enforce. Forestry personnel in 1931 for all of Senegal, however, consisted of one inspector, one controller, and thirteen indigenous forest guards. By this time the Service was taking in substantial receipts for permits, fines, and from selling confiscated forest products. Even with the fines, the forestry agents found that the local population frequently abused forest resources, but they believed that "eventually the habit of respecting wood lands will enter into the local mores."¹⁴¹

Prior to January 1932 Senegal had not created any forest reserves. In 1932 12,200 hectares were reserved and by the end of 1935 a total area of 95,900 hectares had been placed in reserve status. The 1935 Forest Code designated most of the colony's forests as either classified or protected domain. Sixteen new forest reserves were created in the Senegal River Valley in 1937.¹⁴² Classified forest land included all government forest reserves, land with slopes of thirty-five degrees or more, littoral sand dunes, land susceptible to water erosion, and certain tracts of deforested Sahelian land. Forests were to be protected and classified for their own sake, but also to protect the flood regime in the Valley for agricultural purposes.

Reforestation in the Senegal River Valley was recommended in the mid-1930s. Calvel argued that it be mandatory to plant forest reserves compensating for the land cleared for cultivation. He believed 50,000 hectares of reforestation were required in 1937, and insisted on closing another 75,000 hectares to all livestock to facilitate regeneration of degraded

¹⁴⁰ Cercle du Matam, Rapport mensuel. ANS 2G 18-27.

¹⁴¹ Service de l'Agriculture et des Forêts, Rapport annuel 1931. ANS 2G 31-48.

¹⁴² *Arrêté N° 295/AGR du 1 février 1937, JORS* (18 février 1937), p. 114.

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areas.¹⁴³ Rapid revegetation in Reserves strengthened the administration's commitment to setting land aside for protection from fire and herds.¹⁴⁴ Pastoralists were exiled from large zones of forested land due to an imposed policy that separated space and resource use in a way that was quite foreign to local resource users.

Faced with what administrators considered a devastating situation in the colony's forests, they transferred forest policies directly from France in 1935, determined that what had worked so well at home would be able to solve their problems in Africa. More attention turned to conservation of forest resources at this time. Arguments for privatization of forest resources were revitalized; privatization was viewed as the only way to inspire the local population to responsibly manage their forest resources. The Forestry Service especially argued for the establishment of private property rights for *Acacia senegal*, or gum arabic, as the best method for assuring tree protection and regeneration. Aubréville advocated adopting the principal of collective responsibility amongst the herding populations toward forest resources.¹⁴⁵ The 1935 Forest Code for the A.O.F. severed local traditional rights associated with forest resources and accorded the Forestry Service sweeping powers to police and regulate all forest resources of the colony.¹⁴⁶ This legislation inaugurated Senegal's policy of expropriating forest resources from local populations and assigning state agencies to manage these natural resources.

In 1953 the Jammel classified forest was created on 5,900 hectares of land stretching

¹⁴³ Calvel, "1937 Note." ANS 1R 74 (158).

¹⁴⁴ Service des Forêts, Rapport annual 1934. ANS 2G 34-64.

¹⁴⁵ A. Aubréville, "La Forêt Coloniale: Les forêts de l'Afrique Occidentale Française," Annales. Académie des Sciences Coloniales 9 (1938), p. 17.

¹⁴⁶ N° 1704 A.P. Arrêté promulguant en AOF le décret du 4 juillet 1935, sur le régime forestier de l'AOF, IOFS (8 août 1935), pp. 599-606.

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between the Jammel and the Senegal River, from Matam to Nabaaji Siwol and Koundel. Neighboring residents were allowed to graze their cattle in the zone from 1 January to 31 July, but no other animals were allowed in the forest at any time. Individuals and families with previous cultivation rights in the *kollalde* occasionally were permitted to continue cultivation but local inhabitants still opposed the classification and actively protested its creation. According to Foury:

In Senegal, the defense of tree cutting in the classified forest are rare, except in those forests situated along the Senegal River Valley, the region where land tenure consists of well-defined personal rights and where, sometimes, the classified forests have entirely enveloped tillable land, whereby the land holders demand restitution.¹⁴⁷

Over the decades, the colonial administration grew more ardent in their attempts to stop the environmental degradation they saw in the region. In 1953 the Forest Service composed new legislation that demanded greater protection of the soil, imposed anti-erosive cultivation practices, distributed payments to peasants who planted trees, and limited the zones open to herding. Concurrently the Forestry Service seized fallow lands surrounding classified forests and incorporated them in the classified domains. Plans to set a southern limit for cultivation in the *jeeri* and to drive pastoralism completely out of the agricultural zone were drawn up but never instituted.

Complaints from within government ranks called attention to the widespread declassification of forests that took place shortly after classification in response to demands by agriculturalists for rights to clear land for cultivation. The loss of forests worried administrators and yet the drive to expand agricultural production often won out. In other instances, the forest classification policy caused cultivators to shorten the length of the fallow

¹⁴⁷ P. Foury, "Rapport du Service des Eaux et Forêts du Sénégal et de la Mauritanie" (1951), p. 122. Paper presented at the First Interafrican Forestry Conference, Abidjan, 4-12 December 1951. ANS 3R 33 (169).

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of land to which they continued to have access. Actions taken to prevent deforestation in the Valley did not prevent the Water and Forestry Service from promising the public works department the delivery of 1000 tons of wood each month in 1940 to meet the Dakar-Niger railroad fuel needs. Wood of the Senegal River Valley was also exploited to satisfy military and other public service needs.

Local Reaction to Forest Classification

Classifying forest land affected the population's land use system and tenure regime by taking productive land away from the local users. "When such lands are incorporated in a classified forest, the land owning cultivators feel plundered as if it were a theft."¹⁴⁸ To appease the local cultivators who had lost land through classification, local administrators developed a plan in 1939 to exchange classified land with field areas that needed to be fallowed because of declining fertility. They never instituted this rotation plan in the Matam Cercle because of unsettled land disputes and because officials deemed the quality of the fallowed fields so poor that it could not be exchanged for forested land. An alternative plan to compensate land holders for land that had been classified permitted limited cultivation of fields incorporated in the classified forests. Recognizing the villagers' need to clear land for fields, Charbonnier suggested that they simply be required to leave a border of *Acacia nilotica* around every one hectare plot (the maximum field size to be allowed). These trees would become the property of the field cultivator.¹⁴⁹

Regardless of such attempts to acknowledge local complaints concerning classification, cultivators living in close proximity to classified zones felt the negative effects of

¹⁴⁸ Cercle du Matam, Forêts Classée, 1947-55, p. 4. ANS 3R 124 (169).

¹⁴⁹ M. Charbonnier, quoted in "Rapport sur les gommiers et gonakies," Gaolen, 1922. ANS 2R 19 (169).

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classification.¹⁵⁰ The "Union Générale des Originaires de la Vallée du Fleuve" actively opposed the classification of forests in the region and the abusive way the forest guards enforced the restrictions. "...In effect, the decree of July 4, 1935 prohibits us from crossing the classified forests with an axe or shouldering any cutting instrument, in some villages it is impossible for the inhabitants to get the materials needed for fence and housing construction."¹⁵¹ Local inhabitants contested the administration's right to classify the forested lands with quotations from the Muslim law:

It is not a secret to anyone that the immediate environs of all agglomerations should be left free, conforming to the prescriptions of the book of Khalil, where it is said: To be left free – the places where inhabitants go to search for dead wood as well as pasture zones and a distance the length of a half day journey, or even a day's walk. Such is the limit of the village surroundings.¹⁵²

Efforts to settle the conflicts stemming from forest classification and traditional use and management of these lands resulted in renewed calls to recognize local use rights:

Concerning the new forest classifications, and even sometimes the old, the conflicts that arise concern land rights: increasingly the collectivities esteem that the cultivated land and the land in fallow belongs to them.... It would be timely to recognize the rights that the collectivities have in these types of lands. Many of our classified forests, particularly...the forests situated in the Senegal River Valley, merit to be treated and managed like those in France that are our 'Communal' forests.¹⁵³

In 1945, a year of a good flood, many local residents requested permission to cultivate their traditionally held lands that had been incorporated in the classified forests. The

¹⁵⁰ The villagers of Nabaaji Siwol recounted the negative effect the creation of the Jammel classified forest had on their land use strategies.

¹⁵¹ Letter from Union Générale des Originaires de la Vallée du Fleuve to the Gov. Gen. ANS 3R 35 (169).

¹⁵² Letter from the villagers of Oualalde, written to the chef du inspection du fleuve, Gouaux, 5 July 1949. ANS 3R 35 (169).

¹⁵³ P. Foury, Sénégal, Service des Eaux et Forêts, Rapport annuel 1950. ANS 2G 50-46.

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Forestry Service consented to the requests under the condition that the cultivators submit to numerous Forestry Service regulations. Refusing to be co-opted, the cultivators abandoned all thoughts of cultivating.¹⁵⁴

The local population was also affected by the fines and taxes the administration placed on use of forest resources. Tree cutting and forest product collection was taxed if and when the forestry agents could apprehend the culprits. To pay for their expanding labor force the Forestry Service instituted new charges. Herders were especially targeted as the culprits of deforestation. Although their resource use strategies altered very little due to state regulation they became extremely wary of all forestry service officials.

By the end of the 1950s the Forestry Service had become very unpopular amongst the local population. This occurred because of the multitude of restrictions placed on local use of the forest resources, resources that the haal-Pulaar continued to see as gifts from Allah and theirs to use freely.

ALTERED RELATIONS BETWEEN RESOURCE USERS

Many patterns of resource use and interactions between resource users endured throughout the colonial era. Other aspects of the local systems and strategies suffered disruptions, stresses and alterations when confronted with the social, political and economic changes of the era.

Some local resource management rules became obsolete, some remained intact, others could no longer be enforced. The resource management system regulating fishing activities deteriorated the most during the colonial era. The colonial administration segregated each resource use system from the others, failing to comprehend the integrated way that local

¹⁵⁴ Service des Eaux et Forêts, Rapports annuel 1945, p. 35. ANS 2G 45-68.

inhabitants experienced the interactions between their physical and social environments.

Increased individualization of society affected intra-group and inter-group resource management. Land holdings became more fragmented, herders camped in dispersed nucleated settlements and fishers with superior equipment exploited the common property resources to the group's detriment. Interactions between groups started to become monetized and fewer gifts and acts of reciprocity were exchanged.

Local power structures began to deteriorate under changing circumstances. The decisions and directions of water masters were increasingly ignored. Land owners no longer commanded the power they once held, which affected their ability to collect land taxes, control labor and set harvest and planting dates.

The need for cash within the developing market economy and annual taxes affected all resource users. Torooße, Seßße, Subalße and Fulße, but especially the latter groups, cultivated more than in the past. Out-migration was a strategy selected by all, although the Seßße, Torooße and Maccuße left in greatest numbers initially.

The most severe disintegration of a local economy occurred within the fishing economy. Technological and market changes induced changes on a scale and at a speed to which the local common property management system failed to adjust. By the 1940s, people fishing in the area had noticed a marked decline in fish stocks.

Herders confronted spatial marginalization because of policies introduced by the colonial administration. Some of the changes herders faced initiated a decline in interaction between herders and cultivators. Patterns of movement no longer brought the two groups together as regularly as in the past. Rapid herd growth began to strain the resources in the vicinity and more herders elected to move out of the zone in search of better grazing.

State control of the common property forest resources affected all residents of the area

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but to varying degrees. Those with land holdings in newly classified zones suffered important losses of tillable land. Herders endured repeated confrontations with officials who imposed fines and ultimately sought to alter pastoralist strategies in the zone.

By the end of the colonial era the local resource user groups had experienced multiple changes affecting intra-group and inter-group interactions. The speed and degree of transformation would only increase upon entering the era of independence.

In the following chapter the formal and legal structures adopted by the newly created state government to regulate and manage natural resources in the region are analyzed. The lasting influence of the colonial administration's approach to natural resource management is striking. In Chapter VII the local realities of human/environment interactions from independence, through the drought and into the present are examined in detail.

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**DIMINISHING RETURNS:
CHANGING NATURAL RESOURCE MANAGEMENT STRATEGIES
IN THE SENEGAL RIVER VALLEY
AND CONSEQUENCES FOR ENVIRONMENTAL DEGRADATION**

Volume II

By

Julie Elizabeth Fischer

A DISSERTATION

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in partial fulfillment of the requirements
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Department of Geography

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CHAPTER VI

NEW LAYERS OF CHANGE: THE STATE, LEGISLATION AND NATURAL RESOURCE MANAGEMENT

INTRODUCTION

Shortly following independence the Senegalese state enacted new laws aimed at further transforming the local resource management strategies and incorporating local economies into extra-regional structures. The primary objectives of the legislation included increasing state control over economic resources, upholding the state as the legitimate natural resource manager, diminishing traditional local power structures, furthering economic development and protecting natural resources. The new legislation reflects Senegal's French colonial heritage despite its claim of renewed appreciation and recognition of indigenous society.

Land reforms in Fuuta Toro were attempted by the French colonial administration and have continued to the present day. Policy makers have confronted repeated and severe resistance from the local population concerning these changes. Institution of the 1964 *Loi sur le Domaine National* and the 1972 Reform of the Local and Territorial Administration Law in the River Region were delayed until 1980 because of the predicted difficulties in breaking down the local tenure strategies that policy makers maintain inhibit economic development in the region.

Changes within three major spheres, the political, ecological and economic, have led to accelerated deterioration of local natural resource management strategies since

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independence. In the political sphere, the 1964 Law on the National Domain set into motion a new national system of land tenure. The legislation officially abolished traditional land tenure and replaced it with state ownership of virtually all land and other natural resources, while at the same time claiming a return to traditional African practices.

Under this law the entire forested domain and much of the pastoral domain fall under the authority of the Forestry Service. Slowly the effects of this law are being felt by those living in the Senegal River Valley since it became institutionalized through the rural councils established in 1980. The actual effects of these laws are not the same as those that were conceived upon their design. The laws, as they have been applied, constitute a hybrid combining elements of the past with those of the present. Similarly, the local indigenous rules surrounding natural resource control and access have not escaped persistent change but have mutated and evolved as they confront present realities.

The strategies and channels of access to resources have proliferated since independence.¹ Some of these are controlled by the state, others are not. In the Senegal River Valley rights to land and other resources are associated both with the new legislation and traditional structures. According to Berry, access to natural resources through both systems depends on social identity, which is determined largely by historical patterns. This chapter explores the state controlled channels of access to productive resources, considers how traditional structures play into the state system and examines the role of social identity in obtaining access to the newly created institutions.

Over time many local inhabitants have come to regard the state with deep suspicion, stemming from the lived experience of inconsistency, the lack of interest and respect for local problems and the innumerable plans since 1960 that have never been realized. Presently,

¹ Sara Berry, "Social Institutions and Access to Resources," *Africa* 59, no. 1 (1989): 41-55.

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neither state nor indigenous institutions hold a monopoly on natural resource access and management rules.

The following sections examine the legislation and policies enacted since 1960 that are relevant to natural resource management issues in the Senegal River Valley and explore local reactions and local realities. Focus is placed on the 1964 Law on the National Domain and the 1972 Reform of the Local and Territorial Administration Law and their effects on local resource users.

The post-colonial government has sought both to efficiently manage natural resources and to facilitate redistribution of the resources with the stated purpose of achieving greater equality in land holdings by breaking down previous land tenure systems and social hierarchies. In most cases the government has not yet succeeded in effectively managing natural resources. Moreover, the state policies have reinforced social and economic stratification and concentration, thus also failing to meet their second objective.

The following discussion reveals that national policies aimed at protecting natural resources often fail because they are instituted to reply to contradictory directives and tend to serve state interests, not those of local residents. Furthermore, the chasm is enormous between the theoretical aims and application of the policies and laws and the form they take when finally instituted in a particular locality. Whereas most administrators creating the new policies and laws assume a "clean slate," clearing away earlier realities, the new is merely one more layer in a clutter of changes.

THE NEW LAW OF THE LAND: A RETURN TO TRADITION?

On May 1, 1964 Senghor introduced Loi 64-46 on the national domain:

What is it about? It concerns, very simply, to return from Roman law to Black African law, from the bourgeois conception of land ownership to the

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socialist conception, which is that of traditional Black Africa.... It concerns returning to Black African law in adapting it to the demands of our development.²

The Senghorian vision of "returning to African tradition" was to adopt a communal mode of tenure and production based on family units, with the state as the holder of eminent rights over all natural resources. There is no convincing evidence that the idealized African social structures that Senghor referred to had ever existed in Futanke society. Within this chapter the contrasts are noted between the rhetoric of Senghor and the non-traditional impacts that his policies have had.

The new land law was designed to serve three primary objectives by reorganizing tenure at the national, regional and individual scales.³ The first purpose is judicial with an attempt to standardize and unify traditional, Islamic⁴ and colonial rules and regulations. Secondly, the law aspires to meet an economic and philosophical objective by decentralizing

² Ph. Abelin, "Domaine national et développement au Sénégal," Bulletin de l'IFAN 41, série B, no. 3 (1979): 508-538.

³ This chapter includes only a summary of the main points of the legislation. The Law on the National Domain has been thoroughly examined and analyzed elsewhere. I refer the reader to Monique Caverivière and Marc Debène, Le droit foncier sénégalais (Paris: Berger-Levrault, 1988); M. Caverivière, "Problématique Foncière et Aménagement de l'Espace Rural: Le cas du Sénégal," paper presented at the *Atelier sur les nouvelles approches de la planification régionale*, Dakar, March 1991; M. Caverivière and M. Debène, "Sénégal: Problématique Foncière de la Nouvelle Politique Agricole," Penant 98, no. 798 (1988): 496-504; M. Caverivière, "La Situation de l'Occupant du Domaine National," Actes de Colloque sur le Droit et l'Accès à la Terre en Milieu Rural, 23-25 January 1989, Etudes et Documents, special no. 1 (February 1991) (Revue du Centre Ivoirien de Recherches et d'Etudes Juridiques, Université Nationale de Côte d'Ivoire); M. Debène, "L'Etat et l'Accès à la Terre au Sénégal," Etudes et Documents; and Ch. Nuttall, "Enjeux Foncières: Cas de l'Arrondissement d'Ouro Sogui."

⁴ While Islamic principles played an important role in forming the local land tenure system, already discussed in earlier chapters, the tenure system that evolved in the Senegal River Valley did not follow the Islamic *indirass* tenet, which states that holders lose their rights to agricultural land that they have not productively used for ten years or more.

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and deconcentrating political power and land holdings to encourage economic development.⁵ Last, the new land law includes the political objective of more complete involvement of local communities in the development of their resources. To meet the first objective the law abolishes prior codes and systems, replacing it with a single national law. The objectives of decentralization and deconcentration are met through the preference in the law given to the land user versus the indigenous land holder. Local communities are implicated in the application of *Loi 64-46* and the management of local natural resources through the creation of *Communauté Rurale* rural councils. Legislating a new land law that does not take into account enduring traditional tenure system sets the stage for profound tensions in the local context. Groups and individuals invoke elements of either or both the new national land law and the local system that best accommodate their position.

The Law on the National Domain subdivides Senegal's land area into four tenure types, all of which are "owned" by the state: urban, classified, *terroir* and pioneer lands. The study area incorporates only two of these: classified and *terroir* land. Classified zones incorporate many of the areas first classified under colonial rule, including forested land, grazing areas, deep river pools and riverbanks. The *terroir* category includes all land allocated for use and development by the local populations and managed by the rural councils. According to the law, land in all four categories can be repossessed by the state to meet national needs, however defined. Allocating large expanses of territory to local community control expresses acquiescence on the part of the state to involve and give voice to the rural populations.

As indicated previously, the 1964 land law attempts to rid local society of the

⁵ I have translated *mise en valeur* as "develop." This is a highly significant dimension of the 1964 law and subsequent 1972 legislation concerning the rural community councils charged with implementing it.

traditional power structures and the gross inequalities in land holdings that the colonial administration never successfully eliminated. Yet even while advocating a return to tradition, the state argues, in a classical developmentalist mode, that tradition has a tendency to oppose innovations and participation of the population, and the new laws are necessary to encourage development.⁶ Once again there are contradictions between rhetoric and action, as well as between various state policies.

In an effort to abolish traditional large land holders in the Fuuta, article 15 of Law 64-46 awards continued use rights to the effective land users with uncultivated land reverting to state control to be distributed to individuals and groups able to develop it. Theoretically, all active cultivators become rightful land holders under the new legislation and the non-active land owners lose their traditional claims. Land lending and collection of land rents, including *assakal*, are not permitted under the law in the effort to purge the system of land holding elites and the use of sharecroppers and paid agricultural labor. The official rationale for suppressing land lending is two-fold. First, it seeks to eliminate land borrowers who, theoretically, tend to seek to extract maximum benefit in the short-term from the land through unsustainable and environmentally degrading agricultural practices. This position is not necessarily valid and depends on the nature of the land loan. Land in Fuuta Toro can be lent for generations to the same family, thus it has been in the interest of the land borrowers to manage the land well. Second, policy makers have argued that land lending limits investment and development because of the insecurity of holding associated with land lending.

Individuals in the study area with historical claims to land that they do not cultivate personally have, thus far, largely circumvented the impact of the new law by taking one or several different precautions. First, a number of these individuals have acquired seats on the

⁶ M. Guèye, "Notes pour servir à l'histoire de secteur rural au Sénégal," *Mondes en Développement* 13, no. 52 (1985): 611-620.

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local governing body in charge of land distributions. These land holders can assure that their land interests are protected, vetoing any efforts to redistribute their land holdings. Second, the land holders hesitate to lend out the land for more than one or two seasons out of fear of losing their superior land rights. Thus the law has increased land holding insecurity rather than diminishing it because the actual result has been shorter rather than longer loans and not a replacement of land lending with the distribution of permanent holdings to the land users. Furthermore, payments on short-term land loans and sharecropping arrangements have not been eliminated in the study area. Lastly, the land holders give the appearance of working tracts of land that are not, in reality, being cultivated.

This last reaction to the law may have ecologically detrimental consequences by encouraging land holders and owners to shorten normal fallow or to continually work the land so as not to lose their claim. Numerous tracts of land continue to be cleared of vegetation, even though rainfall and flood conditions do not permit cultivation, solely to demonstrate that the land is actively occupied, thereby keeping it from reverting to state jurisdiction.⁷

Even though policy makers object to the supposed insecurity caused by the indigenous tenure system, it appears that the policy makers also aimed to increase land insecurity with the objective of inducing more productive use of the land. According to the Law on the National Domain land ownership remains with the state and only use rights are distributed through the new law. The fact that under *Loi 64-46* land can be taken away from anyone who is not productively using it functions to decrease one's security of holding. This increased level of insecurity was to lead, theoretically, to more productive use of the land. The conditionality of land distributions under the new land law, with the obligation of putting the land into productive use, is meant to stimulate capitalization of land. "The obligation of land

⁷ Several informants explained and admitted employing this practice.

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development is at once a condition of the grant and a condition for maintaining property rights."⁸ This requirement of financially investing in land to guarantee one's use right perpetuates, however, a situation of unequal access to land resources albeit in an altered form. "Mise en valeur" has a very restricted meaning in the Senegal River Valley context, referring almost solely to the development of irrigation infrastructure. This principle of associating the right to land with economic development stems from the colonial era rather than from Senghor's "Afrique traditionnelle."

Some critics have argued that a land law that does not actually award title to the land leaves the land users insecure, thus inhibiting slow maturing investment and development of the land.⁹ Recent studies support the view that private ownership is not the only form of tenure that provides adequate security.¹⁰ The effect of the law on investment is considered in the following section.

The 1964 law encourages land attributions both to individuals and collectives. Distributing land to individuals promotes privatized agriculture, consistent with western notions of economic development. The law limits the form of labor that private holders can exploit on their land, to the use of family members, thereby attempting to avoid widespread use of paid agricultural labor. Capitalization and privatization are often associated with the employment of wage labor, however. Thus, the push to privatize is contradicted by the labor restriction. Furthermore, this labor restraint has possible detrimental ecological

⁸ Monique Caverivière and Marc Debène, Le droit foncier sénégalais, p. 43.

⁹ See P. Bloch, *et al.*, "Land Tenure Issues in River Basin Development in Sub-Saharan Africa," LTC Research Paper 30 (Madison: Land Tenure Center, 1986).

¹⁰ See Migot-Adholla, *et. al.*, "Indigenous Land Rights Systems in Sub-Saharan Africa: A Constraint on Productivity?" The World Bank Economic Review, vol. 5, no. 1 (1991): 155-175 and John W. Bruce, "Do Indigenous Tenure Systems Constrain Agricultural Development?" in Land in African Agrarian Systems, p. 35-56, edited by Thomas J. Bassett and Donald E. Crummey (Madison, WI: University of Wisconsin Press, 1992).

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consequences. The law could induce land holders to circumvent sound, but labor consuming, agricultural practices. To date, the labor restriction has not been applied to the private agricultural developments in the study area, where sharecropping arrangements are the norm. Allocating land to collectives attempts to reorient allegiances from historical Futanke social identities toward an imagined "Afrique traditionnelle" institution -- the cooperative. Newly created irrigation cooperatives in the study area have not replaced traditional social identities, however, but rather incorporated them.

The new land law has fractured the continuity of pastoral space by dividing it between classified, *terroir*, and pioneer zones and splitting unified use spaces between the jurisdictions of different rural councils. Significant portions of traditional pastoral space were designated as pioneer and *terroir* zones, destined primarily for agricultural development.

The rural councils have been given the power to regulate "the rights of passage, the regiment and modalities of access and use of watering points of all kinds...the definition, creation, installation of the passage ways in the interior of a territory, the management of the regeneration of degraded pasture...."¹¹ but in practice the pastoral economy has been largely ignored by the new local institution. Under *Loi 64-46*, herding spaces have been infringed upon from many directions, and the areas remaining open to grazing are fragmented and separated. Santoir argues that herders cannot make efficient use of highly dispersed grazing land.¹² The local pastoral system has been marginalized both by shrinking the available resource use space for herding activities and the lack of interest shown by the rural council members in fulfilling their larger role of local resource managers.

The 1964 legislation also addresses the management of fishing resources in the

¹¹ *Loi 64-573 du 30 juillet 1964 relative au domaine national*, article 8.

¹² C. Santoir, *Raison pastorale et développement* (Paris: ORSTOM, 1983).

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Senegal River Valley. The Law on the National Domain created thirteen classified reserves along the Senegal River, five of which were located in the Department of Matam. Fishing equipment restrictions are applied to these reserves during the flood months and the reserves are completely closed to exploitation during a portion of the year. These regulations echoed earlier local management rules that had not effectively controlled resource access and use since the beginning of the twentieth century. The independent state endeavored to reinstitute certain management practices through legislation.

The *Loi sur le Domain Nationale* establishes new notions of land tenure, use and management. The law also touches on management issues for other natural resources, including pastoral, fishing and forest resources. The 1972 Reform of the Local and Territorial Administration Law goes even further in implicating the state and newly created local institutions in natural resource management.

RURAL COUNCILS AND RESOURCE MANAGEMENT IN THE COMMUNAUTÉS RURALES

In truth the autonomy of the *communauté rurale* is an illusion when its very elevated coefficient of dependence on the powers of the trusteeship is taken into account.¹³

One objective of the 1972 Reform of the Local and Territorial Administration Law is to strengthen local rural institutions by granting rural councils considerable power to control resource management in their respective administrative territories (*Communautés Rurales*).¹⁴

¹³ M. Niang, "La reforme de l'administration territoriale et locale au Sénégal," *Notes Africaines* 172 (1981), p. 107.

¹⁴ For an overview of the structure and functions of the rural councils, see R. Vengroff and A. Johnston, *Decentralization and the Implementation of Rural Development in Senegal: The View from Below* (Lampeter, U.K.: The Edwin Mellon Press, 1989) and M. Bakary Kante, "Reforme Administrative et Participation des Populations à la Gestion de l'Environnement. Une participation problématique des populations au développement ou l'application de la loi 72-25 sur les communauté rurales au Lac du Guiers," (D.E.A. Thesis, Dakar: I.E.S., Université Cheikh Anta Diop, 1981).

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Each rural council has been given the prerogative to develop and institute coordinated development and land use plans, to settle land disputes and to distribute or refuse to dispense use rights to the land under their jurisdiction. One motivation for developing *Communautés Rurales* was to facilitate the task of inventorying the natural resource base and to establish greater equilibrium between different resource uses.

The *Loi N° 72-25 du 19 avril 1972* stipulates in Article 1: "the *communauté rurale* is composed of a certain number of villages belonging to the same territory, united by a solidarity resulting principally from being neighbors, possessing common interests and capable of finding the resources necessary for their development." The administrative reforms were legislated to resolve rural society's needs with local solutions, through structures controlled by the resident population. The rural councils were designed to become the intermediary bureaucracy between the state and the local population. The legislation incorrectly assumes that the *Communauté Rurale* constitutes a natural territorial unit and that its inhabitants will unite around common interests and goals. One of the most striking aspects of local society today is the discord and diversity of agendas, rather than solidarity, pertaining to resource access, use and management.

The *Communauté Rurale* is designed to be both a territorial circumscription and a local collective. According to some, the definition of the *Communauté Rurale* is patterned on the notion of the traditional *leydi*. The two institutions do not correspond, however, either in geographical terms or in their ideological and judicial definitions. *Communautés Rurale* incorporate larger land areas and so it is difficult to apply the same principles of ecological and spatial organization and management as the *leydi*.¹⁵ Furthermore, the institution's ability

¹⁵ M. Niasse, "Quatrième Rapport Trimestriel: Suivi des systemes de production agricole à Doumga Rindiaw," Senegal River Basin Monitoring Activity: Activity Progress Report, edited by M. Salem-Murdock, M. Horowitz and T. Scudder (Binghamton, NY: IDA, 1989), p. 30.

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to foster economic and social development remains severely limited because of the complete lack of financial means. This situation may slowly improve with the 1990 decree legislating control of the territory's budget to the local rural council.

Applying the principle of territoriality to issues of economic development in Senegal is an effort to incorporate the development notion of territorial integration, rather than older approaches emphasizing single dimension functional space.¹⁶ In practice, however, the rural councils are focused uniquely on land distribution related to irrigation development. Territorial development, holistic in design, remains very difficult to institutionalize for multiple reasons, including lack of financial means and the failure of the territorial boundaries to adequately intersect with meaningful social, political and economic spaces.

Legislated in 1972 but not applied actively to the River region until 1980, the *Communautés Rurale* and their associated rural councils remain in the formative phase. The Nabaaji Siwol territory circumscribes a land area of 550.5 km² and incorporates twenty-eight villages. The 1976 population was 14,590 and by 1988 had grown to 21,640, signifying a 3.3% rate of increase. The territory includes land in all of the ecological zones, subsuming numerous *leydi* and cutting across many other traditional boundaries.

The Nabaaji Siwol rural council has yet to develop or approve of a development plan for its *Communauté Rurale*. Such a plan has been ordered by law but the concept is completely foreign to local representatives; furthermore they lack the human and financial resources to execute such an undertaking. The rural council has also failed to keep a complete record of the land deliberations and the land attributions made to date.¹⁷ This

¹⁶ J. Friedmann and C. Weaver, Territory and Function: The evolution of regional planning (Berkeley and Los Angeles: University of California Press, 1979).

¹⁷ Most council members spoke of the importance of keeping a written record of their decisions but their record keeping thus far has been sporadic.

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institution, that could play a very significant role in developing resource use and management strategies appropriate to the local residents, has not actively assumed this role. The only action that the council has taken thus far has been to make a small number of land attributions and occasionally arbitrate land disputes.

The traditional power structures have been incorporated into the territory based rural councils, maintaining and multiplying the channels of access to productive resources even though the law attempts to control the rural councils' composition in an attempt to break down pre-existing power structures. The twenty representatives elected to the rural council through direct universal suffrage (two-thirds of the members) originate from thirteen of the twenty-six villages with two villages sending three councilors each and three villages sending two members each. The remaining third of the councilors are designated representatives of the cooperatives functioning in the region, primarily PIV¹⁸ cooperatives. The average age of the elected members of the rural council is between sixty and sixty-five, indicating the gerontocratic structure of power in the society.

Demonstrating yet another transfer of power from traditional social structures, over fifty percent of the representatives possessed a social title and approximately seventy percent were historically large land owners.¹⁹ The non-land owner councilors are herders, fishing people, and representatives from *jeeri* villages who do not have traditional land holdings in the *waalo*. Cultivators are justly represented on the rural councils but herders are drastically under-represented whereas local bureaucrats and entrepreneurs are extremely over-represented. The law reserves twenty-five percent of the seats for youth and women, but this article of the law has not been applied in the Nabaaji Siwol *Communauté Rurale* and neither

¹⁸ PIV: Périmètre Irrigué Villigeois.

¹⁹ Ch. Nuttall, "Enjeux Fonciers: Cas de l'Arrondissement d'Ouro Sogui," pp. 43-45. The data in this paragraph are taken from Nuttall's study.

of these groups are represented. The local elites are well represented on the *Communauté Rurale* and have been the first to defend and revalidate their land capital by acquiring land through the *Loi 64-46* to construct private irrigated fields. Seven out of the nine land attributions made by the Nabaaji Siwol rural council by 1987 were to council members or their close relatives.²⁰

One intention of the land and territorial reforms is to give greater access to natural resources to youth, women, Maccuße and other historically landless groups in local society. Thus far these groups have not greatly benefitted from the legislated changes. The 1964 land law was not an agrarian reform, allowing those occupying and exploiting the land to remain in place. This has enabled long-time land holders to maintain rights to their land. Until the power structure of the rural councils is altered little will change for the marginalized segments of the society.

The landless and land poor see the incongruities of this new institution that was created, in part, to represent their interests but remains in the hands of customary land holding elites. Local residents agree that such individuals can not be representatives for the landless community members because they give priority to protecting self-interests. The council cannot, at the same time it safeguards its own stake in the land, impartially enforce the Law of the National Domain that advocates redistribution of land. In the words of one informant: "Either the law must be reworked or the Law of the National Domain must be applied with force to protect the powerless...The Futankooße will not change on their own accord."²¹

²⁰ The land distributions referred to here include only decisions on private land. Most land awarded under *Loi 64-46* thus far has been given to village cooperative groups for irrigation development.

²¹ Mamadou Manngaan, Maccudo, NDulumaaji Demße, 5 April 1991.

Resource uses other than irrigation in the *Communauté Rurale* have been ignored by the rural council. Fulße herders constitute a significant portion of the Nabaaji Siwol *Communauté Rurale*'s population but remain drastically under-represented on the rural councils. This lack of representation prejudices their opportunity to pursue development goals and land demands specific to the herding community and economy. Non-representation of the women, herders, fishers and other marginalized groups enables the rural councils to ignore the multiple uses of the resources within their territory. Neglecting herding or any other economic activity, and failing to allocate space to these resource uses, will severely limit the rural council's ability to manage their resources for sustainable development. Traditional resource management strategies relied on complex interactions between the various resource user groups within an extended resource use space. Unidimensional development strategies greatly increase the social, economic and ecological risks associated with natural resource management in the region.

Allocating Land

Local land distributions under the 1964 law began with the institutionalization of the rural council in 1980 but have proceeded very slowly. The rural council's mandate includes allocating *terroir* land within the territory to those requesting holdings. The land distributed by the rural council is taken out of the traditional system and allocated in accordance with the 1964 law. The land allocation process is virtually frozen as local council members fear making any decisions that would distribute land to fellow villagers or outsiders. The only allocations that have proceeded without much opposition are the allocations the rural council members are making to themselves. Even these decisions have slowed as fellow villagers oppose further allocations to council members. The number of local residents seeking land

for private irrigation fields continues to mount rapidly but decisions are not made.

Traditional land holders are seeking title to their historic claims, hoping to hold onto the land until they have the means to develop their land someday or give it to a family member through inheritance. Virtually every attempt to receive title from the rural council is met with fierce opposition by villagers who claim rights to the same land. According to the rules of the Nabaaji Siwol rural council, if anyone opposes a request the council has received it will not take a decision, thus exposing the lasting strength of historic land claims. Contentions between all interested parties must be settled before the case can be decided by the rural council. Active factional politics at the village and *Communauté Rurale* level constitute another battle front for land distributions.

Several different spatial strategies have been pursued by those seeking land under the new legislation. The general rule is that land grants are rarely sought on land held most securely under the indigenous tenure system. Traditional land owners are able to request *waalo* land to which they have prior claim. For the most part *waalo* land remains unallocated under the new law because of the secure hold that the traditional *jom leydi* and *jom kolangal* have on this highly valued land. Only two of the nine parcels distributed in the Nabaaji Siwol *Communauté Rurale* by 1987 were situated in the floodplain. Thus, land distribution under the current law has been frozen in areas where traditional claims remain strong, affecting most of the *waalo* land.

When seeking a land allotment under the new system the requesters tend to request land in close proximity to the river to facilitate irrigation development. This land has been cultivated only rarely within the traditional agricultural system and therefore past claims are weaker. Initial land allocations on this land, especially the establishment of the cooperative irrigation fields, preceded the rural council's creation and were made, using varying degrees

of force, by the *Société d'Aménagement et d'Exploitation des Terres du Delta du fleuve Sénégal et de la Falémé* (SAED). These early land distributions were hotly contested by villagers claiming rights to the land even though much of the *fonde* land is unallocated under the traditional system. Opposition to the PIVs waned over the years but is rising once again as the land area villagers are willing to relinquish is shrinking.

The last strategy is to claim a stake in a frontier zone that has not been cultivated previously. *Jeejegol* land constitutes such a zone and ardent land clearing can be explained in part as a preemptive bid for new land holdings. Widespread land clearing of *jeejegol* land in the study area has rapidly increased during the past decade but in general little of this zone has been distributed through the Nabaaji Siwol rural council. Land claims are made through the indigenous rule of first occupancy, yet again demonstrating that aspects of the local tenure system continue to function in parallel with the new legislation.

Under the laws governing land tenure and the *Communauté Rurale* all land holders are required to apply for titles for their land holdings. Only a minuscule number of cultivators employing local agricultural practices and exploiting traditionally held lands have fulfilled this requirement. Only those wanting to develop private irrigation works have sought official registration. Local residents complain that a family's traditional holdings are too dispersed and fragmented to apply for land titles for each parcel.²² Relatives oppose attribution of family lands to one individual and the land requests brought before the council tend to stir old controversies and disputes. Furthermore, the attribution petitions that have been made meet

²² Record of at least one demand for title to land not to be incorporated into a private or group project appears in the "Proces Verbal de Réunion du Conseil Rural de Nabadji Civol," 28 January 1987. Ceerno Yaya Niang of Boynadji requested title to a piece of *jeejegol* land. This may have been foresight on this individual's part because all of the village's *jeejegol* was subsequently subsumed in the Italian project area. Possession of land title would guarantee the individual's right to a field in the new project.

with extensive delays and problems. Faction membership also plays a detrimental role in land allocation decisions. If a villager belongs to a faction different from that of the rural council delegate(s) from his/her village, the villager has little chance of being granted the land request.

The local residents and rural council members do not agree on whether their land should be given to outsider donor organizations and agro-businesses willing to invest in developing their land for irrigation. The previous Nabaaji Siwol rural council president constantly shifted between two positions, sometimes advocating working with big investors who are interested in establishing industrial irrigation projects in the *Communauté Rurale* while at other times asserting that all their land should be kept in local holdings for local use. The minority supporting outside investment argues that while such projects imply a loss of local autonomy they secure employment and wages for the population. They assert that the rural council should allow big enterprises to come into their zone under well defined contracts for limited time periods. This would earn the *Communauté Rurale* income and would guarantee the return of their land for future use.

In 1990 the state decided that the local rural councils should control their own finances and make decisions related to their expenditures. Most local residents have not paid taxes for many years. The new policy will strongly encourage the rural council members to enforce local tax collection since a large proportion of the monies will flow directly to their treasury for local projects, providing them with their only financial resources. Lack of an overall development and land use plan for the *Communauté Rurale*, the total preferential status awarded irrigation development, and a rural council dominated by traditional elites limit the range of projects the council will likely consider funding. Local budget control is a positive move but the issues of who the council is serving and to what ends remain at issue.

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Devolution of budgetary responsibility to local control corresponds to the state's withdrawal from the rural sector. The *Nouvelle Politique Agricole*, instituted in 1984, is based on the dual notion of peasant responsibility and disengagement of the state. The major objectives of this program include 1) increased food security and agricultural revenues through development of irrigation and improvements to rainfed agriculture; 2) peasant organizational and institutional development; and 3) protection and rehabilitation of natural resources for the protection and improvement of agricultural potential. These plans remain too broad and vague to be instrumental and are not attached to specific regional or local development plans. In an economic environment where producers continue to receive low prices for their goods and face increasing agricultural input costs, the national bias against the peasant population is readily felt. Detached policy objectives will do little to bring about change that will benefit the majority of the local population. While Caverivière supports state withdrawal, maintaining that: "The results of the socio-economic analyses tend to show that the disengagement of the State and the protection of the peasant's autonomy number amongst the conditions essential for the success in regional development,"²³ she offers little clarification of how regional development will occur within the current national policy environment in Senegal. If disengagement of the state equals cutting the life lines of local society the policy will do little to further regional economic development.

A growing portion of the local population has grown disinterested and disillusioned with the development opportunities available to them. They have begun seeking alternative means to gain greater autonomy from indigenous power structures and state control. Villagers, both those living in the area and those dwelling outside the region, are forming private associations, or *Groupes d'Intérêt Economique* (GIE). These efforts are being pursued

²³ Monique Caverivière, "Problématique Foncière et Aménagement de l'Espace Rural: Le cas du Sénégal," p. 10.

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by the economically active younger generations. These new associations often represent a form of resistance both to internal and external power structures.²⁴ Such groups have just begun to request land grants through the Nabaaji Siwol rural council, and have met with strong opposition by local power holders.

LOCAL REACTIONS TO RECENT LEGISLATION

The presumed local authority structure, in the form of the rural council and (to a lesser degree) village heads, differs from the actual authority structure in the study villages. The structure that functions in the villages, influencing decisions and motivations, combines a multitude of elements – old and new, internal and external. The authority structure is far less clear cut in present day society, shifting and transforming to the particularities of the situation. In almost all of the villages, especially the larger ones, there is no single structure that holds authority over the entire village population. This is evidenced by the fact that the question of the rightful holder of the title of village head is hotly contested in most villages.

Dominant factional/clan membership (shifting, relies on both internal and external influences), traditional land holding rights (unchanging and internal), and links to the regional or national bureaucratic structure (shifting, primarily external but can be achieved through use of internal influence) constitute the most prominent attributes determining village level authority. When one or several of these attributes are combined with significant cash wealth and/or age the person is guaranteed a position within the authority structure. The various village power holders can be united or in opposition, and this may shift according to the issue at hand. Each faction within a village has representatives in the internal and external

²⁴ Papa M. Kane, "Administration locale et organisations paysannes" in Crise du développement rural et désengagement de l'Etat au Sénégal, edited by Cheikh Tidiane Sy (Dakar: Les Nouvelles Editions Africaines, 1988), pp. 23-46.

authority structures. Increasingly villagers rely on individual authority holders who have solidified their power by straddling the new and the old, the external and the internal.

Traditional social channels employed by local resource users to gain access to natural resources continue to survive although they have evolved and mutated as the local resource users are confronted with a multitude of changes, including stronger state control over local natural resources and newly created institutions responsible for resource use and access. Many local residents consider the changes proposed by the Law on the National Domain as revolutionary:

In Pulaar it is said: 'the world does not evolve except to put the first last, and to make the last the first.' In my opinion, [the Law on] the National Domain is a system that creates a permutation to the order of things: the first will become the last, and the last first.²⁵

Although the weakness of the state and the lasting strength of the local power structures have greatly prohibited the legislation from being implemented according to plan and according to its intent, the new laws are having some effect on access to productive resources.

While the indigenous institutions no longer function as they did in the past, remnants and permutations of the past power structures influence the way that the new law takes root in the local milieu. The original intent of the law was distorted immediately upon its application under the influence of local realities. In the study region even partial implementation of the local interpretation of the law has caused confusion, increased land holding insecurity and rekindled past power struggles. Those holding political and economic power according to the indigenous social system are actively seeking to secure positions of power under the newly emerging system. Those who realize that they could improve their land holding status through correct application of the law advocate rigid implementation of *Loi 64-46*. Moreover, in one circumstance a person may rely on tradition yet in a subsequent situation invoke

²⁵ Quoted from unidentified interviewee during a group interview, LawLaw, 10 April 1991.

application of the current law.

According to the vast majority of the local informants the Law on the National Domain imitates the land tenure regime of the Almamate. Once again higher authorities control land allocation and individual land holdings can be expropriated, leaving the local population with few rights over their land resources. "Just as in the time of the Almaamis, the power of the state exceeds the power of the villagers over their own lands."²⁶ For many villagers the rural councils equal the state even though these councils were legislated in an effort to decentralize land tenure decisions and allow local communities a certain level of autonomy. More significant to the villagers is the power that the state, through the *préfet* and *sous-préfet* – maintains with the right to override local decisions.

Most traditional large land holders, recognizing that they have the most to lose if the new law is applied correctly, either oppose the new legislation or seek to control its application by sitting on the rural council. They recognize that they fare far better under the existing local system whereby they control the principal channels of access to resources. One land owner's reaction expresses a widely held sentiment: "The changes of the day are alarming – including the unheard of need to formulate requests to exploit land that is rightly ours."²⁷ In contrast, former slave caste members acknowledge the novel position that the new law affords them, entitling them to their own land holdings for the first time in their history.

The concept of property has taken new and loaded meaning in the face of the Law on the National Domain, the push for rapid irrigation development and increased state intervention in the region. The state's control over access to natural resources, the threat of

²⁶ Interview with the head of the Dem clan, NDulumaaji Demße, 2 August 1990.

²⁷ Interview with Maamuudu Hasan, village chief, Kaawal, 22 September 1990.

land loss and the capital investments being made to develop irrigation in the region have imbued land and land ownership with new meaning for local residents. For many traditional land holders these changes signify the deterioration of the concept of property as they knew it. Their loss of land rights translates into a loss of power. Others maintain that the notion of landed property and property rights are stronger today than anytime in the past. One informant explains the growing significance of property: "The idea of property is more important today....because today people are being told that they may no longer own what they once owned."²⁸ Similarly, "the concept of private property and the separation between property and people has increased since the introduction of irrigated fields."²⁹

One of the primary objectives of the new land law is to further economic development, which has been very narrowly defined by the government and local residents. For villagers and state officials alike, irrigation clearly signifies productive development (*mise en valeur*), but few other activities are identified as legitimate. Tree planting is the only other form of investment recognized by villagers that constitutes productive development. According to villagers land planted with fruit trees remains in the hands of the owners as long as the trees are alive.³⁰

No herding activity is considered a legitimate form of development under the Law on the National Domain. Pastoralists complain bitterly that herding activities do not qualify as *mise en valeur* under the new law and, therefore pastoralists can not acquire land through *Loi 64-46*. Many herders believe that eventually they will lose access to the Valley completely as

²⁸ Interview with Demba Joop, Maccudo, NDulumaaji Demße, 20 April 1991.

²⁹ Interview with the Mamadu Bah, village chief, BokkiSabbundu, 26 February 1991.

³⁰ Interview with Saidou Dem, private field owner, 4 April 1991. This is a commonly held view although the Law on the National Domain does not make this guarantee and all land distributions made by the rural council must be reevaluated and could be redistributed at the time of the holder's death, whether the land has trees planted on it or not.

land is developed for irrigation. *Loi 64-46* advances indirectly the demise of the pastoral economy by defining acceptable land development in such a narrow way that it almost exclusively sanctions land distribution for agricultural production only. Furthermore, political power at local, regional and national scales is in the hands of agriculturalists, who are able to control access to productive resources to the detriment of pastoralists.³¹

The lack of interest in pastoralism by the rural councils has at least two sources. First, the national land law and the agricultural program being promoted have relegated pastoralism to a position inferior to agriculture.³² Second, the rural council membership under-represents the herding population and over-represents local land holders. The councils' primary, if not sole, concern has been with controlling the distribution of land rights, which are given out exclusively for agricultural activities.

Losing Control?

Throughout the study zone villagers voice fears that they are losing control over their land and other resources, even as they argue that the Law of the National Domain has not been enforced within their territory. One informant justified the increased concern for retaining land rights: "Land is all we have left, all our other natural resources are gone."³³

Local interpretation of the Law on the National Domain involves the notion that a family is free to exploit the land that it can exploit itself and that all other land should be

³¹ R. L. McCrown, G. Haaland, and C. De Haan, "The interaction between cultivation and livestock production in semi-arid Africa."

³² Refer especially to the forestry codes, *Loi 65-23 du 9 février 1965, décret 65-078 du 10 février 1965, Loi 74-46 du 18 juillet 1974; Décret 66-45 du 19 janvier 1966* that declassified over 10,000 hectares to give to a Mouride leader for peanut cultivation and the recent Mbekhe incident.

³³ Interview with Mamadou Kane, NDulumaaji Dembe, 21 April 1991.

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given to and cultivated by anyone who can work it independently. Land owners assert that such a law has no place in the local setting because all land belongs to someone: "Application of the new land laws makes no sense here because there is no surplus land that does not have an owner and needs to be given to other residents or newcomers."³⁴ This is the same argument made during the colonial era when the administration deemed some land "vacant and without owner."

Historic land holders assume that if they continue to cultivate all their land they can retain their rights to it, and yet they cannot cultivate their land under present climatic and technical conditions. The local residents realize their precarious situation – the Law of the National Domain claims state control of any land not cultivated for ten years, but the Manantali dam presently holds back the floodwaters thus prohibiting *waalo* fields from being cultivated. When OMVS failed to release flood waters for two consecutive years many local residents asserted that the state was purposely eliminating the flood so it could claim that local residents were not cultivating the land. In reaction "people are now trying to make it look like they are working the land when in reality they are not."³⁵ One strategy for declaring one's rights to a fallow field is to regularly clear the natural vegetation. This land clearing exposes the soil to erosional forces and diminishes the prospect of subsequent regeneration of vegetation. In the past, regenerated vegetation on fallowed land constituted valuable grazing and provided important resources that were collected by the local population.

Local land holders fear their land being lost to a multitude of outsiders. The first category of outsider is the state. Land owners see no way to oppose the power of the state which has the power to claim any resource that it wants. This feeling of voicelessness

³⁴ Interview with the head of the Coongan clan, NDulumaaji Demße, 12 August 1990.

³⁵ Interview with Oumar Yaya Dem, NDulumaaji Demße, 31 March 1991.

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explains why there has been so little opposition to projects instituted by the state, such as the 450 hectare NDulumaaji perimeter, as opposed to the active resistance to projects by fellow residents, neighbors and individuals from outside the *Communauté Rurale*.

The second category of outsiders, according to historic land holders, are fellow residents who are social outsiders because they do not hold locally recognized rights to land. In the past such a person could arrange to clear a field and cultivate until the owner reclaimed the land. Since the new land law protects the active cultivator, the land holders hesitate to let others cultivate their land, even under a sharecropping relationship. If the land owner agrees to let someone cultivate, s/he often limits the arrangement to one to two seasons since the law allows the cultivator to claim legal ownership after exploiting the land for three years. Active cultivators have made only infrequent claims of land ownership since few community members dare to oppose the local system, but such cases do exist and their numbers are rising.³⁶ Most significant at this point is that the law has begun to change patterns of land lending and land use because of increased land holding insecurity. The rural council's rulings on these claims remain inconsistent and occasionally illegal. In two cases the Nabaaji Siwol rural council clearly sided with tradition rather than applying the new legal code. This occurs because the council members are the historic land holding elite who continue to protect their own interests.

One objective of the Law on the National Domain was to redistribute access and increase equality of land holdings between members of the local population. Although this has occurred to a limited degree in village irrigation perimeters (PIV), acquisition of private land holdings remains off limits to those who are not historic land holders. Individuals who do have not inherited *waalo* or *fonde* land holdings have no possibility of obtaining land for

³⁶ There are at least five current disputes falling into this category in NDulumaaji Dembe. This is a very recent phenomenon but villagers maintain that it is evolving rapidly.

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private irrigation works.³⁷ "The descendants of slaves will not easily find land here. Even the people who are not slaves do not easily find land, all the greater reason if the person is a descendent of a Maccudo."³⁸ Once again, the redistributive purpose of the law has not been fulfilled largely because individuals have been unable to circumvent the interests of the historic land holders.

Another group of resident outsiders involves younger community members who have not yet inherited family land. An evolving phenomenon concerns the youth who have out-migrated and who now want to acquire and develop village land holdings. These requests are significant to the state because the immigrants possess private capital to invest in land development. Local land holders, the elders of the community and many other villagers strongly oppose distributing land to the youth, especially those possessing significant monetary wealth. Age continues to have a powerful role in local society and young people are largely prohibited from obtaining land for personal use through the rural council.

Villagers also see their land being lost to neighboring communities as land is redistributed within the context of multi-village irrigation projects. Villagers argue that their land should not be taken from them for project development to be redistributed to residents of other villages if their own irrigation needs have not been satisfied. Project bureaucrats and the state maintain that they have the right to reallocate land holdings since traditional land rights have been abolished and the development of irrigation infrastructure relies on financial assistance for the state.

Recently the Minister of the Interior requested that the rural councils of the

³⁷ All of the prior slave caste families and all of the rural councilors interviewed confirmed this statement.

³⁸ Interview with Oumar Yaya Dem, Ndulumaaji Demße, as Counselor to the Nabaaji rural council, April 1991.

department of Matam assist the political refugees from Mauritania by offering land they can cultivate. Viewing this as another outside threat to the sovereignty of their land resources, the councilors remain wary and have thus far refused to consider the government's solicitation. The refugee populations have been given only enough land to establish camps within the borders of the Nabaaji Siwol *Communauté Rurale* but have not been granted open permission to cultivate surrounding fields or develop land for irrigation. While the right to cultivate a dryland field is relatively easy to obtain, local residents assert that the refugees will never be awarded land for irrigation.

In 1987 the Law on the National Domain was modified to allow Senegalese from outside of a *Communauté Rurale* legal access to land.³⁹ Since the state wants the land redistributed to those who can invest in it, and because the local residents often do not have the financial means to exploit the land, the state argues that others must be allowed access. Local residents, men and women, landless and land owners, of all classes and ages oppose people coming from Dakar and other regions to exploit their land. These outsiders are feared by all local residents because they possess the power and money necessary to develop the land as required by the 1964 land law. The only way the local population can legally protect their land from these outsiders is by making capital investments in and developing the land themselves.

No outsider individuals have successfully gained access to land within the borders of the Nabaaji Siwol *Communauté Rurale* but the villagers sense this possibility as a constant threat. The threat is real enough, as the rural council members have received numerous requests from outsiders. Although the state has not yet intervened on the behalf of the outside investors, the villagers have few doubts that this will occur in the future.

³⁹ See Cellule Après Barrages (CAB) 1987, concerning modification of article 18 of Decree 64-573 of 30 July 1964.

Religious leaders, wealthy bureaucrats and entrepreneurs from Dakar and foreign donor investors present the most significant threats according to villagers. Many argue that local land losses would cause social upheavals and devastate the local community's reproductive capacity by taking away their only resource existing for future generations. "If we don't do anything the wealthy will come and take over our land to our detriment. If we give the land to Ifra [any local resident] no one will be able to take the land from him; by inference we should imitate Ifra and consolidate our property...."⁴⁰

The numbers of outsiders seeking access to land in the Nabaaji Siwol *Communauté Rurale* remain small if one excludes state authorized projects such as the NDulumaaji Intermediate Perimeter and the Italian donor project. One religious leader from Touba, the capital of the Mouride brotherhood, sought access to land within the *Communauté Rurale* borders but was flatly refused. The two central factions in the *Communauté Rurale* firmly unite around this issue – to keep outsiders out. "The moment that we are a little negligent and another occupies our land, we will not be able to make them leave."⁴¹ Rural council members argue that until all of the demands made by local residents have been satisfied the rural council cannot give their land to outsiders. "The government accuses us of being conservative but we must think of our children. These children will return one day in search of land and with money to invest. We must protect our own future."⁴² The fact that the state has not intervened to redistribute extensive tracts of the land in the *Communauté Rurale* reveals that local political and land holding structures have thus far continued to influence the

⁴⁰ Quoted from unidentified interviewee during a group interview, LawLaw, April 1991. Tree planting assures greater land tenure security.

⁴¹ Interview with Oumar Yaya Dem, NDulumaaji Dembe, as Counselor to the Nabaaji Rural Council, April 1991.

⁴² Interview with the past president of the Nabaaji Siwol Rural Council, Muussa NDiaye, 29 March 1991.

wider political process.

The rural council members and villagers throughout the *Communauté Rurale* recognize the present and growing need for assistance from people in external authority structures to protect their territorial integrity. Many residents agree that if it were not for the efforts of Futankooße in Dakar advocating for the land rights of the local population their land already would have been distributed to outsiders. In Dakar many bureaucrats and religious leaders originating from the Fuuta are endeavoring to protect the region's land for the local population. Some local residents view this protection as a double edged sword, recognizing that the same Futankooße in Dakar who are protecting local interests are the people in the best position to make land claims in the future.

The threat that outsiders, however defined, may procure rights to their land has persuaded a few land holders to negotiate arrangements with villagers holding capital but no land. Increasingly villagers are willing to consider a joint project rather than lose the land to outsiders. Such deals range from making a single payment to the historic land holders, essentially purchasing the land, to giving the original land owner a substantial holding in the irrigation project.

Private irrigation field owners, all of whom are historic land holders who have also sought title from the rural council, assert that their current land rights are extremely secure and sense no loss of control. With a deliberation passed down from the rural council, the private land holders emphasize that they possess both local and state sanctioned rights to the land, thus doubling their tenure security. Private land owners acknowledge, however, that under the current land law their private fields are not inheritable under the new land laws. The land is only temporarily distributed to those who put it under production, but can and will always revert back to the state. Hence land holdings approved of by the rural council are

not safe from state reclamation and manipulation. This raises questions about the effect such land laws will have on private investment. As noted above, the western view on appropriate land tenure arrangements asserts that if private land holders do not have title they will be less willing to make slow maturing investments. Although the data available for the study area are insufficient to determine the precise effects of the new tenure arrangements on private investment, requests for private land acquisitions have steadily increased since 1980 when the law was first implemented in the Fuuta. Current tenure, combining traditional and state systems, is proving secure enough to warrant economic investment.

Within the general mood of fear of loss of control, some women have asserted greater control over resources to which they have rights under the indigenous system. These women are less willing to give up their inheritance rights to land in the midst of the current changes in land legislation. Recognizing the potential value of land and the scramble to acquire land, women are more commonly demanding their rightful inheritance. The Nabaaji Siwol rural council has only ruled in one case involving a woman but many other women are claiming inheritance rights to both irrigation plots and traditionally cultivated land.

Members of the village irrigation fields (PIVs) assert ownership of their individual plots if they were part of the group since its creation, or if they inherited or purchased such a plot. However, if the person fails to cultivate the land or if the member does not abide by the group regulations, the group can take the plot away and redistribute it to a new holder. Thus, group rights and control over land resources supersede the individual's rights to the individual parcel. The fact that the group's rights transcend those of the individual provides the group with the power to manage the project for the benefit of all participants.

Three land transfer arrangements exist in the PIVs, two of which are not recognized under current national law, one of which is new to local society. These are 1) the plot can be

sold if the owner is going to leave the group entirely, with the purchaser becoming the new owner, constituting a wholly new form of land transaction for the haal-Pulaar. Plots have been sold for 50,000 F CFA and 100,000 F CFA. The possibility of sale is established in the by-laws of the PIVs in NDulumaaji Demɓe. Outright sale of land is not sanctioned by the national land law or local tradition but is justified, according to local residents, because of the capital investments made by PIV field owners. 2) The field can be given to another person for free use for a season or series of seasons; or 3) the plot can be cultivated through *rem-peccan* or sharecropping. Sharecropping is gaining importance rapidly in PIVs as plot holders acquire plots in multiple PIVs and require additional labor. With each newly created PIV many of the same people gain access, but do not possess the family labor required to work the land. In one of the PIVs of NDulumaaji Demɓe thirty-three percent of the active plots were being cultivated through sharecropping during the 1990 season. Individuals unable to pay for cash inputs can gain access to rice cultivation by sharecropping. The rising incidence of sharecropping in the PIVs is another indication that social inequalities are not disappearing.

Informants from all levels of the local social hierarchy agree that the Law on the National Domain and recent economic developments have not fundamentally advanced equality in access to productive resources between castes, classes and the sexes. Under both traditional social structures and application of the new legislation, the two largest agricultural groups presently inhabiting the Fuuta are marginalized – women and landless peasants without capital.

A central aim of both the 1964 and 1972 legislation and the creation of PIVs was to increase social equality through more uniform land distribution and local control and management of natural resources. Although the law sanctions access to land by landless community members the traditional social institutions prohibit them from gaining access to

any land other than cooperative irrigation projects. While members of the former slave caste can now acquire access to plots of land they call their own through PIVs, they can not become officers of a PIV nor are they able to gain access to land for private development, much less become a member of the rural council.

The rural councils, under the 1964 and 1972 legislation, have been invested with significant power, to achieve multiple resource management objectives. In reality, however, the Nabaaji rural council has pursued an agenda favoring cultivators to the detriment of herders. The space available for grazing has diminished as more land has been allocated for irrigation. Under-represented on the rural council, the herders have yet to launch a campaign to protect their interests.⁴⁹

The 1964 Law on the National Domain is meant to be supple and flexible, aiming to equitably meet the needs of a rapidly evolving society while encouraging capital investment in rural development. The law's application at the local level has lead to numerous ambiguities and contradictions, however. In the hands of the local authorities the legislation is manipulated to serve the interests of power holders. On the other hand, the 1964 and 1972 legislation attempt to alter existing authority structures. The law permits, even guarantees, a place for the local residents to manage and develop their own natural resources. Currently two systems regulating access to land are evolving in the same space – local authority structures co-exist with the state reforms – leaving many community members with a sense that they are losing control.

⁴⁹ In recent research in the Barkedji Arrondissement, Kristine Juul found that Fulbe were requesting land through the rural council as a preemptive strategy to block Mouride clerics from acquiring land for cultivation. See K. Juul, "Problèmes Fonciers et Aménagement Territorial en Zone Agro Pastorale: Le cas de l'Arrondissement de Barkedji" (Dakar: CSE, 1990).

SUMMARY

The 1964 Law on the National Domain and the 1972 Reform of the Local and Territorial Administration Law place authority and responsibility for the development and management of natural resources in the hands of local residents, yet the administration maintains ultimate control of the resources as land and other natural resources are state property. In many ways the Senegalese state acts as a stronger and more direct manager of natural resources than did the colonial administration.

The legislation has failed to bring about significant changes in local resource management for a number of reasons. First, the state has not truly devolved power to the local institutions. The rural councils do not have true sovereignty over decisions and may even make decisions against their own interests because of the leverage of higher authorities. Second, traditional power structures continue to control the channels of access to productive resources. Traditional authority structures function in tandem with the newly created rural council, which is dominated by the local elite. The various agendas of the different power holders at the local level and those situated outside the village and *Communauté Rurale* often diverge. Finally, although the legislation was aimed at creating territorial resource management units, local application of the laws has focused solely on land allocations for irrigation development to the detriment of pastoralism, forest use and other resources. Discrepancies between various laws, such as those between the land law and the Forest Code, further prohibit integrated local management of natural resources.

The following chapter turns to an analysis of the evolution of local resource management strategies since independence. The focus is on the social, ecological and economic transformations that have occurred since 1960. Irrigation has been the primary response to both the ecological and economic dilemmas in the region. Short-term objectives

pursued out of self-interest in restricted spaces characterize many of the present day natural resource management strategies.

CHAPTER VII

DIMINISHING RETURNS: LOCAL ACCESS TO NATURAL RESOURCES SINCE INDEPENDENCE

INTRODUCTION

Environmental degradation in the Sahel gained international attention a decade after Senegal's independence, during the 1968-1973 drought. From their inception, discussions have advanced divergent ideological positions, disparately placing blame for environmental degradation on climatic conditions, local misuse of resources, overpopulation or external structural causes. In the Senegal River Valley, the evidence reveals that elements of all these factors must be examined to fully comprehend human-environment interactions and changing local access to and use of natural resources. Local resource users disagree amongst themselves as to the primary causes of degradation, state bureaucrats have different interpretations, researchers, technicians and international donors still others. Three levels of influence contribute to the construction of these interpretations: 1) larger social, political, economic and environmental circumstances shaping people's actions and choices; 2) organizations and institutions that alter and respond to the particular context and shape the constraints and opportunities of the local population; and 3) the local people who influence, respond to, and interpret the environmental, institutional, and human forces. One challenge of this study is to understand the selective interpretations of human-environment interactions in the study area.

The decades following independence have been filled with a vast array of social and

ecological changes affecting local resource access, use and management strategies. The origins of many of these transformations lie in the pre-independence era and have manifested themselves over time, while other changes have come into existence only following independence. In the Senegal River Valley, recent pressures on the natural resources have resulted from the changing patterns of access to resources, multiplication of overlapping rights, altered patterns of resource use, encroachment of common property systems, climatic fluctuations, a transformed agricultural system with the introduction of irrigation, numerous legislative changes, fuller incorporation of local society into the national and international economies, changing social relations, increasingly self-oriented resource use strategies and rapid human and herd population growth. These overlapping social, economic, political and environmental factors, too dense and intertwined to weigh separately with any degree of authority, determine the current form of human-environment interaction that exists presently. The incredible swiftness of transformations on multiple fronts drastically reduces the ability of local users to respond and adapt, thereby devaluing and threatening the integrity of local environmental knowledge systems.¹ In some circumstances indigenous management strategies have been rendered inappropriate by changed conditions.

Significant social inequalities existed in the local society long before colonial rule and independence, but access to and control over resources remained in the hands of the resource users at the local level, often for common use by group members. Currently, the local resource users are often unsure of their control of many aspects of the natural resources within their resource use space; also they no longer function as the managers of local

¹ This position stands in contrast to Paul Richards. See P. Richards, "Community environmental knowledge in African rural development," *IDS Bulletin* 10, no. 2 (1979): 28-36; "Ecological change and the politics of African land use," *African Studies Review* 26, no. 2 (1983): 1-72 and *Indigenous agricultural revolution. Ecology and food production in West Africa* (London: Hutchinson, 1985).

resources. Furthermore, local users can rarely gain access to sufficient resources needed for their subsistence. The proliferation of overlapping rights and the conflicts that ensue between different rights holders have also influenced access to and use of resources.

Natural resource management remained under state control following independence, perpetuating the separation between local resource users and natural resource management by removing power and prerogative from the local population. Colonial administrators initiated this process and following independence the Senegalese government pursued and solidified national control of natural resources. The disruptions of the local management systems that began under colonial administration have resulted in virtual disintegration in some cases. Since independence the enforcement powers of the state have significantly increased,² thus expanding its ability to execute state codes and edicts. Legislation enacted in the mid-1960s and early 1970s (see discussion in Chapter VI) theoretically transferred some rights and responsibilities back to local institutions. However, in actuality the state has preserved its authority over natural resource management. The concentration of control over natural resource use at the national level has continued to undermine the capacity of local communities to respond to changing conditions.

Interactions between local resource users and regional and national structures have multiplied and deepened since independence, integrating the local society more fully into larger domains. Resource use and management decisions in the Senegal River Valley are affected, and often times determined, by national agendas and policies. As the Senegalese peanut economy has waned, the national government has been forced to seek alternative sources of revenue. Once again development of the Senegal River Valley has been heralded

² See Mark Schoonmaker Freudenberger, "The Great Gum Gamble: A Planning Perspective on Environmental Change in Northern Senegal," p. 217 for data on the rapid increase of forestry service personnel on the eve of independence.

as the panacea to national scale dilemmas. In the post-independence era international donors have supported economic development of the region, further accelerating the region's assimilation with national structures. Irrigation developments especially have imposed new demands on and removed choices from the population. Redclift describes this process of separation between the environment and local society:

the need to increase cash income, repay debts and meet the necessities of the household impinge upon poor people while they are held in a vice by the terms of trade which govern intersectoral and international relations. As 'development' removes them from control over their own environment, their control is assumed by transnational companies and capital-intensive technologies....the environment is relocated not as part of a *local* system of production, but as a link in the international division of labour.³

Influential outside groups, along with a small local elite, have assumed increasingly powerful roles in the local arena of resource management. They maintain control over the more productive and reliable resources in the area. During the past twenty-five years common property management systems have been increasingly undermined, and with them the ability of significant segments of the local population to secure their reproduction has eroded. The increasingly anarchic and individual oriented resource use strategies of herders, fishers and cultivators, along with the persistent breakdown of common property management rules, as discussed in Chapter V, provide vivid evidence of the demise of common property management systems. This situation has made many local residents more dependent on the market and state for the provision of basic necessities. The majority of local residents attempt to secure livelihoods on more marginal lands; at times these are the same lands where the Senegalese state is pursuing ambiguous conservation policies.

Virtually none of the haal-Pulaar remaining in the region rely solely on local natural resource production systems to secure household reproduction. Remittances sent home from

³ M. Redclift, Development and the environmental crisis: red or green alternatives? p. 130.

out-migrants are used to purchase food and other necessities, in addition to covering irrigation production costs. Local production systems no longer occupy the principal position in the society. This marginalization affects resource use and management. Less labor is made available and often the labor is of poorer quality as younger children increasingly are given primary responsibility for managing production. Furthermore, the idea of maintaining the natural resources for future generations seems to hold less weight as the population turns to other strategies to gain their subsistence. Driven by immediate subsistence demands, local resource users are forced to exploit the natural resources with little regard for the future. The option value of investing in the maintenance of the environment has decreased as a consequence of the strains to meet immediate needs.⁴

The Senegalese government and international donors have pursued economic and technological strategies that largely have ignored local natural resource management strategies and distanced the local population from control over their own environment. Irrigation, in part a technological solution to the poor climatic conditions and in part an approach to economic development, has been instituted throughout the river region since the early 1970s. Implementing irrigation development has far reaching consequences for agricultural production as well as the other resource use strategies in the region.

Agriculture, and specifically irrigation, has become the monodevelopment policy for the Senegal River region, marginalizing all other natural resource use economies. The incongruity of this single faceted agenda cannot be ignored during an era when most thinking advocates the replication of the diversity and complexity found in natural systems. Political economic and spatial marginalization of the pastoralist economy in the region has persisted since the colonial era. Currently the state is interested in reincorporating herding into the

⁴ P. Blaikie, "Environment and access," p. 22.

economy of the Senegal River Valley but through the alternative format of penned animal husbandry, divorced from traditional production strategies. And finally, when the government elected to dam the river and control the natural flood, they elected to pursue agricultural development over maintenance of the fishing economy. Fishing in the region has been eradicated, in all practical terms, with little prospect for its revitalization. The irrigation program in the region also risks further devastation of forest resources.

In the past, although the different segments of the population were more clearly divided in their use of resources, their resource use spaces and their production systems were more interdependent and interactive. Today, while the local resource users scramble to reap what they can by partaking in numerous resource use activities, the different economies and spaces appear to be less interactive and reciprocal. This chapter is divided into four sections to reflect natural resource management in light of the key events and agendas of the present era. In the first section the effects of the drought and recent ecological changes are considered. This is followed by a discussion of the national and international response to the drought – the development of irrigation – and the impact these decisions have had on local society. Next the current state of the *waalo-falo-jeeri* system is considered in the context of the politico-spatial unit of the *Communauté Rurale*. The transformations that have taken place in the local agricultural, fishing, herding and forestry economies since 1960 are interwoven over the course of several sections. A subsequent section reviews the field evidence of environmental degradation and relates it to shifts in climate, and resource use and management systems. The final section examines the interactions and reactions between local resource user groups.

"THE RAIN NO LONGER FALLS, THE RIVER NO LONGER FLOODS"

Deciphering the causes of the recent climatic shift remains obscure and determining the multitudinous effects of the drought years can only be roughly approximated. But for anyone who was living in the Senegal River Valley during the 1970s the swiftness and immensity of change cannot be exaggerated. This section summarizes the major impacts of drought for the resource users in the study area.⁵

The 1968-1973 drought, coupled with the persistence of frequent low flood and rainfall years from 1974 until the present, have contributed to the dramatic transformations occurring in the biophysical sphere.⁶ The regional climatic conditions of the past quarter century have presented formidable obstacles for sustained production by local natural resource users. Reduced rainfall over the past two decades unquestionably has effected ecological change, especially on vegetation communities and the groundwater table.

Drought and cyclical climatic fluctuations are not new to the Sahel,⁷ and the absence of a long-term local climatic record does not permit assessment of the relative severity or length of the 1968-1973 drought. This case study establishes, however, that the recent climatic trends can not account for the full range of social and ecological transformations that have occurred during this period. The dialectic relationship between climate and social change has determined that the biophysical changes that have occurred because of low rainfall

⁵ Many others have written on the general impact of drought, the climatic changes that have occurred over the past several decades. This section attempts to deal with the specifics of a limited area. Refer to works by Jean Copans, Jean Gallais, Michael Glantz and Michael Mortimore for thorough accounts of the Great Sahelian Drought.

⁶ Many of the ecological changes related to drought are presented in sections of Chapters III and VII of this dissertation.

⁷ See E. Rasmusson, "Global Climate Change and Variability: Effects on Drought and Desertification in Africa," in Drought and Hunger in Africa: Denying Famine a Future, edited by M. H. Glantz (New York: Cambridge University Press, 1987), pp. 3-22. Opposing sides of this argument were reviewed in Chapters I and III.

have led to social transformations that have, in turn, had further impact on the biophysical environment, creating a series of feedbacks. This cycle of environmental decay increases rapidly the reproduction costs of the household,⁸ intensifying the contradiction between resource management for current production and long-term sustainability.⁹

The local populations' responses to the climatic conditions since 1968 have differed from outsider reactions. The local residents view the situation as a continual, on-going process with accumulating effects, whereas outsiders tend to react to particular disconnected episodes of drought. These disparate perspectives partially stem from the different time scales used in the respective analyses. Local residents have a long-term perspective of the regional climate whereas outsiders adopt a short-term view of only the most disastrous climatic incidents of "crisis." Interpretations of and solutions to climatic fluctuations vary with the time and spatial scales employed in the analysis.

The drought-induced ecological decline throughout the zone has been severe. The physical effects of the drought can be sub-divided into at least two main categories: 1) physical degradation caused directly by lower rainfall; and 2) environmental degradation caused by changes in social structures triggered by the climatic changes. Logically this chain of causation could be extended even further but our capacity to decipher the links of longer chains of interactions remains limited.

The dual season agricultural system that was practiced in Fouta Toro was hit from both sides with the drought. The rains became so inadequate and undependable that cultivating rainfed *jeeri* fields no longer provided any security. The loss of the annual flood

⁸ P. Blaikie, "Environment and access," p. 28.

⁹ Numerous informants blatantly admitted that they do not hesitate to exploit natural resources today in ways that jeopardize their future well being. The choice seems clear enough to them - thinking about the future is not really an option when they can not even secure present needs.

meant an immediate and drastic decrease in cultivable *waalo* land in the study area.

Herd losses experienced by the Fulße in the Matam region in the early 1970s were drastic, varying between 40 and 60 percent.¹⁰ While the intensity and duration of the drought accounts for most of these losses, the severity of the damages has been linked to the herders' abandonment of movement.¹¹ The drought also promptly revealed the imbalances between herd size and the capacities of the grazing resources. The disorganization and lack of coordinated management of pastoral resources, at any level, also became sorely apparent during the recurring drought episodes.

Patterns of movement and transhumance that had experienced change during the colonial era were further transformed as a result of drought and related changes. Many of the transhumance routes no longer bring the Fulße *jeeri* into the floodplain. Only the small numbers of Fulße *jeeri* presently cultivating *waalo* lands move seasonally into the floodplain. These herders now move their herds further south during the dry season. The lack of flooding in the *waalo* has resulted in diminished grazing possibilities. Also the expansion of irrigation fields has diminished the space left for herds. Another herding strategy that has developed subsequent to the recent drought years is one of perpetual movement, but this occurs in the Ferlo rather than the river region. Drought has had the opposite effect too, causing some herding families to sedentarize near irrigation fields providing them with the option to purchase fodder in times of great need.

Many of the herders who had moved northward into Mauritania to escape control,

¹⁰ Ch. Ba, Les Peul du Sénégal, pp. 155-156 and Ch. Santoir, "Les sociétés pastorales du Sénégal face à la sécheresse 1972-73. Réactions à la crise et degré de rétablissement deux ans après. Le cas des Peul du Galodjina," in Stratégies pastorales et agricoles des Sahéliens durant la sécheresse 1969-1974, edited by J. Gallais (Talence, France: CEGET, 1977).

¹¹ See Ch. Santoir, Raison pastorale et développement (Paris: ORSTOM, 1983) and J. E. Ellis and D. M. Swift, "Stability of African pastoral ecosystems: Alternate paradigms and implications for development," Journal of Range Management 41, no. 6 (1988), p. 458.

taxation, and recruitment during the colonial era returned to Senegal during the drought years. Many of these herders returned from Mauritania in the 1970s because the Moors began to move into the Valley with their camel herds, increasing competition over resources. Furthermore, camels could not be kept out of their fields and the Fulße felt voiceless in the face of this dual ruination, not daring to protest against the Moors. The Fulße also began encountering problems with authorities when they wanted to cross the river to sell their animals in Senegal. State agents controlled major crossing points and prohibited herders from moving herds back and forth. Fulße decided to leave these hostilities behind and return to Senegal. Herders also moved into the study area from other places in Senegal, especially the Podor area, that had been more drastically affected by drought. Both these trends increased the population seeking access to declining resources in the area. The practice of reserving field and grazing areas diminished over the decades but fell into total disuse with the drought years. People's resource use strategies became increasingly individualized and communal management practices ceased to be paramount.

The herders residing around NDulumaaji Demße and Cerngal attempted to close the zone during the first wave of herder immigration. The resident herders attempted to move the newcomers toward open spaces further away from their villages. The local herders were attempting to avoid the fate of these newcomers by protecting their pasture land and conserving their resources for as long as possible. The newcomers relied on state sanctions to remain in the area, arguing that under state law they had the same rights to pasture use as the resident population. This is an interesting example of a disenfranchised population seeking protection from the very authorities that had marginalized them, to fight against members of the same ethnic and resource use group who considered them outsiders.

Herd composition altered subsequent to the 1968-1973 drought. Goat herds now

constitute the largest portion of animals owned by most herders. While goats are better adapted to the ecological risks of the zone, they require more labor, which is in increasingly short supply as most adult male labor has exited the region. The emphasis on goats and sheep also demonstrates greater orientation towards raising animals for the market and the preference to specialize in activities with rapid turnover.¹²

During and after the 1968-1973 drought years, sedentary agriculturalists invested in animals, and herders who lost most of their stock during the drought have become laborers — animal keepers for the agriculturalists. Agriculturalists had greater access to disposable income when stock prices plummeted and were able to buy animals cheaply. Conversely, Fulbe herders faced the double jeopardy of reduced animal prices and skyrocketing costs of grain and other food stuffs. Fulbe who have been able to maintain herds are forced to continually augment their animal sales as the price per animal declines relative to other prices. Herd quality was of little importance during the crisis; the single immediate objective was to maximize the numbers of animals surviving the drought. That this objective may have had negative repercussions on the physical environment was of little concern to the local population.

One reaction to the drought employed by all resource users in the zone was to escape the devastation and seek survival outside of the region. A surge of young men flooded into Senegal's urban centers and beyond, as local resource use strategies were abandoned to the remaining productive women and older male community members.

The wage-seeking labor out-migration that has been characteristic in the Senegal River region since the turn of the century, and perhaps earlier, began more recently amongst the

¹² Sara Berry asserts that where insecurities are high, people will tend to maintain "as liquid a position as possible in one's asset holdings." See Sara Berry, "Social Institutions and Access to Resources," p. 49.

Fulɓe.¹³ The loss of herding labor has affected the management options open to families.

The herding options available are: 1) younger children have taken over herding responsibilities; 2) more animals are pen fed on purchased fodder; 3) herds are combined with those of a relative or friend; 4) herds graze unattended; and 5) herding labor is purchased.

The lack of annual flooding was the next to the last blow for the fishing economy that had already been devastated by the unremitting social and technical changes experienced since the turn of the century. A new reaction of the Subalɓe to the latest upheaval caused by the drought was to relocate in southern Senegal to pursue their fishing activities along the water courses in the Casamance region.

Fish that were once returned to the river, because of their small size or undesirable eating quality, are retained today. Smaller and smaller net hole sizes permit those still fishing in the area to capture most of the remaining fish but even those nets often come up empty (during one interview with a fishing family camped on the bank of the Jammel, the woman prepared purchased ocean fish for their lunch). The long series of low flood years and the subsequent construction of the Manantali dam have all but annihilated fishing resources in the region. Due to the marginal position of the fishing economy, its management no longer concerns state authorities.

The severe drought years of 1968-1973 and 1983-1984, along with two decades of low rainfall, have had their toll on local forest vegetation. The impact of the drought cannot be fully measured, nor can it be analyzed separately from the social, economic and political factors influencing forest resources. Nevertheless the prevailing consequences of prolonged

¹³ See Ch. Santoir, "Peul et Aménagements Hydro-Agricoles dans la Vallée du Fleuve Sénégal," in Pastoralists of the West African Savanna, pp. 191-213, edited by M. Adamu and A. H. M. Kirk-Greene (London: International African Institute, 1986), pp. 191-213; Ch. Nuttall, "Occupation de l'Espace, Mutation et Développement dans la Moyenne Vallée" and Ch. Ba, Les Peul du Sénégal.

drought and low rainfall cannot be diminished even if the vegetation will gradually regenerate and the possibility of this occurring is growing increasingly unlikely. The present biophysical changes influence local resource use and management strategies.

The episodes of severe drought occurring since independence have led to extreme losses of trees, especially the *Acacia nilotica* stands in the floodplain. Even if the droughts have induced merely temporary ecological alterations in the local ecosystems, the consequences have been far-reaching and tumultuous on the vegetation. Current local forest resource use and management strategies are affected by this and other interlocking social, economic and political factors.

THE BLUE BELT – THE SENEGAL RIVER'S ENDURING PROMISE OF IRRIGATION

State and international response to the 1968-1972 drought called for immediate irrigation development in the Senegal River Valley. After generations of proposals and studies showing the economic and ecological infeasibility of irrigation in the region, the drought finally thrust irrigation into the unquestioned foreground. Irrigation became the only option that the state and donors considered, and the state acted with a heavy hand in pursuit of its agenda.¹⁴ During the past fifteen years numerous researchers have analyzed the social, economic, political and ecological dimensions of irrigation projects established in the Valley.¹⁵ This study is primarily concerned with examining how irrigation developments

¹⁴ See for example: République du Sénégal. Région de Sénégal Oriental. "Elaboration du II Plan 1965-1969." Dakar, 1965.

¹⁵ The documentation and research on irrigation development in the Senegal River Valley could, itself, dam the river. I cite only some of the major works: Adrian Adams, La terre et les gens du fleuve: Jalons, balises (Paris: Harmattan, 1985); G. Belloncle, ed., Participation paysanne et aménagement hydro-agricoles: Les leçons de cinq expériences africaines (Paris: Karthala, 1985); P. Bloch, "Land Tenure in the Bakel Irrigated Perimeters," Bakel Discussion Paper Series Nos. 1-14 (Madison, WI: Land Tenure Center); J.-L. Boutillier and J. Schmitz,

have affected local natural resource access, use and management. This section focuses on three themes: 1) state involvement in irrigation; 2) the relationship between irrigation and differential access to resources; and 3) the technical problems and ecological consequences of irrigation.

Direct State Involvement in Irrigation

Current plans involve irrigating 81,000 hectares on the left bank by year 2000, of which 29,000 hectares had been developed for irrigation by 1988. To meet the year 2000 objective, 4,730 hectares must be developed each year (calculating from 1988) but the actual land area prepared for irrigation amounted to 1,870 ha/yr between 1986-1989. Furthermore, a significant portion of irrigated land goes out of production each year. Under the rubric of the *Nouvelle Politique Agricole*, instituted in 1984, the government assumes that peasant groups will accept ever greater responsibility to increase the land area being developed for irrigation. In mandating such local involvement, no one considered how local populations would acquire the enormous monetary, technical and human resources necessary for completing this task. Due to the lack of necessary means, few new initiatives have been taken by members of the local community. The rhetoric also stresses local level input and

"Gestion traditionnelle des terres et transition vers l'irrigation: Le cas de la vallée du Sénégal" in Cahiers ORSTOM, série Sciences Humaines 23, nos. 3-4 (1987): 533-554; G. Diemer and E. van der Laan, L'irrigation au Sahel: La crise des périmètres irrigués et la voie haalpulaar (Paris: Karthala, 1987); P. Engelhard, Enjeux de l'après-barrage: Vallée du Sénégal (Dakar: ENDA/Ministère de la Coopération Française, 1986); the entire issue of Cahiers de la Recherche Développement 12 (1986); P. Mathieu, "Agriculture irriguée, réforme foncière et stratégies paysannes dans la vallée du fleuve Sénégal, 1960-1985" (Dissertation, Fondation Universitaire Luxembourgeoise, 1987); R. P. Miller, "Peasant Autonomy and Irrigation: Innovation in the Senegal River Basin" (Ph.D. dissertation, Northwestern University, 1984); Ch. Nuttall, "Occupation de l'espace, mutation et développement dans la moyenne vallée du fleuve Sénégal;" Sidy Seck, "Irrigation et aménagement de l'espace dans la moyenne vallée du Sénégal" (Dissertation, Université de Saint-Etienne, 1981); and a series of Senegal River Basin project reports issued by Institute for Development Anthropology, Binghamton, NY.

cooperative effort for the benefit of all community members. In reality, the development of irrigation has favored certain segments of the local and national population far more than others.¹⁶

The insistence on rice production, rather than some other grain crop, stems from the government's national policy and donor pressure. Paddy rice, an unknown crop to the local population, was not received readily by local producers. Labor intensive, and requiring numerous and expensive inputs, local rice production often failed to measure up to expected production predictions. A large percentage of profits from the harvested rice goes directly to paying off production debts, an arrangement that favors the government's agenda over the producer's well being. Rice prices are set by the government, with the aim of producing rice in the Senegal River Valley for the urban populations. Later in the year, during the hunger season, Fuuta rice producers are forced to purchase more expensive rice on the open market.

Irrigation was first introduced in the study area in 1974. When SAED¹⁷ initiated irrigation works in the region they did so amidst much local opposition. Villagers strongly resisted the first efforts by the state to usurp control of their land resources by creating irrigation infrastructures, staging (sometimes violent) protests as the parastatal constructed the fields. Stories of villagers chaining themselves to trees and inflicting damage on SAED equipment are not uncommon. Local residents opposed SAED's management of their resources and were wary of letting village communal and private land holdings be incorporated into village irrigated fields or PIVs (*Périmètre Irrigué Villageois*). SAED finally

¹⁶ See B. P. Thomas, "State formation, development, and the politics of self-help in Kenya," *Studies in Comparative International Development* 23, no. 3 (1988): 3-27 and E. A. Brett, "Adjustment and the state: the problem of administrative reform," *IDS Bulletin* 19, no. 4 (1988): 11 for further discussion of these issues.

¹⁷ SAED — Société d'Aménagement et d'Exploitation des Terres du Delta, des Vallées du fleuve Sénégal et de la Falémé.

succumbed to the forceful opposition of local residents and changed its strategy by first seeking permission directly from the villages and, since 1980, from the rural councils before constructing new fields. Slowly they convinced local residents to participate in the irrigation developments, which were designed to function using local labor.

The effort to create village level, cooperative run irrigation works was a positive shift away from the large scale irrigation projects which dominated earlier development programs in many African countries. Although the first cooperatives were formed under SAED's close direction and coercion, subsequent PIVs were started by villagers when they recognized that state subsidized irrigation provided them with one of the only means to continue cultivating in the zone. The villagers continued to cede land to SAED into the 1980s, but only under the condition that they would regain access to their land if high floods returned (a condition that SAED pays lip service to but would not honor). State subsidies dried up in 1988 and since then no new PIVs have come into existence in the study area and many have gone out of existence because of this change in policy.

All village irrigation cooperatives created under the direction of SAED maintain a similar structure. Membership is open to villagers interested in cultivating rice and able to pay the necessary monetary expenses and who have the labor required for cultivation. The largest determining factor for group membership is possession of adequate financial means and it is the costly aspect of irrigation that determines that cooperative membership is not equally held by all villagers.

The state's plan has been to attempt a form of democratization through distributing equal irrigation holdings to all residents in the Valley. The government's goal to provide 0.25 ha/person of irrigated land in Matam area by 1994, a year before the artificial floods are to cease, will not be met. At the present time the total land area prepared for rice cultivation

is inadequate for all active cultivators to receive the intended one-quarter hectare plot.

Moreover, the land that has been put under production has not been distributed equitably amongst local residents. While the government has instituted some regulations that make equal allocations more possible, the cost of irrigation combined with the enduring traditional social structures facilitate recuperation of land holdings by the local elite. Even though village level irrigation development may be far more consonant with a sustainable development ethic, "to assume that such societies are undifferentiated, that all interests are served through subscription to 'community development efforts' (WB 1989: 169), is to mythologize."¹⁸

Even if all active villagers obtained one-quarter hectare, the objective would fail to meet subsistence needs much less provide the state with the surplus production it expects. Insufficient land appropriate for irrigation, combined with the elimination of *waalo* production, the loss of fish resources and the marginalization of herding, inevitably strains human and ecological resources in the region. Irrigation also limits the geographical region that can be exploited by the local population because of the need to stay close to project sites and its high labor demands. Such spatial constrictions increase the pressure on the immediate local environment because resource use activities must be carried out in a more restricted area.

The national agenda to produce surpluses and to terminate subsidies in the Senegal River Valley has led the state to curtail its interest in promoting small-scale village irrigation works. The donor supported NDulumaaji Intermediate Perimeter represents the state's new vision for the Valley. The 450 hectare field incorporates land from three village territories, crosses *Communauté Rurale* boundaries and involves cultivators from five villages. Financed

¹⁸ F. Mackenzie, "Development from Within?," p. 27.

by the French government, the project design was based on notions of integrated rural development¹⁹ but quickly reverted to being strictly an irrigation production scheme.²⁰

Hostilities abound between inhabitants of the neighboring villages with each group claiming that they have not received just access to the project. Those villages contributing land to the project argue that all their villagers should be given plots before outsiders gain access. The project administrators and the state agents completed the project without obtaining village and rural council endorsement. For donor funded projects of this nature decisions are made at the national level and then are announced to the implicated villagers. Neither village communities nor individual inhabitants who lost land to this particular project were compensated in any way for their losses.

Differential Access to Irrigation

As recounted above, one official objective of irrigation development is to create greater equality in access to productive land. This objective is pursued through two policies: first, all residents, former slaves and land wealthy nobles alike, are given equal sized plots in the village cooperative fields as PIV members; and second, sharecropping in irrigation perimeters is prohibited. After years of irrigation development in the region, however, many aspects of the traditional social hierarchy and power structures have been reestablished in the perimeters.²¹ In addition, villagers not holding positions of power within the traditional

¹⁹ République du Sénégal, SAED, "Projet d'Aménagement, Hydro-Agricole dans le Département de Matam, Phase III: Plans de Développement et Etudes Techniques Détaillées" (Paris: SATEC, SCET, SONED, 1984).

²⁰ Interview with M. Delacroix, Caisse Centrale de Coopération Economique, Dakar, 23 March 1990.

²¹ I refer the reader to the reports summarizing recent work completed by Institute for Development Anthropology, particularly M. Horowitz, *et. al.*, Suivi des Activités du Bassin du Fleuve Sénégal, Phase I: Rapport Définitif (Binghamton, NY: IDA, November 1990). See also

structures but who have earned significant cash wealth outside the village have been able to acquire multiple plots in the PIVs. While it is true that PIVs have provided the first opportunity for Maccuße to acquire secure land holdings (other than *jeeri* fields), their options remain limited. Nobles continue to assume all positions of power and authority as the officers of the PIV cooperatives, permitting them, among other benefits, the choice of the best plots in the fields.

As more perimeters have been constructed the social elites have accumulated multiple irrigation plots that are cultivated by sharecroppers rather than household labor. The numbers of villagers cultivating under sharecropping arrangements have steadily increased since the inception of irrigation. In stark contrast none of the Maccuße with multiple irrigation plots use sharecroppers to cultivate their holdings. The state has turned a blind eye to the use of sharecroppers, favoring their production objectives over social ideals. As long as the demand for irrigation exceeds the supply of fields, the social elite remains favored, receiving a greater proportion of land holdings than is warranted by their numbers.²² Maccuße remained under-represented in NDulumaaji Demße until the demands made by nobles had been satisfied, whereas the Fulße have not received irrigation holdings proportional to their representation in the study villages under any circumstances.

Maccuße villagers first acquired high value land through their involvement in village irrigation projects. This group views as highly significant the changes that have occurred with the introduction of irrigation. Maccuße informants firmly recognize, however, that they

Ch. Nuttall, "Mutation de l'Espace, Mutation et Développement dans la Moyenne Vallée du Fleuve Sénégal;" G. Diemer and E. van der Laan, L'irrigation au Sahel and J.-P. Minvielle, Paysans migrants du Fouta Toro and the Land Tenure Center Bakel project reports by Peter Bloch and David Miller.

²² This finding is supported by M. Niasse, *Suivi des Activités du Bassin du Fleuve Sénégal, Phase I: Rapport Définitif* and J.-P. Minvielle, Paysans migrants du Fouta Toro.

could not acquire land for a private irrigation project. Traditional property owners refuse them access to all suitable land for these purposes. "A Maccudo could never get anyone to agree to give him land.... If the Law of the National Domain actually were instituted in the region, it would be very significant for those without traditional access to land. We would benefit most definitely from a true application of the new laws."²³

Fulße waalo, most of them visitors to the territory, are denied access to own plots in the PIVs, and only rarely acquire permission to sharecrop.²⁴ After several generations in the area many *Fulße* rarely experience the consequences of being an outsider, but they revert quickly to this status as regards permanent access to land. Many families have lived in the region for two generations or more but cannot gain access to village irrigation fields. The current situation is motivating some *Fulße waalo* to consider returning to their villages of origin to develop irrigation projects where they retain traditional land rights. After several generations away from home, however, they are unsure of what their status would be upon returning. In the few cases where *Fulße* have been admitted to local PIVs, they pay exaggerated entrance fees because of their outsider position. The sale of animals, however, provides a primary source of income to support irrigation enterprises for *Fulße* and other cultivators.

For the past five years people who traditionally have not cultivated, especially *Awluße* but also members of artisan groups, are now partaking in irrigated agriculture as sharecroppers and, most recently, are seeking access to their own fields. After much resistance, these people now consider cultivation, specifically irrigated rice, as a necessary activity. Similar to former slaves, these groups do not have traditional access to land and see

²³ Interview with Jenngudi Sih, Maccudo, NDulumaaji Demße, 5 April 1991.

²⁴ The IDA study provides statistics that support this finding. See M. Horowitz, *et al.* *Rapport Final Intégré*, pp. 246-248.

no opportunity to acquire land for private irrigation developments.

No women in the study area are direct members of any PIV, nor are they private field owners, but some have become PIV plot holders through inheritance or via ghost membership. Although no villagers claimed that women are prohibited from becoming principal members of PIVs, neither did anyone think that this would occur. Even if women are the primary laborers in the field, the land is allocated to a husband or son. Women have the legal right to acquire land through the Law on the National Domain, but local society has not incorporated this principle into their land distribution decisions.

Traditional land holders are the only individuals who have gained access to land and other resources to create private irrigation projects. While they remained limited in number in 1990, the interest in private irrigation works is increasing. The Nabaaji Siwol rural council has distributed land to a number of private concerns for irrigation development, most of it going to rural council members.

The latest project type appearing in the region is irrigated fields organized and developed by immigrant representatives with immigrant money.²⁵ A group of male villagers from NDulumaaji Dembe who live and work in France recently funded a forty-five hectare field. The entire field, minus a few of the plots reserved for the field managers, is cultivated through sharecropping. The group encountered grave difficulties and hostilities mounted by villagers when they attempted to acquire land for the project. Key villagers seemed to oppose this group of fellow villagers more vehemently than they had contested recent state directed

²⁵ Whereas earlier types of village projects by immigrants, such as the building of mosques, clinics and schools served as a form of "legitimation" of the migrants in the face of village authorities, the irrigation projects have had the opposite effect, threatening village authorities, as the migrants seek access to land resources. For a discussion of the migrants' funding of village projects, see Philippe Lavigne Delville, "Migration et structuration associative: Enjeux dans la moyenne vallée," in La Vallée du fleuve Sénégal: Evaluation et perspectives d'une décennie d'aménagements (1980-1990), pp. 117-140, edited by Bernard Crousse, Paul Mathieu, and Sidy M. Seck (Paris: Karthala, 1991).

projects. Older villagers fear these younger fellow villagers who possess the power to appropriate village lands with money. The elders assert that it is as if their own people were taking land away from them. The rural council would not approve the land allocation because some of the council members from NDulumaaji Demße opposed the distribution. Only after four years of lobbying, exploring and investing in every possible option including, ultimately, bribing a number of power brokers in the village, were the immigrants able to acquire land. This case illustrates Berry's assertion that investment in social relations diverts surplus from investment in directly productive resources.²⁶

Today individuals and private groups²⁷ face strong opposition from fellow villagers as they search for available land for irrigation projects. The rural council refuses to allocate land if there are disputes surrounding it or if another villager claims traditional rights to the land. Furthermore, acquiring *fonde* or *waalo* land through the rural council no longer guarantees that the individual or group will gain access to the riverbank for pump installment.²⁸ The riverbank owners adjacent to deep pools commonly refuse those seeking access, especially private field owners. Finding a place to install the pump has become one of the most difficult tasks of the private field holder. Riverbank owners are using their power to negotiate deals with the irrigation field owners. Such arrangements include annual rent

²⁶ S. Berry, "Social Institutions and Access to Resources," p. 45.

²⁷ By independent groups I am referring to the recent development whereby immigrant groups are organizing into *Groupements d'Interêt Economique* (GIEs) to develop irrigation perimeters. These new projects are not considered PIVs, and the group members are viewed as "outsiders" by village residents because they are young males who do not have traditional access to land but hold capital. The hostility these groups face from fellow villagers is enormous even though they are seeking to develop village land for communal benefit.

²⁸ The river and riverbanks (twenty-five meter width) are actually state property ("*pas géométriques*") but *falo* field owners maintain traditional rights over this land and, by association, river access. Refer to Article 5 of *Loi 76-66 du 2 juillet 1976 portant Code du Domaine de l'Etat*, *IORS* (20 septembre 1976), p. 1478.

payments and land rights in the private perimeters.

Technical Problems and Ecological Consequences of Irrigation

The primary physical problem confronting the cooperatives is that the soil condition where the perimeters are situated are largely inappropriate for irrigation. The land that SAED and village groups have been able to gain access to is *fonde* land and the soils in this ecological zone usually do not contain adequate amounts of clay for paddy irrigation.

Another physical problem results from the severe evaporation rates common in the region. High evaporation, deficient water supplies, and soils with low water retention not only lead to poor rice yields but also contribute to rapid salinization of the top soil.

The technical dilemmas facing the PIVs involve pumping sufficient amounts of water over the riverbank, often a ten to twelve meter upward displacement. Irrigators located along branches of the Senegal River, such as the Jammel, face an even more severe dilemma since the Manantali dam and controlled water releases have diminished water levels. Insufficient water flowing into the Jammel from the Senegal River due to deficient releases from the dam eliminates the possibility of irrigation.²⁹ The total lack of drainage canals in the PIVs and private perimeters poses a further threat of progressive salinization of the top soil. Earthen dikes surrounding many of the perimeters require regular maintenance and reconstruction, for which labor is often lacking.

The costs of numerous inputs, most importantly the motor pump but also fuel, fertilizers, and seeds place a large burden on rice cultivators. Traditional forms of agriculture

²⁹ This situation affected one private perimeter, two PIVs and the Ndulumaaji Intermediate perimeter during the second cropping cycle of 1990-1991 – four out of the six perimeters cultivated during the season. SAED encouraged cultivation, even forcing the members of the Intermediate Perimeter to cultivate. The crops were abandoned in mid-season when the Jammel dried up. No flood water had been released in 1990.

require only minor capital inputs, in vivid contrast to the high costs of irrigation. Withdrawal of state subsidies and cheap loans has forced irrigators to borrow from the National Credit Bank, to subsidize their irrigation efforts with the remittances received from out-migrants, or to stop irrigating. Since its inception irrigation has been assisted by cash earned off-farm by family members employed in wage labor. To limit the costs of irrigation cultivators try to irrigate with reduced inputs. As long as the motor pump functions farmers will commence a season, but the possibilities for disastrous yields are abundant. Motor pump failures, lack of spare parts, insufficient fuel supplies, low or no fertilizer applications, and the use of poor seed all exist as possible scenarios.

Even though numerous local residents voiced that "what is done in common has more power,"³⁰ organizational and social problems have been cited as the primary cause for PIV failure. Members often reject the group leadership — who are not elected democratically but are self-selected and represent the local power elites — who retain enough power to continue to control positions of power but not adequate legitimacy to rally widespread support of and adherence to their rule. Calls for communal work projects, for canal reparation and maintenance, frequently go unheeded. A large part of the problem is that plot owners do not control adequate labor to meet all of the household's demands. Each cultivator has multiple fields, both traditional and irrigated, and labor is often in short supply. Even though population growth has been rapid in the past twenty years, out-migration of the productive male population reaches upward to fifty percent. Cultivators also admit that part of the problem is the lack of interest in investing in anything that does not result in direct individual gain. There is wide consensus that the struggle for survival has become extremely self-oriented with little interest in communal activity or welfare such as is required in the PIV

³⁰ Interview with Moomunou Bah, NDulumaaji Demße, 26 March 1991.

organization.

Traditionally cultivators relied on the extensive land use practice of fallowing when faced with declining fertility. Today PIV cooperatives regularly abandon irrigated fields. It is as if the historical field fallow/abandonment practice, that is appropriate in an extensive agricultural system, has been incorporated into the PIV irrigation system when the group is confronted with one or more technical, social or physical problems. Field "fallowing" is inappropriate, however, for capital intensive agricultural systems such as irrigation. Four of the six PIVs in NDulumaaji Dembe have been abandoned within ten years of their creation and three of these cooperatives have constructed fields in new locations.³¹ One private irrigation field owner professed that he would abandon his present field site and make a new field if the land quality significantly diminished. The real cost of infrastructure development in irrigated fields does not make this extensive land use practice economically feasible. The field owners had not based the management of their fields, however, on real costs which they are now forced to do since the withdrawal of state subsidies. Also, until recently *fonde* land was available for new PIVs. With increased demand for irrigable land and a new hesitancy on the part of traditional land holders to relinquish land, finding a new field site will no longer be easy. The irrigation land that has been abandoned lies totally void of vegetation and exists as a reminder of the ecological devastation clear cutting and irrigation can cause in this arid environment.

³¹ Out of 215 perimeters developed in the Department of Matam, only 121 were cultivated during the 1989-1990 season. These data were acquired through personal communication with SED staff in Matam.

DIMINISHING RETURNS

According to the local residents, drastic changes in resource use strategies began occurring only after Senegal gained independence. This section summarizes significant transformations that have occurred in the *waalo-falo-jeeri* system since the 1960s that have affected resource access and use. Altered social and ecological conditions have led to a drastic decline in productive land area, increased competition for the remaining cultivable land, grazing, fish and forest resources and expansion into new areas and the deterioration of communal management and property systems. National policies have instituted further changes in natural resource use and management. Mutations of earlier practices and structures exist alongside novel strategies. The state's management policies for each of the major natural resources are considered in this section.

Ironically, at the same time integrated local natural resource management has been advocated and legislated through the creation of the *Communautés Rurale* the social and resource use spaces have continued to be separated and categorized into distinct sectors -- fishing, herding, agriculture, forestry. The tendency that began in the colonial era, to sequester the different productive activities into discrete and limited spaces, continues today.

The Consequences of Land Resource Competition

Decreased areas of productive agricultural land, coupled with "simple reproduction squeeze"³² at the local level, population increases and the loss of local control over land resources have all led to increased competition for access to land among local users. Chapter VI described how local land holding elites maintain their control over land resources through dual adherence to traditional structures and contemporary laws. Increased land competition

³² H. Bernstein, "African peasantries: a theoretical framework," Journal of Peasant Studies, no. 4 (1979), p. 427.

has caused rents to rise, altered inheritance practices, curtailed land lending and changed the *rem-peccan* relationship.

Within families, competition over access to land resources has affected inheritance patterns. The processes of *waalo* and *falo* field subdivision and fragmentation continue, resulting in land holdings that are sometimes too small to be cultivated.³³ Households in the same segmented patriliney occasionally elect to reunite the field segments and rotate the field between all rightful holders on an annual or per flood basis. Land inheritance patterns have evolved from an arrangement whereby the land was given to the oldest male in the family who cultivated it until his death to individualization of holdings and finally to the present rotational arrangement when individual holdings become too small for individual use.³⁴

People continue to acquire access to *waalo* and *falo* fields through inheritance, sharecropping, free loans or by renting (*coggu*), a practice that experienced first a rise and subsequent decline since independence.³⁵ Over the years the cash value of land "rental" has risen steadily.³⁶ Most informants claim that the use of sharecropping arrangements is growing more frequent. The *rem-peccan* system has changed in one important respect,

³³ When the *falo* fields are cultivated one can readily see one and two meter strips that remain uncultivated. These constitute individual land holdings that are too small to cultivate but are not redistributed to holders of adjoining fields.

³⁴ One interviewee (in his late sixties) stated that it was his father's generation that began the rotation system. Interview with Mamadou Sarr, in field, 18 February 1990. The commencement of this system corresponds to the fragmentation of extended family households into nuclear households. A marked increase in subdivision of compounds began occurring in the late 1950s and early 1960s.

³⁵ Since the 1980 institution of the 1964 Law on the National Domain, field owners often rent or freely lend land for only single seasons rather than a period of years. Landholders fear that they will lose their right to the land if exploited by someone else for more than two years (this was discussed in Chapter VI).

³⁶ Currently rent for a *falo* field is 500 F CFA per two meter strip. The seasonal rents for *waalo* fields range between 5,000 to 20,000 F CFA depending on field size and situation.

partially due to increased competition, to the detriment of the sharecropper. In the past the production was divided often into thirds with the sharecropper receiving two-thirds of the harvest. Presently fields that are sharecropped in the study zone are split into equal halves. Land owners maintain that this change has occurred because diminished flood levels limit the amount of available arable land thereby reducing viable land holdings. Deteriorating flood conditions coupled with continued high demand for land has led to deteriorating conditions for the sharecropper.³⁷

The *jeeri* fields that continue to be cultivated are fallowed less often out of fear of losing control of the land. Cultivators are well aware that soil degradation and reduced crop yields result from no fallowing, but people are more apt to remain on the same field under the present social and ecological conditions. Productive rain-fed field sites are limited and in demand and fallowing a field could result in the loss of future access to the land. Confusion over the meaning of the 1964 land law, competition for control of productive land and the current sense of diminishing control of their resources has made many cultivators apprehensive about fallowing their productive fields, even *jeeri* land.

As vast agricultural zones have gone out of production the *jeejegol* has become a new cultivation zone in the area. Expansion into this frontier zone has resulted from local residents seeking free access to productive land. Most of the *jeejegol* land in the study zone

³⁷ IDA researchers in the Matam region report different findings on the question of present sharecropping arrangements. Magistro found that *rem-peccan tatibal* (division of harvest in thirds) is currently more common than *rem-peccan didibal* (division of harvest in equal halves), while the inverse was true in the past. He does not provide any analysis of this change. Niasse reports the same finding for Doumga Rindiaw, explaining that the heavy labor required to clear the land in 1988 made the *rem-peccan didibal* unsatisfactory for sharecroppers. Only Nuttall found that *rem-peccan didibal* dominated in Bokidiawe, but proposed that the unacceptability of this arrangement for sharecroppers accounts for the large expanses of uncultivated *waalo* land in 1988. See M. Salem-Murdock, M. Horowitz, and T. Scudder, eds., "Activity Progress Report," Senegal River Basin Monitoring Activity (Binghamton, NY: IDA, November 1989).

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has been converted to rain-fed fields during the past ten years, with massive land clearing during the 1990 season, as local producers seek out new areas to compensate for the land that has gone out of production. Deforestation of the zone has proceeded rapidly over the past decade, with most of the fields created within the past four years. Twelve hectares of wooded *jeejegol* land in the NDulumaaji Demße *leydi* were cleared in 1990, representing a small total area that accounts for a significant percentage of the remaining wooded land in the zone. The *jeejegol* was not cultivated before the most recent drought because the soil was too humid for rainfed agriculture and did not receive flood waters to permit recession agriculture. Today cultivating *jeejegol* land reduces the risk of rainy season crop loss because the heavier soils retain more moisture than the sandy *jeeri* soils and virtually replaces *jeeri* cultivation.

The possibility for land grabbing has contributed to the interest in the *jeejegol* zone. There are no traditional holders of this land, which exists as part of the village communal holdings, leaving it free for the taking by those who clear the land. At a time when local residents fear that they are losing control over their land, they are eager to claim rights to the communally held land before the *Communauté Rurale* redistributes it to other villagers or outsiders. In the past, such land would be in the trust of the *jom leydi*, who would grant permission to those requesting the right to clear a field. Today villagers are asserting claims to this land through clearing and cultivation, without seeking prior permission. What is particularly interesting, however, is that while the *jom leydi* is no longer consulted as he was in the past, social rules that control access to land resources continue to exist in the village, effectively limiting access to *jeejegol* land to Torooße and Seßße. The prospect that this land may be irrigated in the future also accounts for some of the recent interest in the *jeejegol*. When asked if *jeejegol* land will be incorporated into irrigation projects, the new field owners admitted that they assume this will occur. As current exploiters of the land they calculate that

they will receive priority access to new project land if their fields are consolidated into future developments.

In the past five years cultivators in the study area have begun to exploit a new niche in the *jeeri* zone. Residents have cleared seasonal lakes for traditional rainy season fields in the *jeeri* and *jeejegol*. As cultivators search for soil types and field environments with high moisture retaining capacities, new unclaimed sites are explored. Lakes were once considered communal property and protected as seasonal water sources for herds and humans. Habitation on their borders was strictly prohibited, yet now they are cleared and cultivated. After the trees in these low lying areas are cut and the land is cultivated, the lakes cease to exist and the tree species do not regenerate. Only the lakes in the immediate vicinities of villages continue to be protected from devegetation and cultivation.

Extensive cultivation practices still dominate in the *waalo-falo-jeeri* production system. Less total area is cultivated today than in the past, even with population increases, because of decline in rainfall, lack of flooding, and the slow development of irrigation infrastructure. Cultivation maintains priority over other resource uses, which has facilitated its expansion into new niches, such as the *jeejegol* and dry lake beds. No local authority serves to protect long-term communal interests, although the rural councils have been enlisted to perform this function. While extensive land use practices made sense in the past, their applicability to current conditions is questionable. Clearing woodlands and land grabbing for short-term gain have long-term consequences for the survival of the biophysical environment and, in turn, for the local society. These practices are transforming the environment in ways that may ultimately make it less productive. But, as Mackenzie points out, the current circumstances of the local producers has led to a situation whereby villagers are calculating that the "maximization of short term economic gain through mining of the resource base may

outweigh the long term consequences of this action."³⁸

No Motivation to Move

In the past the cattle kept the herders alive but now the herders must struggle to keep the animals alive.³⁹

The independent state of Senegal has continued to manage pastoralists in much the same way as did the colonial authorities. Herding activities, and the associated local common property system, continue to be blamed for much of the environmental degradation in the region. Sedentarization, through the construction of bore wells and the creation of reserves, has remained a favored strategy. Provision of veterinary and sanitation services prevailed as the mainstay of the government's strategy toward the pastoral economy.⁴⁰ Efforts to introduce commercial management schemes became more prevalent after independence but few advancements were ever made on this front. Rather, most state policies and strategies continue to marginalize pastoralists. While animal husbandry is accepted as an appropriate economic activity for the state to encourage, the local production system and resource management strategies of the Fulbe have been repeatedly rejected. The little that the government has accomplished and the minuscule amounts spent on the Fulbe pastoral production system are the most notable features of their policy.⁴¹

The expanded number of wells and bore wells during the late 1970s and early 1980s

³⁸ F. Mackenzie, "Development from Within?", p. 17.

³⁹ Interview with unidentified Pullo during group interview, LawLaw, 10 April 1991.

⁴⁰ *Décret 62.0258 du 5 juillet 1962 relatif à la police sanitaire des animaux* created "sanitary routes" along traditional migration and commercial axes, whereby health papers were required at all bore wells before animals were allowed to water.

⁴¹ See Ch. Ba, *Les Peul du Sénégal*, pp. 202-203 for a summary of state expenditures on pastoralism.

opened up new areas to year-round grazing but also continued to concentrate livestock, leaving large grazing areas almost unoccupied. The Pastoral Service and the Water and Forestry Service were charged with assuring environmental conservation in the newly opened pastoral zones. They enforced programs limiting herd numbers, enforcing bush fire control, and improving regeneration of vegetation. Such policies allowed them to restrict and control herding activities.

With the loss of mobility, social cohesion, and pastoral spaces,⁴² along with increased herd sizes, the post-independence production system and management strategies of the Fulße no longer achieved long-term stability between herders, herds and the physical environment. Social cohesion has generally declined, replaced by individual resource use strategies.⁴³ The transformation of what was once a common property management system into a competitive, individual-oriented system has been detrimental to the pastoral economy and the physical environment.

Herd sizes continued to grow as a result of the veterinary practices, the construction of bore wells, household economic interests and the discouraging economic policies toward animal sales. Even with the huge herd losses incurred with drought, the herd sizes have largely been recovered although herd composition has changed. No longer subject to traditional social, ecological and economic controls that kept herd sizes in line with available resources, herds have expanded without pause.

The Futanke pastoralists have never been incorporated fully into the market economy, therefore no system exists for consistent offtake to control herd growth. Much of the animal

⁴² See Ibid., p. 149 for supporting data.

⁴³ See Steven Lawry, James Riddell and John Bennett, "Land Tenure Policy in African Livestock Development," in Livestock Development in Sub-Saharan Africa: Constraints, Prospects, Policy, edited by James Simpson and Phylo Evangelou (Boulder: Westview, 1984), pp. 245-259 for a discussion of this transformation.

marketing activity that takes place is speculative and dominated by non-Fulɓe such as local entrepreneurs, livestock service agents, and wealthier cultivators. Those involved in irrigation market goats and sheep to cover the input costs of irrigation. The government has not shown much interest in supporting a regional market for milk production; instead they have focused on developing meat production for the international market. National policy makers envision the creation of large scale ranches in the Ferlo and pen-feeding arrangements in the Senegal River Valley, eventually eliminating traditional production systems.

Fulɓe have become increasingly sedentary. This is true of both Fulɓe *waalo* and Fulɓe *jeeri*, even though most of them continue to seasonally move their animals out of their primary zone. To accommodate herd needs while remaining sedentary, herders are adopting two principal strategies. On the one hand, Fulɓe are separating the herds from the household for more extended periods of time, sending the herds with individual family members or hired labor. On the other hand, the herders increasingly rely on pen feeding larger numbers of animals, using purchased and collected fodder part of the year.

Following the first strategy, normal patterns of movement for cattle herds are southeast into the *jeeri* and eastward into Mali for the sheep herds. The animals return to the family residence for only a short period of time during the annual cycle. Moving the entire family in search of grazing is rarely done today for several reasons. First, good pastures are very widely scattered; secondly, herders increasingly rely on cultivation and must remain near the fields and, thirdly, Fulɓe value being close to the amenities found in villages.

The second strategy evolved as greater quantities of rice stubble became available for use as fodder. This development follows the program advocated in the *Nouvelle Politique Agricole*. In the national policy program the river region is designated as a zone for intensive

herding of young animals, exploiting agricultural by-products for fodder.⁴⁴ The long-term effort to sedentarize the Fulße is finally showing results.

The Fulße in the near-*jeeri* who customarily moved into the *waalo* during the dry season, even after the bore wells were constructed in the 1950s and 1960s, seldom pursue this strategy today.⁴⁵ The *waalo* no longer provides adequate pasture and is too densely populated with year-round resident Fulße. The only recent newcomers to the *waalo* have been Fulße from Mauritania fleeing from or driven out of that country with the 1989 events. Although the refugees brought large herds into the zone their numbers quickly diminished as they moved southward to the southern Ferlo in search of better pasture. Their presence temporarily stressed the scarce pasture resources according to local residents, but the impact of this influx is difficult to calculate and passed within two seasons.

Seasonally moving to the *jeeri* is not feasible for many Fulße in the Valley due to the elevated number of animals required to maintain the herd's needs and the needs of the family when in the *jeeri*. A large herd is required because an increasing portion of the animals must be sold during the season to pay for the upkeep of the rest of the herd, especially to cover water costs.

Remaining near the river means that herders do not pay for water, but it usually means that some fodder must be purchased. Conversely, moving towards the *jeeri* usually guarantees free grazing, but water costs can be high. One way or another, the pastoralist today usually pays a substantial amount for some aspect of herd maintenance, a novel development in the pastoral economy.

⁴⁴ See République du Sénégal, Ministère du Développement Rural, Direction de l'Élevage, "Nouvelle Politique Agricole-Voley Elevage" (Dakar: MDR/DE, 1985) and SODESP, Note technique No. 16, Bilan technique et économique au 30 juin 1985 (Dakar: SODESP, 1985).

⁴⁵ Until very recently Fulße from Kaawal, Katoote, Gudule, Nabaaji Siwol, Saraduru, Hontorobe, Cikit, Pambi, Seedo and LawLaw moved their herds into the *waalo* after harvest.

The Fulße in the study area are becoming less distinct from the sedentary agriculturalists with herds. Both groups are primarily sedentary, employing laborers to tend their herds and pen feeding an increasingly large portion of the herd. Herd numbers have risen along with irrigation developments, both as a way to pay for irrigation costs and because agriculture is not sufficient for household reproduction.⁴⁶

A Losing Battle: Fishing in the Senegal River Valley

It is a cry of alarm that we issue to the Administrative Authorities. Less than ten years ago, those fishing with large nets returned from an outing with three, four, five boats, and even more, filled with fish of the best quality. It was the easy life. Now fish have become impossible to find; the fish is depopulated.⁴⁷

The impact of the *gußal* net continued to intensify and by 1961 the *gubal* net was responsible for an average of 47.3% of the total annual fish production in the Senegal River Valley, accounting for an even higher percentage for the period December through May. The proportion of production acquired from the use of the *gubal* in the Matam region remained lower, at 23.6%, but still accounted for a significant proportion of the annual catch.⁴⁸ The heavy reliance on this form of fishing provoked a disequilibrium between offtake and fish stocks and also generated the underemployment of many artisan fishing people.

Social differentiation within the Subalße fishing community, which manifested itself through the differential access to the *gubal* net, led to the continued deterioration of the common property system, that basically had deteriorated greatly by independence. The

⁴⁶ Oussouby Touré, "Développement pastoral et contraintes foncières dans la zone sahélienne du Sénégal," (Dakar: CSE, June 1991).

⁴⁷ Ibrahima Sériba Thioub, chef du Centre d'Information de Matam, "Rapport Annuel 1964 - Faccicule 2" (Dakar, 1964), p. 2.

⁴⁸ R. Cremoux, Etude de la Pêche dans les Eaux Fluviales du Nord Sénégal (Richard-Toll, Sénégal: Service des Eaux et Forêts, Octobre 1961).

regulated and sustained local management system gave way to open access resource use, along with minor developments of private access to fishing resources. Only meager attempts were made by the state to control and manage access and use of the fishing resources. Greater heterogeneity of interests and capabilities developed within this relatively closed group, leading households to pursue their own economic interests and autonomous decision making, reinforcing the breakdown of local-level community controls.

Early in the post-colonial administration, the Water and Forestry Agency restricted the number of *gubal* nets allowed in the Valley by assigning each fishing cooperative a limited quantity of permits. The purpose of this restriction was primarily conservationist but the government also sought to protect the small-scale fishers who were disappearing as a consequence of *gubal* net fishing.

Interestingly, the government's approach to managing the local fishing economy combined state regulation with a recognition that local fishers had a role in resource management. Using members of the fishing population was, in part, a necessity since the government did not have adequate human or financial resources to manage fishing activities throughout the Valley. Legislation in 1963⁴⁹ divided the Senegal River and its tributaries into fishing sectors or territories, purportedly respecting the "natural units of exploitation and development."⁵⁰ The Subalbe were required to organize into fishing cooperatives and regional councils that were composed of delegates from each fishing village in the sector. The regional state authorities were directed to consult with these councils in regards to questions concerning the administration and development of the local fishing economy, thereby closely involving, in theory, the local population in resource management. The

⁴⁹ *Loi N° 63-40 du 10 juin 1963 réglementant la pêche dans les Eaux Continentales.*

⁵⁰ République du Sénégal, Conseil Economique et Social, "Etude sur la Pêche Fluviale au Sénégal" (Dakar, Novembre/Decembre 1970), p. 17.

cooperatives and their leadership were given the task of enforcing the rules and regulations established by the state while retaining traditional responsibilities such as opening and closing the fishing season. Cooperative presidents regularly conferred with village elders and *jaaltaaße*, to whom they were related frequently, about these dates and other management issues, thereby maintaining links between the traditional and contemporary authorities. The newly instituted cooperative, portrayed at its inception as an institution that would enable fishing people to strengthen their economy, never performed its promised functions nor assisted significantly in the management of the fishing resources.

The state also attempted to manage fishing resources through a licensing system. All river fishers were required to purchase a license from the Water and Forestry Service but this system did not limit entry and only succeeded in increasing the hostilities the local fishing population felt toward the state.

By incorporating members of the local populations into the bureaucratic structure the state authorities attempted to co-opt local fishing people. Council members became the agency's police and were commanded to seize anyone fishing in the classified reserves and/or using banned fishing equipment. "The right to fish is no longer a personal right; it belongs to the State who grants permission, case by case, either for free or for a steep price. The repression of infractions is strictly defined according to form and scope."⁵¹ Objecting to this mandatory liaison with the government agency, the delegates, in alliance with the village *jaaltaaße*, often attempted to settle disputes and infractions on their own rather than take the offenders into Matam for official reprimand.

Assimilating local fishers into the administration's program largely failed to improve management of fishing resources for several related reasons. The local population maintained

⁵¹ Ibid.

that it had a local management system that the government simply duplicated for the purpose of extracting fines and fees from the local population. The state's creation of a parallel management system continued to encourage many fishers to reject all rules and regulations, be they of local or state creation. Local users spurned outside control of their resources and eventually associated all resource management with the state.

State and local management faltered for a second reason, initiated at the turn of the century and discussed in earlier chapters. The use of *gubal* nets and other improved fishing equipment increased competition and facilitated accumulation. The common property fishing resources were exploited with individual short-term gains in mind, to the demise of long-term community welfare. Neither local or state regulations successfully impeded the process of increasingly autonomous decision making and resource use.

Some fishing people now maintain that they would have been better off if the fishing resources had more strictly managed by the state, asserting that strong state management would have prohibited overexploitation. Most fishers, however, continue to view state regulation of fishing resources as an unwanted intrusion into local society.

Fish resources have faced drastic declines over the past several decades and the fishing people are witnessing the virtual end of their economy. The combined effect of changes in fishing equipment, low rainfall and virtual loss of flooding, irrigation pumping, the Manantali dam, destruction of fish habitats, the construction of the new levee structure at the inlet of the Jammal, a breakdown in the local resource management systems and the failure of state imposed regulations have all contributed to the loss of fish stock. The reason offered most often by local fishers to explain the tremendous devastation of the fishing economy, other than drought, is over-fishing. Most local resource users maintain that over-fishing, due to improved equipment and "self-interest" led to declines even before the lack of flooding and

rains.

The situation of the fishing population has become more complicated due to the political strife between Mauritania and Senegal. Fearing for their lives, many fishers have not cast their nets into the Senegal River since early 1989. If it were not for the violent confrontations between Senegal and Mauritania the fishing people from the Jammel would be fishing the Senegal River part of the year, where the catch is significantly better and easier. Some fishers living on the Senegal River risk their lives to fish, with loss of life a possible price to pay.³² With the numbers of people fishing the river drastically reduced, the catch per fisher has greatly increased.

The vast majority of Subalße families can no longer rely on fishing for the reproduction of their household; instead their subsistence hinges on the receipt of remittances from family members working as wage laborers outside of the community, and increased involvement in agriculture. Some of the young men who have left search new fishing zones downriver in Richard Toll or in the Gambia and the Casamance. Subalße had the advantage of early access to SAED installed irrigation projects because of their relative proximity to the river although their access to land was limited.

The fishing peoples situated along the banks of the rivers possess few land holdings, a situation which has come to haunt many of them as the fishing economy disappears. The Almaamis and earlier rulers awarded fishing people little of the highly valued *waalo* land. As cultivation has become an increasingly vital activity for the fishers almost all households today rely on some field cultivation for their survival. Their lack of traditional ownership or access to productive land has put them in a precarious situation, although this did not put them at a

³² While conducting field work in the area between March 1990 to June 1991 I received information concerning three deaths and numerous other injuries incurred by the fishers attempting to work on the Senegal River.

great disadvantage when rice production first began in the region because the state awarded the Subalfe irrigation perimeters. More recently, however, traditional land holders have blocked their access to further land acquisition for irrigation.

The power, authority and purpose of the *mawdo ndiyam* and *jaaltaaße* have greatly diminished and will finally disappear the longer the people live without fishing. These water masters acknowledge that they will forget their "science" due to the lack of practice and application and that the society will no longer recognize a critical role for these individuals. A former water master sadly commented that the *Seßße* who fished for generations will simply become *Toroöße* if their resource base disappears.

The decline of fish stocks due to the loss of the annual flood following the construction of the Manantali dam is guaranteed to be severe.³³ Abolishing the annual flood eliminates the possibility of maintaining the essential interaction between the river and the floodplain. During the flood phase fish migrate into the backwaters to reproduce and the freshly hatched fish consume the dissolved nutrients from floodplain vegetation. Small scale fishing projects have attempted to supplant river fishing, but these have been unsuccessful technically and could not begin to replace the river and backwater fishing economies.

Separating the Trees from the People and the Land

Local forest resources remained under the authority of the central government after independence. As was true of the colonial forestry department its successor has been unable to successfully control or manage the use of forest resources. The 1965 forestry code instituted a regime of state protection of the forest "privileging penal sanctions which seem far

³³ Gannett Fleming Corddry and Carpenter Inc., "Assessment of Environmental Effects of the Proposed Developments in the Senegal River Basin, Partial Report for Fisheries" (Dakar: OMSV, 1978).

removed from the communal logic that is understood in the land law."⁵⁴ Indigenous knowledge and organizational capacity held by the local populations continues to go unutilized. Bromley asserts that such resource management "by proclamation" has "created perverse incentives at the local level where it suddenly became an act of honour to defy absurd institutional arrangements -- as well as a necessity for survival."⁵⁵ A new forestry code, placing greater management powers in the hands of the local population, has been under consideration for years. But, "fettered by the colonial legacy of the forest management and institutions, the state now finds it difficult to negotiate a new relationship with natural resource users."⁵⁶

The 1964 Law on the National Domain accorded the Forestry Service full control of Senegal's forested areas and all commercial forest exploitation.⁵⁷ The 1935 Forest Code was revised in 1965 with only a few alterations made to conform to the 1964 Law on the National Domain.⁵⁸ The Forestry Service expanded its role as policing agent, witnessing a large build-up in forestry agents with independence. The 1972 law accorded rural councils the

⁵⁴ M. Debène, "Rapport de Mission," Manuscript (Dakar: CAB, 1990).

⁵⁵ D. W. Bromley, "Natural resources and agricultural development in the tropics: Is conflict inevitable?" in Agriculture in a turbulent world economy, edited by A. Maunder and U. Renborg (Oxford: Gower, 1986), p. 322.

⁵⁶ Mark Schoonmaker Freudenberger, "The Evolution of the Gum Arabic (*Acacia senegal*) Collection System in the Jolof, Northern Senegal c. 1890-1990," paper prepared for the International Association for the Study of Common Property Common Property Conference, 26-29 September 1991, Winnipeg, Canada.

⁵⁷ There are several recent publications that review Senegal's forest resource policies and legislation. See K. Elbow and S. W. Lawry, "Forestry Legislation in Senegal," Report of a consultancy for Direction of Soil Conservation and Reforestation, Senegal Reforestation Project USAID no. 685-0283 (Dakar: USAID, 1989) and K. Elbow and A. Rochegude, "A Layperson's Guide to the Forest Codes of Mali, Niger, and Senegal," Land Tenure Center Research Paper No. 139 (Madison, WI: Land Tenure Center, 1990).

⁵⁸ *Décret N° 65-078 du 10 février 1965 portant code forestier.*

responsibility of managing land and other natural resource access and use, but in reality the state has continued to control forest resources. The villagers maintain the right to manage usufruct of their wooded lands for subsistence purposes, but the state manages all commercial use of wooded lands and forests, which is driven by national energy policies. The contradictions between local responsibility and local powerlessness, first dichotomized in the colonial era, continue to the present day. "To ignore the tensions between the village and the center is to miss the essence of natural resource policy in many parts of the world."⁵⁹ Such tensions include different priorities in resource use, disparate objectives regarding that use, and dissimilar means for addressing conflicts among users at the local level and between local users and outsiders.⁶⁰

Forest legislation enacted in 1974⁶¹ replaced the legislative portion of the 1965 Forest Code but no major changes in the division of power or definition of use rights occurred. The law upholds the legal framework for direct state regulation of the use and management of forest resources in Senegal. The new law assigned the forestry service new powers as "intermediary" in the management and exploitation of forest resources within the agricultural zone. In the agricultural zone grazing is allowed without restriction and field clearing is granted with permission from and according to regulations of the forestry service. According to the Code, cultivators throughout Senegal are required to preserve twenty mature trees or sixty seedlings per hectare of wooded land that is cleared for agriculture. All commercial uses of forests, even those found in agricultural zones, are determined by the

⁵⁹ D. W. Bromley and D. P. Chapagain, "The village against the center: Resource depletion in South Asia," American Journal of Agricultural Economics 66 (1984), p. 868.

⁶⁰ Ibid.

⁶¹ *Loi N° 74-46 du 18 Juillet 1974 portant code forestier (partie législative)*, JORS 4375 (26 août 1974).

forestry service and are subject to the same regulations, permits and fines as in the forest domain.

In response to growing national and international concern over the environment, the government of Senegal created the Ministry for the Protection of Nature in 1983 but the ministry had been dissolved by 1990 in response to the demands of structural adjustment. During its existence the ministry assumed the task of limiting and rationing access to natural resources, including those used in the production of charcoal.⁶²

The most significant state forestry policy affecting local resources in the recent decades concerns charcoal production.⁶³ Since 1986 charcoal producers have been in the River Region, manufacturing charcoal for export to urban markets. Even after discouraging charcoal production in the 1970s out of concern for drought related degradation of forest resources, the growing urban demand for the product pushed production to points as far afield as the study area. Production zones and associated quotas are determined on the national level and production plots are assigned by Department level forestry personnel. The local population has little voice in the use of their tree resources for charcoal production.

Trees and land in Senegal are administered separately by two different bureaucratic structures and regulated through contradictory laws. These incongruities further complicate local resource management efforts. The two sets of laws operating include the 1964 and 1972 laws discussed in Chapter VI and the national Forest Code. The 1964 Law on the National Domain accords rural councils wide control over resource use decisions for the land under their jurisdiction. The 1972 legislation strengthens local rural institutions and gives rural

⁶² Jesse Ribot delineates and analyzes the failures of the rationing and quota systems, see J. Ribot, "Markets, States and Environmental Policy: The Political Economy of Charcoal in Senegal" (Ph.D. dissertation, University of California-Berkeley, 1990), pp. 128-130.

⁶³ See Ribot's thesis for a full discussion of the Senegal's charcoal production policies.

councils the prerogative to develop and institute coordinated development and land use plans for its territory. According to the present Forest Code, however, the rural council has no authority to mandate regulations affecting commercial activities of forest resources in their territory nor to distribute land for clearing without the forestry service's permission.

In direct contradiction to the Forest Code, the Law N° 80-14 of 3 June 1980 grants the rural council the right to plan for the exploitation of all forest products that are gathered and cut. Great ambiguity results from the contradictions between the Forest Code and the 1980 amendments to the Local and Territorial Administration Law. These incongruities and the separation of the trees from the land highly confuse matters for those communities interested in managing and protecting their physical environment.⁶⁴ A village may be able to acquire wood lands through the rural council to create a protected forest reserve, but the forestry service holds the legal authority to make management decisions concerning the trees on the acquired land. The rural council's lack of rights to legislate regulations pertaining to commercial exploitation of forest resources currently affects the local communities that oppose charcoal production in their territory.

The recent changes originating both externally to and internally within the local communities have caused a deterioration of the existing forest common property resource system. Local institutional disintegration has occurred as practices of resource use change, rights come into competition and the local management systems confront outside influences.

The question of who actually controls access to and use of the wood resources in the Senegal River Valley immediately emerges as a confusing issue. Ambiguities arise because of the discrepancies between legally assigned rights and accepted or practiced local rights. Furthermore, application of both set of rules varies according to the level of outside,

⁶⁴ A new Forest Code has been drafted, but not yet promulgated, that grants local communities greater local control over forest management.

especially national, interest in the resources. These uncertainties become even more confusing when state laws are inconsistently applied to local situations. State laws may be superimposed, in theory, on local rules but not enforced when the state has no interest in controlling access to and use of the resources. The same state laws may be applied with force in a particular local setting where the central government has direct interest in the resource. The Forest Code altered little for inhabitants of the study area when it was first enacted; only recently, when these regulations were actively enforced in the region, did their impact become apparent.

Since the 1935 French colonial forest decree, the forest resources have been treated as a mixture of common property and state property, with the forestry service maintaining management jurisdiction while appropriating some rights to those who have traditionally used these resources. Today the local rules that once governed the use of forest resources are no longer accepted by the forest service because the national demand for these resources, specifically charcoal, has increased. Furthermore, the local rules are not accepted any longer by all members of the community. The common property rules no longer successfully define user group membership, user rights nor serve to reduce conflict between traditional user groups and between the local users and outsiders.

SHRINKING SPACES

The post-colonial, post-drought situation in the study area is recalled as a series of losses for all resource user groups. Land has gone out of production, water no longer flows, trees have become desiccated, the grasses do not grow and the fish have vanished. This section focuses on the consequences of natural resource losses and on the changing spatial dimensions of the resource use strategies of resource users.

Resource use space is being reorganized and redistributed amongst the competing resource users in the zone. The shrinking space available for productive natural resource use activities affects the organization with each resource user group, the relations between members of different resource user groups and the interactions between all resource users and the physical environment. The losses of natural resources have put more pressure on the resources that remain, increasing competition for access to and control over productive resources.

Losing Land

Lower flood levels and rainfall account for major losses of productive agricultural land in the *waalo*, *falo* and *jeeri* and have led to the clearing of *jeejegol* areas. River flooding has been very irregular since 1968, initially because of altered climatic conditions and subsequently due to mechanical regulation of the river's flow. Since the Manantali dam became operational in 1988, controlled releases have been non-existent or inadequate for traditional floodplain agriculture with the exception of the 1988 flood season when extensive flooding of *waalo* land permitted cultivation. Promised timely releases of reservoir waters have not occurred, proved insufficient or have failed to correspond to natural flood peaks from other branches of the river causing two distinct floods, thereby devastating crops. Official plans incorporate artificial flooding during a transitional phase, to be continued until the local population becomes involved fully in irrigation agriculture. The leadership of the tri-state Senegal River development organization OMVS (*Organisation pour la Mise en Valeur Fleuve Sénégal*), however, does not agree with the principle of continued artificial flooding and has failed to carry out the policy. The OMVS's position is steeped in political battles which have little relation to the local populations along the river. The political tensions

between the member countries have prohibited them from making joint decisions concerning water releases. Without a flood, the *waalo* – the most productive and least risk-laden agricultural land – is left fallow. The local land users have had no say in any of these decisions that determine their fate.

Impending stabilization of the water level of the Senegal River threatens to eliminate a large portion of *falo* field production along the river's banks and the banks of its tributaries. Controlling water levels through scheduled releases to generate hydro-electric power and permit year round irrigation will abolish the natural cycle of submersion and fertilization of the riverbank fields. Delayed releases, or releases that do not correspond to the natural flood peak, have already had devastating consequences for those cultivating the river banks, wiping out planted fields.

Recent construction of irrigation infrastructure, primarily dikes, in proximity to newly cleared *jeejegol* zones has put the productive viability of many of these fields at risk. Dikes around project areas have impeded essential runoff from reaching the *jeejegol* fields, diminishing the land's agricultural potential. The dike around the NDulumaaji Intermediate Perimeter was necessary for the irrigation project but has been disastrous for the fields on adjacent lands. Large expanses of *jeejegol* land recently cleared for rainy season cultivation have been abandoned because of these micro-hydrologic changes caused by irrigation dike and canal construction. Since traditional cultivation practices are not recognized as a form of "*mise en valeur*," neither project authorities nor the state are compelled to remunerate the losers.

Jeeri cultivation has all but been abandoned by most local residents. The risks associated with rainfed agriculture under present rainfall conditions, lack of fencing material and the related risk of field damage caused by herds, combined with lack of adequate labor

have led many cultivators to desert their *jeeri* fields.

The short- and long-term consequences of the recent rapid clearing of the *jeejegol*, some of the last remaining wooded areas in the study area, can only be postulated, but the repercussions appear negative. Loss of the wooded area affects herders who camped in the zone and exploited the area for fodder throughout the year but especially during the dry season when grasses are especially scarce. Clearing the wooded *jeejegol* also means a loss to the poorest community members who form the segment of the population most dependent on gathering wild fruits from the zone. Furthermore, all villagers regularly collect fuel wood in the *jeejegol* zone. Over the years increasing numbers of residents from neighboring villages situated in the *jeeri* have come to the remaining *jeejegol* zones to cart off wood for fuel and construction.⁶⁵ These possibilities will disappear with continued *jeejegol* clearing.

As land resources shrink land disputes continue to rage, blending tradition with contemporary land issues. Land disputes were found to be frequent occurrences in all the villages in the study area, although most older informants insisted that land disputes were even more common in the past than today. When the *waalo* lands flooded regularly the battles over field boundaries and inheritance rights abounded. The quality of the disputes is slowly evolving, however, because current law protects the active cultivators rather than traditional land holders and has legally eliminated traditional land rights and claims.

In the past most of the land disputes were settled internally, by the elders of the village. When the neutral parties could not resolve a dispute the case was taken to be judged in Matam by colonial authorities. With independence, factional alliances played a larger role in village politics and the possibility of reaching a neutral village decision diminished.

⁶⁵ Fifty-seven percent of those interviewed stated that neighbors are likely to enter *jeejegol* areas to collect wood and other forest resources, as compared to twenty percent who stated that neighbors came in the past.

Settlement of village disputes increasingly demanded outside mediators. Today the rural council is responsible for neutrally mediating land disputes, but factional membership and local power struggles influence decisions.⁶⁶ As discussed in Chapter VI, the local elites serving on the village council continue to protect historic power structures, making decisions that fuse and confuse tradition with current law.

Displacing the Fulɓe

The significant decline in the availability of grazing resources and pastoral spaces along with the growing numbers of animal owners has increased competition over the remaining resources. This competition has stimulated a rise in efforts to control access to and use of scarce resources. Greater tensions have developed between outsider herders moving into zones occupied by resident populations, be they Fulɓe or other animal owners.

The development of irrigation and the clearing of *jeejegol* land present numerous difficulties for the Fulɓe since the changes have destroyed important grazing zones. Furthermore, the loss of the flood waters virtually eliminates floodplain grazing possibilities. Many of the reserved animal pathways leading to water sources, in this case the river, have been impeded by the construction of a maze of rice fields, canals and dikes, making access to watering increasingly difficult. Animals often are not allowed to freely enter rice fields after harvest, eliminating another important source of forage and posing a herd control problem throughout the year rather than just during the agricultural season. There is also fundamental conflict between the herding and irrigation calendars should the herder want to cultivate rice since herds normally move away from the river into the *jeeri* at the same time labor is needed for rice cultivation.

⁶⁶ Interview with Moominou Bah, Ndulumaaji Demɓe, 14 August 1990.

Reminiscent of the earlier and continuing policies instituted to the south when the Mourides were conferred huge tracts of grazing land for peanut production, the development of irrigation has eliminated land traditionally available to the pastoralists for seasonal grazing. Coexistence between the two user groups becomes more tenuous as irrigation expands. The overlapping rights in and multiple uses of these resources have dwindled and the production systems have grown mutually exclusive.

Recent construction of the NDulumaaji Demŕe Intermediate Perimeter, encompassing 450 hectares, has altered drastically the grazing options for local herders. The mere size of this new type of project portends worse times ahead for herders since perimeters of this magnitude are now the model type for the region. The resident herders have lost a major portion of their grazing lands and can no longer stay in the area throughout the year unless they rely on purchased fodder. Yet, moving out of their home residence confers upon them the status of strangers and outsiders, making resource access all the more onerous.

Herders' concerns mount as they receive warnings that infractions for animals entering the fields will now be settled by killing the animals or fining the herders exorbitant sums. "The project authorities and the state have written rules concerning the irrigated lands which are clearly anti-pastoral.... The government is clearly on the side of the cultivators. Now that agriculture demands capital investment there is no tolerance or mutual understanding between the herders and cultivators.... The herders have lost out."⁶⁷ The pastoralists feel marginalized as irrigation developments progress. Pastoralists have ambiguous attitudes toward irrigation works, however, since they also recognize their growing need to partake in these developments.

Many herders speculate that traditional forms of animal raising will not endure into

⁶⁷ Interview with Amadou Mamadou Ly, NDulumaaji Funeeŕe, 5 August 1990.

their childrens' future. They maintain that herders will be forced to combine irrigation with pen feeding, which fits the government's vision of meat production. Herders calculate that they will either need to enter irrigated agriculture more fully or move out of the region entirely. At present a principal reason herders are investing in rice production is to produce rice stubble needed for their animals. If they do not cultivate their own fields they are forced to routinely purchase rice stubble. The availability and prices of stubble are highly variable and depend on the quality of natural grazing in the area, the amount of rice stubble produced in the vicinity and the time the purchase is made. Prices range from 5,000 CFA to 30,000 CFA for the stubble on less than two-tenths of a hectare. The rights to graze on a rice plot with green regrowth is sold for as much as 45,000 CFA.⁶⁸ This situation of purchasing field stubble contrasts sharply with the earlier arrangement whereby cultivators invited, and often compensated, herders to graze their herds on a harvested field.

Within-group unity and the arrangements between herders have diminished as individual households attempt to survive the economic and ecological adversities of the region. Individualistic resource use strategies adopted to meet immediate needs predominate. Resource management for long-term ecological and economic sustainability are not viable options for herders struggling to survive.

Sedentary villagers are more tightly controlling herd movements in their territories because of their own increased use of pasture for their growing herds. Residents recounted a number of episodes whereby the majority of villagers successfully prohibited fellow villagers from inviting Fulße to install their herds on fields for manuring. The villagers increasingly refuse to tolerate the traditional practice of sponsoring herders because they do not want Outsider animals in their territory. The villagers also prohibit visiting herders from exercising

⁶⁸ Interview with Bahoore Bah, Pullo *waalo*, 2 March 1991.

horum, the fencing in grass and forest areas around their camps for private use, a common practice in the past.

Within the last five years the residents of several of the villages in the study area have demanded that visiting herders living in their *terroir* rejoin the village to preserve the pasture for all users. This has been a common local strategy for the past fifteen years, to minimize trampling and to ensure that villagers, with growing herds of their own, have the same access to the grazing resources in their territory as the outsiders. Sedentary villagers own many more animals than in the past and they are interested in preserving the pasture within their *leydi* boundaries for their own use.

In all the village territories in the study area, including those belonging to Fulße, there is currently some use of guards to patrol the woodlands, a practice instituted since the 1970s. Anyone entering the area bearing an axe is subject to fines, putting herders in a precarious position since they invariably carry axes. Village opposition to herders is mounting with some villagers wanting to totally prohibit herders from living within their territory. The Water and Forestry Service agents often side with the sedentary villagers, claiming that the Fulße pose the most significant threat to the environment.

Directly controlling access to grazing resources in the *jeeri* continues to be impractical and unacceptable but increasingly restricted access is accomplished by regulating access to water sources in the vicinity. Fulße *jeeri* have a greater opportunity to close areas to outsiders than Fulße *waalo* because they can control access to water. In the *jeeri* a newcomer must purchase or otherwise arrange access to water. Since 1984 village *Groupes d'Intérêt Economique* (GIE) have taken over operation of the bore wells from the state. Under village control, an outsider often pays twice the price as local residents for water at a bore well. By refusing to sell newcomers access to wells, charging exorbitant rates or by denying them the

right to dig seasonal wells the resident herders can effectively limit access to grazing in the area. Excessive water prices drop when no pasture remains in the vicinity.⁶⁹

Efforts to keep visiting herders out of an area are balanced with the age old recognition that all herders regularly need to move to outside territories to secure grazing. The distribution of grasses fluctuates too much for herders to want bounded resource spaces. As in the past, herders too tightly controlling the boundaries of their grazing territories may find themselves without access to neighboring zones in a time of need. Informants varied in their attitudes toward the practice of controlling access to water and grazing resources. Some asserted that such controls have always functioned in their society, others claimed that the restrictions were recent developments; but all agreed that this behavior has drastically increased in the past fifteen years.

As the open access grazing resources in the *waalo* and *fonde* diminish, some herders have been driven to move their herds away from rice cultivation areas into the *jeeri*, increasing the demand on the resources in this zone. The Fulbe *jeeri* claim that the recent increase in numbers of users has caused overexploitation of resources, but add that they have few options for curtailing resource use because they do not consider limits on herd size or the creation of grazing reserves as feasible options. From their perspective the only feasible solution is to create an even greater number of watering spots to improve herd dispersal.⁷⁰

To secure substantial dry season grazing areas for individual herd use, some Fulbe

⁶⁹ Group interview with residents of Laawol Diop, Fulbe *waalo*, 6 March 1991.

⁷⁰ For examples, see H. Barral, *Le Ferlo des forages* (Dakar: ORSTOM, 1982); E. Bernus, "Possibilités et limites de la politique d'hydraulique pastorale dans la Sahel Nigerien," *Cahiers ORSTOM*, série Sciences Humaines 11 (1974): 119-126; F. Bourlière, J.-C. Bille, M. Lepage, G. Morel, M. Y. Morel, A.-R. Poulet, "Recherches écologiques sur une savanne du Ferlo septentrional, Sénégal," *La Terre et La Vie* (Juillet-Septembre) 1972: 325-473 and G. de Wispelaere, "Les Photographies Aériennes Témoins de la Dégradation du Couvert Ligneux dans un Géosystème Sahélien Sénégalais: Influence de la proximité d'un forage," *Cahiers ORSTOM*, série Sciences Humaines 17, nos. 3-4 (1980): 155-166.

jeeri are opting to move deeper into the Ferlo settling far from a secure water source.

Preferring to use labor to haul water rather than to seek ample grazing resources, the animals are left unattended in the expansive pasture surrounding the camp. Family members transport huge quantities of water by cart and donkeys to the herds that cannot walk the distance between the camp and water source. This is a relatively new management strategy, requiring sufficient labor and capital to purchase the necessary equipment and to make the daily water runs.

With restricted movement, greater pen feeding and increased competition over resources, a significant commerce in *jeeri* grasses, primarily *Commelina forskalaei* and *Andropogon amplexus*, has developed in recent years, beginning as early as 1973 near Lawlaw. People in NDulumaaji Demße first purchased fodder around 1980. Some Fulße *waalo* go to the *jeeri* toward the end of the dry season to collect the grass and transport it to their herds. *Jeeri* villagers cut and transport cart loads of grass to market in the roadside and *jeejegol* villages. A cart load can procure 5,000 F CFA when fodder is in short supply. This market declines when the amount of available rice stubble increases. The Fulße *jeeri* try to protect the grass resources in their village vicinity from outsiders but they realize that they have no official or traditional backing to claim ownership of the grasses. They exploit the grasses closest to the village as quickly as possible and use group pressure to stop outsiders from intruding too closely into areas where they claim priority rights.

As pastoral spaces shrink herders are forced to abandon areas where they have sojourned for decades, if not generations. In leaving home the herders acquire outsider status wherever they go. Outsider status weakens one's range of choices and power to make decisions about resource use and management. Access to water, grazing and land for cultivation are controlled by permanent residents. For example, an outsider herder in the

waalo cannot cultivate there except through a *rem-peccan* relationship. They rarely gain access to *falo* fields, even under a sharecropping arrangement, because of the high resident demand for these fields. While some conserve rights to fields in their home territories of origin, many lose or give up rights to family lands by permanently out-migrating.

The further from home the herders move, the more problematic their relationships with local residents and state authorities become. The herders from the study area began to regularly move their herds into Mali thirteen to fourteen years ago, and this has caused the herders unprecedented problems and hardships which seem to intensify each year. Every household that has sent herds to Mali spoke of the imprisonments and fines incurred. Malians accuse the herders from the Fouta of ruining their natural resource base by chopping down their trees, starting forest fires, bringing sick animals into their zone and generally degrading their resources. The Malian Water and Forestry Service, known throughout West Africa for their draconian approach to resource management, regularly seizes Futanke owned herds and fines the herders.⁷¹ Once again, the outsider is seen as the culprit of degradation. As transient herders face mounting risks they have begun to favor staying closer to home even if this means purchasing fodder and/or water for their animals.

As pastoral space has been infringed upon from many directions, the areas remaining open to grazing are fragmented and separated. Herders cannot make efficient use of such highly dispersed grazing land⁷² and they are searching for alternative solutions in the spaces that remain available to them.

⁷¹ Group interview with residents of Laawol Diop, Fulbe *waalo*, 6 March 1991.

⁷² Ch. Santoir, Raison pastorale et développement.

Fighting Over the Fish that Remain

The 1964 Law on the National Domain created thirteen classified reserves along the Senegal River, five of which were located in the Department of Matam. Fishing equipment restrictions applied to these reserves at the time of flooding and were completely closed to exploitation during other periods of the year. Local residents knew the value of protecting the deep pools for a portion of the year and these areas had been protected under the local management system. The traditional rules no longer effectively protected the resources by the 1950s, however, and the state endeavored to reinstate these practices through legislation.

Local reaction to the state's directive to classify certain sections of the river gave rise to villages claiming stretches of the river as private village property. These local claims extended far beyond the sections of the river incorporated in the fifteen reserves. To the present day villagers continue to close sections of the Senegal River to outsider fishers. Hence, in the 1960s, the right to fish the pools that were once respected as communal seasonal reserves began to be treated as a private commodity. The *jaaltaaße* started abusing their power by charging fees for access to the reserve pools. The need to purchase rights to fish in the reserves prohibited equal access by all fishing people in the community and important segments of the river were no longer treated as a communal resource. Non-fishing villages situated along sections of the river containing deep pools imitated the actions occurring in fishing villages and increased control of their village waters. Village chiefs began charging for fishing rights or closed their pools completely. The practice was further corrupted when the *jaaltaaße* and village chiefs encouraged competition between the fishers to procure ever higher prices for fishing rights. The price of access continued to rise, individual rights to the reserved pools were sold and non-paying fishers lost access to extensive parts of the river.

Many local fishers objected to the corrupted *sokre*, or closure, system. In their support, the Water and Forestry Service asserted that the river, except for the classified zones, was public domain and free for use by all. Although the state affirmed that villages could not own fishing zones or charge entrance fees to sections of the river, these practices continued in many of the local communities. According to informants, traditional *sokre* has not been practiced on the Senegal River for the past fifteen years, for the past twenty years on the Jammal, and throughout most of the floodplain for the past seventeen or eighteen years. *Sokre* is no longer respected because of its corruption and because of the numerous conflicts that have erupted within and between fishing communities prior to its abandonment. Declining fish yields and a series of drought years also precipitated the decline of *sokre* and the rise in private fishing sector claims.

The Water and Forestry Service also attempted to regulate floodplain fishing after independence. The agency viewed with disdain the traditional practice of damming the backwaters to trap the fish for subsequent harvest, maintaining that it caused severe destocking. The technicians argued in favor of allowing the fish to return to the main channels of the Senegal River or tributaries after migrating into the backwaters to reproduce. They asserted that this would greatly augment fish stocks and help sustain river fishing. State agents never officially restricted backwater fishing practices, however, and they continued unabated.

Eventually in the 1970s the Water and Forestry Service reversed its stand and actually sided with backwater fishers, granting them permits to dam the inlets and protect the floodplain fishing grounds.⁷³ This policy to distribute permits stands in contradiction to the prohibition of private claims to river zones. This distinction corresponds to the state's

⁷³ The reasons for this policy reversal were not ascertained.

recognition of property rights in the floodplain while denying private rights to the river.

According to the agency, floodplain fishers can command control of backwater zones because they possess the *waalo* land over which the water flows, and it is the land not the water that is seen as a private resource.

Tensions between resource users heightened within floodplain fishing groups later than within Subalße communities. The local leaders had been able to maintain control over seasonal and equipment restrictions and limit the user group by residency until very recently. Social differentiation within the group of backwater fishers, which has traditionally combined nobles and former slaves, has not led to a deterioration of the communal management strategies. Their struggle to control access to the resources, which are spatially bounded by the village territorial limits, has been with the backwater fishers of other territories and with neighboring Subalße. The former *mawdo ndiyam* of NDulumaaji Demße dates the first major strains with "outsiders" over fishing access rights to 1962. The practice of outsiders coming in to fish closed areas has become increasingly widespread and can be accounted for principally by the growing scarcity of fish resources. The low flood years, beginning in 1968, have exaggerated these conflicts as river and floodplain fishing people compete for access to shrinking resource base. The tensions between Subalße and backwater fishers have become more pronounced as fish resources grow rarer.

Conflicts and competition between floodplain fishers are swelling because there are far fewer bodies of water to fish coupled with very meager fish stocks. One water master admitted that his power to manage resource use under the present conditions was waning. Some villages are attempting to protect and close smaller and smaller waterways for their own use but others argue that such restrictions are not allowed. Fishing people from villages that do not possess floodplain fishing areas oppose restricting access to the backwaters. They

argue that under the present circumstances of extreme resource degradation interested resource users should be allowed open access to all viable fishing grounds. Permits from the government to protect their backwater fishing zones have functioned to substantiate the villagers' claims on the resources and solidify their authority in managing and controlling the fishing waters.

The Subalße, who once fished the backwaters during the open rainy season and during the dry season when the season opened, contend that they are no longer allowed to fish the zone. The Seßße and Maccuße backwater managers and fishers maintain that the Subalße have not fished in these waters for generations but are currently seeking access due to the low yields in the river. In the past the backwater fishers relied on the Subalße for their occult knowledge and technical expertise, but under today's conditions of scarcity and safer waters, they oppose the Subalße's superior technical abilities and want to prohibit them from exploiting the backwater fisheries. Members of all fishing groups maintain that the notion of privatizing fishing waters has strengthened as the fishing economy has declined.

In recent years Subalße from the Jammel, closed out of the floodplain, also have been ostracized by resident fishers when they attempt to fish the Senegal River. The Jammel fishers are considered outsiders and are not allowed to fish near villages. The resident fishers assert that the increased numbers of outsiders coming to fish the Senegal River have caused overexploitation of the fish resources. In response, they are attempting to exclude all outsiders, preserving the river for their own use. If a newcomer settles near a fishing village, especially if the visitor possesses superior equipment, the person will be ordered to move. Possession of proper identification from the Water and Forestry Service presumably guarantees all fishing people the freedom to settle anywhere along the river but this has not proved to be the case as competition over resource access and control mounts.

Managing Dwindling Forests

Recently the local populations have lost further control of their common forest resources as the national government scrambles to secure energy supplies for urban dwellers. National demands on wood resources in the region are mounting along with rising local needs and diminishing availability. National forestry policy permits the government to use the natural resources in the River Region for the benefit of the entire state, particularly the urban populations, thus greatly affecting the demands placed on the forest resources.

Competition between local users for access to a diminished resource base, expanded land clearing for cultivation, and national demands for woodfuels have increased the pressures placed on forest resources in the area. Local communities have had divergent reactions to forest resource exploitation under rapidly evolving circumstances. Some local residents have sold the wood off their land, a practice that is neither recognized by tradition nor legally sanctioned by the state. Others have pursued "conservationist" strategies to protect their resources from all outsiders, even their neighbors. The issue of defining "outsiders" has become paramount in the context of local reactions to forest use.

Ambiguities have arisen over which community members maintain use rights to forest resources. The 1965 Forest Code states:

In the forest domains the bordering rural communities or the traditional users are authorized to exercise use rights, without any formality. These include the collection of dead wood, the harvesting of wild fruits, food and medicinal plants gum and resins, straw, honey and all other use rights recognized by the decrees or laws of [forest] classification.⁷⁴

Rights can be held by either the people living in proximity to the resources or those who traditionally exploited the resource, but the state fails to recognize that these are not always

⁷⁴ *Décret N° 65-078 du 10 février 1965 portant code forestier (partie réglementaire), Chapitre III, Article 19.*

the same groups.⁷⁵

A range of conflicts over access to and control over forest resources has evolved in the past several decades. First, tensions have developed within communities, between local residents who oppose clearing important woodlands for agriculture and those who prioritize agriculture above all other resource uses. Second, sedentary villagers have developed a strong opposition to Fulbe herders entering their wooded areas. Third, local residents have clashed with charcoal producers, the forestry department and neighbors over the use of local resources for charcoal production.

The first controversy arises from increased competition for access to a dwindling common property resource base. Land clearing for agriculture did not infringe upon the activities of those collecting and gathering forest products until very recently. Pursuing one resource use did not eliminate the prospects for the others, which is now the case. Both traditional management rules and the national agenda favor extension of agriculture, offering the users of other forest products few defenses. The Forest Code stipulates protection of a minimal number of trees on cleared land, thereby making possible multiple land uses, but in practice local residents and forestry agents ignore this rule. The growing competition for forest products that results from the shrinking resource base has led villagers to more strictly define insiders versus outsiders for purposes of collecting and gathering.

Sedentary villagers have assigned Fulbe herders the status of "outsiders" and hold them responsible for the damage effected on trees. Debranching caused little concern or reaction in the past. Since the early 1970s, however, lopping has been deemed unacceptable

⁷⁵ Mark Schoonmaker Freudenberger makes this point, which is of great importance to his analysis of the conflicts over use rights of the *Acacia senegal*. The law did nothing to resolve the competing demands of Fulbe *jeeri* and Moors. See M. Schoonmaker Freudenberger, "The Great Gum Gamble: A Planning Perspective on Environmental Change in Northern Senegal," pp. 266-267.

by non-herders, a position long supported by the Forest Service. Herders are victimized in this context, with little or no substantive data proving that lopping causes degradation. Furthermore, defining Fulɓe as outsiders and placing all blame on one group ignores the fact that others also partake in these practices.

Villagers have organized groups to police their wood lands to catch Fulɓe culprits, who they punish or hand over to forestry agents. The local populations have attempted to address this particular issue both with and without state support. Not only has the forestry department failed to facilitate local involvement, it often spurns input from villagers. The Forest Service strictly opposes debranching but also objects to local control over and management of forest resources. This leaves local community members powerless and their resources unmanaged because the state does not possess the human or financial resources needed to perform its duties.

Lastly, the controversies surrounding charcoal production raise multiple issues about local resource control and management.⁷⁶ Community members have come into conflict with the state, outsider producers and neighboring villagers over charcoal production on village lands. Currently the Senegalese forestry department and the charcoal producers are actively asserting access to the local wood lands for the production of charcoal. The forestry department, rather than the community members, is licensed to determine use rights to local resources. This license is applied whenever the department has a significant interest in the resources. Prior to opening the zone to charcoal production, the local inhabitants virtually were free to exploit their common wood lands according to traditional use rules. When national charcoal policy expanded the charcoal production zone to include the area around

⁷⁶ See J. E. Fischer, "Charcoal Production in the Common Wood Lands in the Middle Senegal River Valley: Conflicts over use rights," unpublished paper, for a complete discussion of charcoal production in the study area.

Matam, however, it became the agency's primary responsibility to install the charcoal producers and it promptly assumed a regulatory role.

Villagers in the area have diverged in their responses to the introduction of the charcoal industry. Such differences confirm the difficulty of extracting causal factors from local responses. One response was taken by a local community in the study area – the villagers elected to protect their communal wood lands and fought to close their territory to outsiders. A second response occurred much more often among the villages in the study area – they chose to sell their wood resources to the charcoal producers. Their position evolved both out of their skepticism that state authorities will accord the local communities power to control access to their common property wood lands and their new opportunistic attitude toward resource use. These divergent responses have caused mounting tensions between neighboring communities and a breakdown in the multi-village common property system as villages prohibit neighbors from entering their territory to exploit the natural resources.

Scarcity Creates a Market in Forest Products

In addition to the sale of trees to charcoal producers, declining availability of and rising demand for forest resources have created a local market for forest products. Markets for wood for construction and cooking fuel have developed in the past fifteen years. The price of wood continually rises, with greater numbers of people making purchases over the years. Seventy percent of the respondents collect wood more frequently than in the past, and approximately sixty percent have altered where they go to collect wood, with thirty-one percent traveling further. Over fifty-eight percent of the population now purchase wood, whereas less than six percent purchased wood in the past. Residents from neighboring *jeeri* villages are far more likely to travel to the remaining *jeejegol* to collect wood and other forest

products. The factors influencing more people to purchase wood include the increasing difficulty of finding firewood, the time needed for the task and the lack of adequate household labor. Greater cash income, acquired through remittances, also permits more villagers to purchase wood.

The demand for wood for house construction expanded shortly before independence. As villagers became more sedentary, no longer moving to their *waalo* fields, their house style changed to a type that required far greater quantities of wood. Cement and imported wood and zinc constitute the most recent materials used in house construction. While houses made from purchased materials denote symbols of economic success, they are quickly becoming the only feasible form of construction because of the lack of adequate local wood resources. Informants from NDulumaaji Demße pointed out large tracts of bare ground that had been cleared of trees that had been used for house construction. With changed climatic conditions the trees have never regenerated.

The prices local woodworkers charge have more than doubled in the past six years. According to one of the only remaining woodworkers in the area, wood that was found in one afternoon a decade ago now requires two days to gather. Few people contract traditional woodworkers any longer, preferring to purchase cheaper manufactured items sold in urban markets.

Other markets for forest products have appeared and disappeared due to resource scarcity. The local demand for honey, grasses, gums and resins, wild fruits and medicinal plants still exists, but the products seldom are found. The cash market for these resources developed only during the past twenty years. When the resources were widely available and easily collected, households met their own demands and the local market remained insignificant. Supplying the urban market in wild fruits has evolved since the 1970s.

Fruit of the *Boscia senegalensis*, the most common wooded species growing in the ferruginous *jeeri*, has been collected and sold for many decades by Fulbe and Wolof. The amount of fruit produced has declined with lower rainfall, but local residents continue to collect and export what they can find. The Fulbe partake in this market but hesitate to admit their involvement, associating such activities with people of low social status. Increasingly local residents utilize *Boscia* as a source of fuel wood rather than for its fruit, as it is quickly becoming the only remaining source of wood in the area.

The sale of *Ziziphus mauritiana* and *Balanites aegyptiaca* fruits rapidly expanded over several decades but has waned even more quickly. Wolof merchants began coming to the villages in the study area to purchase the fruit approximately twenty years ago. By 1991 collection and sale of these fruit were rare. Local residents cite three reasons for the decline of this resource, listed in order of importance: land clearing, the drought and a range of seasonal factors such as decimation by grasshoppers. The areas where these species continue to grow are being cleared rapidly for cultivation. Expansive clearing for irrigation since 1987 has destroyed some of the prime stands of these trees.

Since the establishment of the export market local intermediaries have controlled sales. These merchants purchase the fruits from villagers, often in the form of credit, and resell the produce to Wolof transporters from Dakar. The prices paid to villagers were always held low enough to guarantee a large margin of profit for the local merchants. According to data from all of the merchants involved in this trade in NDulumaaji Dembe, villagers could jointly earn as much as 1,000,000 CFA. This amount proves highly significant, especially since most of the villagers involved in the collection and sale of these fruits are often women and children from the poorest families. The loss of the trees means a significant loss to the participants in this activity.

One merchant's records show the importance of these sales and the recent decline of the market:

Year	Total # of Sacks	Purchase price/4 kgs	Sale price/ 4 kgs	Intermediary's Total Profits
1983	42	50-175 CFA	175 CFA	94,500 CFA
1984	112	125-150 CFA	210 CFA	292,320 CFA
1985	65	125-200 CFA	275 CFA	263,250 CFA
1986	65	100-175 CFA	260 CFA	286,650 CFA
1987	170	100-200 CFA	250 CFA	612,000 CFA
1988	58	100-200 CFA	325 CFA	365,400 CFA
1989	42	150-175 CFA	335 CFA	260,820 CFA

This merchant made no significant purchases in 1990 and predicted that the trade in wild fruits would quickly evaporate. In the words of one resident: "At the present time the herder finds it difficult to find enough *jaabe* [*Ziziphus mauritiana* fruit] to fill his stomach, therefore it is illogical to think that enough can be found for commerce."⁷⁷

Today the closest groves of gum arabic (*Acacia senegal*) to the study area are situated near LawLaw. The first claimant maintains rights to a demarcated area that can be inherited by other family members. The residents of LawLaw started to exploit gum seriously in the last twenty-five to thirty years, usurping the rights to this resource from Moor gum collectors.⁷⁸ The acacia "fields" have become as important to some Fulbe as grain fields; and similar to grain fields, the size of an individual's acacia stand varies with the quality of

⁷⁷ Interview with unidentified woman, Laawol Diop, Pullo *waalo*, 25 September 1990.

⁷⁸ See M. Schoonmaker Freudenberger, "The Great Gum Gamble: A Planning Perspective on Environmental Change in Northern Senegal" for a thorough discussion of the history of gum collection and the conflicts between Moors and Fulbe over access to and control over *Acacia senegal* stands.

rains and the availability of labor. The quantity of gum collected and the price earned has deteriorated over the years, however, to the point where tapping has become uneconomical for some Fulbe. Nevertheless, competition for access to the resource continues to increase due to the diminished acacia stands. The departure of Moors in 1989 quickly eliminated the principal source of competition. Before the great die-offs due to the drought and the over-tapping of stressed trees, the *Acacia senegal* grew in the vicinity of Kaawal and in the near-*jeeri* and *jeejegol* village zones.

Charcoal production, discussed above, constitutes the newest use of forest products in the region and has stimulated new controversies and an unusual market in wood/tree sales. While charcoal production is only one of the many uses of the wood lands, it stands as one of the most apparent and destructive, and is almost wholly controlled by outsiders.

Although forests and wood resources are often considered flows, in the Senegal River Valley these natural resources may be best thought of as stocks since the physical quantity of wood is more or less fixed under present climatic conditions. There is little regeneration taking place in the *Acacia nilotica* gallery forests today or in any other species other than the *Balanites aegyptiaca*. The current management issues concern questions of who should have access to the resource for extraction purposes and who should bear responsibility for protecting the still living tree populations.

THE CURRENT BIOPHYSICAL CONDITION OF REMAINING RESOURCES

The changes in the climatic conditions experienced in the region since the late 1960s, along with transformations that have occurred in the local resource management and use systems, have precipitated environmental degradation of all the resource bases. Some of the ecological effects have been noted in previous sections but the major trends are summarized

here.

Environmental Degradation on Agricultural Lands

Devegetation increases the possibility of water and wind erosion degrading the soils in the zone. Some of the older *jeejegol* fields, which have not been fallowed since their creation, show signs of severe top soil erosion and general degradation. Under present climatic conditions tree regeneration is unlikely on vacated agricultural fields, be they irrigated or *jeejegol* land, thus exposing the soil to greater possibilities of year-round erosional forces.

An environmental issue concerning the *falo* riverbank fields involves the unpredictable effect that water released from the reservoir, which contains less suspended sediment, will have on riverbanks downstream of the dam.⁷⁹ Releasing water from the reservoir may lead to channel scouring, further devastating remaining *falo* fields and eroding the river valley.

Residents noticed changes in the way the zone flooded in 1988 compared to earlier floods. The 1988 flood carried more sand particles, versus silt, possibly because of years of accumulation of eroded material remaining in the channel bottoms of tributaries and along the river banks. Backwater channels filled more slowly and with greater difficulty, flooding less land than a flow the same size inundated in the past. Also, a thin layer of sand was deposited on the surface of the flooded land. The combination of a long stretch of dry years, devegetation in the region, soil erosion and mechanical regulation of water flow has affected the flood regime.⁸⁰

⁷⁹ See G. E. Hollis, "Hydrological Issues: Part I" and "Hydrological Issues: Part II," The Senegal River Basin Monitoring Activity (Binghamton, NY: IDA, 1990).

⁸⁰ Madiodio Niasse confirms these findings in research completed in neighboring Doumga Rindiaw. See M. Niasse, "Troisième Rapport: Suivi des systèmes de production agricole a Doumga Rindiaw," p. 32.

Sheet and gully erosion have increased in the *jeeri* fields according to the accounts of local residents. The force of runoff is exaggerated because of the lack of ground cover, causing increased erosion leading to significant losses of top soil and declining soil fertility. Little is done to deter sheet erosion and degraded fields are simply abandoned. Gully erosion in cultivated fields is sometimes fought by constructing barriers of branches and sand to slow the water's flow. Cultivators rarely chose to divert the water from their field, as they did in the past, because they depend on the runoff to secure adequate moisture for their crops. Indeed, cultivators more often reported that they construct small canals to funnel run-off onto their fields since the decline in rainfall in the early 1970s.⁸¹ These simple structures can have detrimental effects when high intensity rainfall events occur, being the cause of significant field gullying.

Traditional methods for improving soil quality include additions of manure or fertilizer, burning the ground cover to add nutrients to the soil before cultivation, fallowing, and trapping wind blown and water born sediments on the field with vegetation or fencing. Only the last of these practices is widely employed today. Significantly, cultivators no longer invite herders to corral their animals on harvested *jeeri* land because adding organic matter during drought conditions increases rapid desiccation of the soil.

Herding in Today's Biophysical Environment

For the local herding population "overgrazing" referred to a situation whereby "the herds are stronger than the pasture," and was viewed as a temporary or seasonal condition. Herders maintain that prior to 1968 grazing resources were more plentiful than herd demand, except during occasional dry years or when insects decimated the vegetation. In the past

⁸¹ Interviews with Bahooro Bah, Pullo *waalo*, 2 March 1991 and Mamadou Kane, NDulumaaji Demße, 23 March 1991.

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herders did not refer to overgrazing as a long-term degradational process, but this has evolved in recent years as pastoralists see grass composition change and areas remain denuded.

Many herders assert that permanent degradation of the pasture is caused uniquely by the lack of rain and not through anthropomorphic actions. In contrast to this position, some herders cited the occurrence of invader species in degraded lands which they claim results from overuse and not low rainfall. Three species commonly appear in degraded *seeno* soils: *bamaambi*, *ledde pure/boti* and *selawlaw*, none of which are consumed by herd animals. Some herders reluctantly admit that trees are being killed from over-cutting and not just drought, acknowledging a human component to degradation. Herders listed tree species according to grazing preference⁸² and today only *Balanites aegyptiaca*, one species out of fifteen, can be commonly found. In contrast, several species not consumed by herds are proliferating, such as *Boscia senegalensis* and *Calotropis procera*.⁸³

The losses of the tree species are occurring due to ecological changes as well as alterations in resource use and management systems. When a herder has hungry animals s/he will kill trees if that is the only available fodder. "We cannot think of tomorrow when we have problems keeping the herd alive today."⁸⁴ Under today's circumstances the herder often focuses on the immediate survival of the animals. They claim that in a situation where there are not even enough trees to meet today's needs, preservation for the future is hardly an

⁸² Listed in order, preferred tree species include 1) *Balanites aegyptiaca* 2) *Acacia albida* 3) *Dichrostachys glomerata* 4) *Cadaba farinosa* 5) *Maerua oblonifolia* 6) *Maerua angolensis* 7) *Combretum aculeatum* 8) *Pterocarpus ernaceus* 9) *Loeseneriella africana* 10) *Grewia bicolor*, *Grewia senegal*, *Acacia raddiana*, *Acacia nilotica*, *Acacia seyal*, *Sterculia setigera*

⁸³ See Henri Poupon, *Structure et Dynamique de la Strate Ligneuse d'une Steppe Sahélienne au Nord du Sénégal*, Travaux et Documents de l'ORSTOM N° 115 (Paris: ORSTOM, 1980) for data on the decline of species consumed by herds versus the expansion of species not used for forage.

⁸⁴ Group interview in Laawol Diop with Fulbe *waalo*, 6 March 1991.

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option. Many herders are beginning to doubt that productive pasture can be restored even if rainfall increases: "There is too much that has been lost that will never return."⁸⁵ Several studies have indicated, however, that many of the grass species would regenerate under improved rainfall conditions.⁸⁶

Use of the *jeejegol* has significantly altered during the past twenty years. The *jeejegol* is now heavily occupied by herders and agriculturalists as a primary zone of activity throughout much of the year. Herders keep animals in the remaining *jeejegol* on a year-round basis whereas in the past the zone provided only seasonal pasture during the dry season. As the herds of the sedentary cultivators continue to grow, the *jeejegol* provides a forage area in close proximity to the villages. Fulbe who settle on the edges of agricultural villages, to have better access to cultivation opportunities and field stubble for fodder, place higher demands on the *jeejegol*. The zone, put to such heavy grazing use, has degraded significantly and rapidly. Concern over grazing pressure will soon be obsolete, however, as the *jeejegol* rapidly disappears due to clearing for cultivation.

Herders continued to water their animals at temporary lakes in the *jeeri* during the rainy season even after they had become more sedentary. This seasonal movement away from the wells and river assured a certain conservation of the physical environment.⁸⁷ This practice has been curtailed in both time and space during the past two decades, however, as the lakes fill up with sediment and lose their water holding capacity or are converted into

⁸⁵ Interview with Bahoore Bah, Pullo *waalo*, 2 March 1991.

⁸⁶ See J. Valenza, "Surveillance continue de pâturages naturels Sahéliens Sénégalais: Résultats de 1974 à 1978," Revue d'Elevage et Médecine Vétérinaire en Pays Tropicaux 34, no. 1 (1981): 83-100 and E. Bernus, "Exploitation de l'espace et désertification en zone sahélienne," Travaux de l'Institut de Géographie de Reims, nos. 39-40 (1979): 49-59.

⁸⁷ See H. Barral, *et. al.*, Systèmes de Production d'Elevage au Sénégal dans la région du Ferlo (Paris: GERDAT/ORSTOM, 1983), p. 83.

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The trees bordering and growing in the depressions have been subject to cutting for the past ten years. Branches lopped by herders remain in the depression and cause wind blown particles to accumulate. Eventually this causes major sediment build up, and combined with water born sediments settling in the lake bottoms, results in diminished water depths and greatly diminished water retention. Lakes that once conserved water for six to seven months now dry up after two months. The loss of seasonal lakes limits the area the herds can exploit and adds pressure to those resources in close proximity to permanent water sources.

Grass quality and quantity has been affected by the lack of rain, overgrazing, trampling, and premature grazing. The invasion of *Cenchrus biflorus*, *Trianthema portulacastrum*, *Cassia fora*, *Cassia occidentalis*, *Tribulus terrestris*, and *Zornia diphylla* into the herbaceous stratum of the study area has been widespread.⁸⁸ Some of these invader species have lower grazing quality than the replaced species. Extremely important perennials, including *Andropogon gayanus*, *Cymbopogon proximus*, and *Cyperus conglomeratus* have largely disappeared. The substitution of perennials by annuals, however, does not have necessarily negative implications for fodder availability.⁸⁹

While there is some dispute over the relative loss of productivity when perennials are replaced by annuals, the repercussions of their disappearance for environmental degradation are generally negative. Annuals typically indicate 1) a shorter productive season; 2) lower nutritional value; 3) the lack of perennial stumps, thus eliminating natural enrichment to the soils; 4) the loss of fauna and flora activity during part of the year; and 5) greater wind erosion because of the loss of stumps, which hold in place the topsoil layer.

⁸⁸ My findings are supported by J. Valenza and A. K. Diallo, "Etude des pâturages naturels du nord Sénégal," *Etudes Agrostologiques* 34 (1972).

⁸⁹ M. Mortimore, *Adapting to Drought*, p. 202.

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Relying on annuals for fodder is problematic because trampling and early grazing easily damage grasses that have not taken secure root. The density of annuals is considerably reduced through dislodging and destruction of germinations. In turn, the loss of all the photosynthesizing parts at the leafy stage results in a reduction of the creation of reserves in the underground parts, which subsequently causes a reduction in root growth, thus affecting water supply and plant growth. Grazing during the early growing stages reduces the number of new flower-bearing shoots and the number of seeds produced. Overgrazing easily occurs with annuals because early germination and a short cycle leads to a decrease in primary production. When animals are grazed on young annuals the reseeding potential decreases and deterioration of the pasture results. The strategy of the Fulbe at the beginning of the rainy season is to reach fresh green pasture as soon as possible, arriving before others to exploit the new, and extremely scarce, resources. After months of inadequate pasture the herders are unable to wait until the annuals are mature before grazing their animals.

During years of low rainfall and with the degradation of pasture areas herders have relied more on areal grazing and debranching for herd survival. Trees are not a new source of fodder for herds, but dependence on them and the harm incurred from the practices has increased with altered climatic conditions and increased competition over dwindling resources.

Researchers have stated that plant and soil indicators can be good tools to evaluate environmental degradation in areas where the ecological complexities are not well known.⁹⁰ Niamir found that a number of parameters are better indicators than individual species.⁹¹ Most plant species are not very sensitive tools because their behavior is similar under drought

⁹⁰ See M. Niamir, "Grazing Intensity and Ecological Change in Eastern Senegal" and R. O. Whyte, Tropical grazing lands: communities and constituent species (The Hague: Junkw. Press, 1974).

⁹¹ M. Niamir, "Grazing Intensity and Ecological Change in Eastern Senegal."

stress as under grazing stress. The best parameters include: percentage of bare soil, total herbaceous density, and total tree density. Bare soil is an important indicator because it is correlated with water infiltration. Bare ground inhibits infiltration which in turn affects grass production.⁹² There is little value in evaluating grass cover and density as indicators of environmental quality or degradation because annual grass growth is primarily a function of the year's rains.

Analysis of tree densities in the *fonde*, *jeejegol* and *jeeri*, discussed in Chapter III, reveal tree densities in the study area are lower than what would be expected for these zones.⁹³ Analysis of the changing density of forested lands was possible by comparing the two sets of air photographs (see Appendix III for detail). Zones of forested land had all but disappeared (5.30%) by 1980 whereas they constituted 13.35% of the land area in 1954. This constitutes a 60% loss of forested land in twenty-six years.⁹⁴ The overwhelming majority of forest and tree/bush savannah had become treeless grass land by 1980, rising from 19.28% of the land area in 1954 to over fifty percent in 1980. Such drastic vegetation changes reveal the reality of environmental degradation in the study area.

⁹² G. Boudet, Les pâturages sahéliens. Les dangers de dégradation et les possibilités de régénération. Principes de gestion améliorée des parcours sahéliens (Maison-Alfort: IEMVT, 1976).

⁹³ See H. Poupon, "Structure et dynamique de la strate ligneuse d'une steppe sahelienne au nord du Sénégal" and J. E. Lawesson, "Sahelian woody vegetation in Sénégal" *Vegetatio* 86, no. 1 (1990): 161-174.

⁹⁴ Christian Nuttall analyzed two sets of air photographs (1950 and 1980) for a zone in close proximity to my study area. Nuttall calculated a twenty-five to thirty percent decline of forest in the Matam/OuroSogui area between 1950 and 1980. See Ch. Nuttall, "Occupation de l'Espace, Mutation et Développement dans la Moyenne Vallée," p. 119.

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The Ecological Condition of Wooded Lands

Since 1968 large expanses of gallery forests in the Senegal River Valley have been lost and have not regenerated. "Cemeteries" of *Acacia nilotica* trees are common throughout the *waalo*. The diversity of tree species that once grew in the *waalo*, *fonde*, *jeejegol*, and *jeeri* has diminished, with many species no longer reproducing or only occurring as discrete individuals (Appendix I lists the tree species historically found in each of the ecological zones). The losses, in sheer quantity as well as in diversity, of forest resources have startled local resource users. In the collective memory of local residents the tree losses associated with the 1968-1973 drought years are unprecedented. Local residents correlate forest degradation with the recent drought years, making many complacent about their ability to protect and manage the environment. A widespread tendency to attribute the recent degradation solely to natural causes exists. The failure to see the interrelated ecological and human causes of the decline in vegetative cover relieves the resource users of all responsibility to protect and manage their resources.

Little western scientific data on vegetation losses during the 1968-1973 drought years exist, as environmental monitoring only began as a reaction to the crisis. Most of the contemporary data is collected in the form of satellite imagery,⁹⁵ at a scale that fails to capture the detail necessary for evaluating the evolution of individual tree species and small land areas. Although a recent study on Sahelian woody vegetation in Senegal could not disconfirm a floristic change from savanna to desert vegetation, the author argues that "the degradation process does not occur as a continuous advance of the desert boundary into the

⁹⁵ The *Centre de Suivi Ecologique*, under the direction of the *Ministère de la Protection de la Nature*, monitors biomass changes in northern Senegal using satellite imagery and areal photographs.

neighboring land, but rather in a complex, patchy fashion...."⁹⁶ The study did find that tree densities and diversity have diminished in the past several decades, a likely indication of degradation. The tree density data collected for this study (see Appendix V) cannot be analyzed for change due to the lack of prior baseline data in analogous sites. Freudenberger maintains that regeneration of *Acacia senegal* has increased with the return of higher rainfall, but the regeneration capacity of this and other species remains unclear.⁹⁷ Exploding populations of desert rats that consume the new seedlings is just one factor affecting regeneration of trees. Growing herds and the removal of decomposing wood and brush also limit natural regrowth.⁹⁸

The studies on vegetation change have not attempted to evaluate the anthropogenic influences on local vegetation. Although this study cannot distinguish the impact of biophysical factors from the human influences, the need to recognize the interrelationships between all of the factors is explicit. The changes in vegetation resulting from the severe droughts of 1968-1973 and 1982-1984 have had repercussions on local management, access and use of forest resources.

Even with increases in rainfall the Senegal River Valley will not experience regeneration in important wooded zones. The completed construction of the Manantali dam reduces the likelihood of *Acacia nilotica* reproducing in the floodplain, since consistent flooding has been effectively eliminated. The loss of flooding and related changes, such as a lowered water table, affect a wide range of tree species. The impacts of this large scale

⁹⁶ J. E. Lawesson, "Sahelian woody vegetation in Sénégal," p. 29.

⁹⁷ M. Schoonmaker Freudenberger, "The Great Gum Gamble: A Planning Perspective on Environmental Change in Northern Senegal," pp. 280-281.

⁹⁸ See Ibid., p. 281 for a discussion of the role decomposing vegetation plays in natural regeneration. The conclusion that herds affect regrowth was made from personal field observations which are supported by many of the previously cited Sahelian field studies.

change are only beginning to take effect.

RELATIONS BETWEEN NEIGHBORS: INTERACTIONS AND REACTIONS BETWEEN LOCAL RESOURCE USER GROUPS

The coexistence of diverse user groups in the Senegal River Valley has always implied the existence of both cooperation and competition over access to and control of natural resources. In recent decades competition has increased between these groups, while the complementary interactions between the different resource use strategies have declined.

Constricted spaces and a shrinking natural resource base have altered the ways that local populations interact with the physical environment and with each other. A hierarchy of uses and users functions as more users compete for access to the same resources. Some of the multiple uses and overlapping rights have become mutually exclusive.⁹⁹ As different users compete for access, determining whose definition, rights and claims are accepted and acted on are crucial questions.

More of the households needs are met through internal household strategies and reliance on the market, depending less on interactions and exchanges between groups. Households have become *less* specialized, partitioning less often along specific resource axes, in order to increase their resilience to diverse stresses. Recent climatic, social and economic perturbations have led to the elimination of most specialized life styles, such as that of the Subalfe fishing households and the Fulbe herding families. Correlated with the increased melange of a household's economic activities, the mutually beneficial interactions between herders, cultivators and fishing people have largely disintegrated in recent decades. Many of the interactions between the various groups have become formal market relations.

A countertrend has developed parallel to the tendency toward increased household

⁹⁹ See P. Peters, "Embedded Systems," p. 192.

diversification. Cultivation, specifically irrigation, has taken precedence over other resource use activities in the Senegal River Valley, eclipsing all other activities. "A certain number of consequences are going to spring from this true technological revolution. In the first place, this will occur at the expense of the two other principal complementary sectors of the traditional system: fishing and herding."¹⁰⁰ Whereas multiple uses of the resources coexisted in the past, irrigation developments diminish the potential for coexistence. Within the hierarchy of resource use strategies, agriculture has been assigned priority status. Cultivation has had favored status, both at the local level and at the national and international levels, throughout this century, but not until recently has this implied the elimination of other resource activities.

Torooße and Seßße benefit more from the preeminence of agricultural activities because of their social and political power and their greater access to land resources. Social differentiation within Seßße and Torooße groups means, however, that the distributional effects, both the risks and the benefits, of this trend are complex and uneven both within and between groups.

Even though these groups have increased their stake in other resource use activities, particularly investment in herds, they do not rely on spatial mobility as much as the Fulße, depending on pen-feeding instead. Therefore they are able to combine animal husbandry with irrigation even though extensive pastoral activities have been spatially marginalized by perimeter construction. As non-Fulße households acquire more animals, their dependence on the Fulße lessens. Increasingly households meet their own daily milk needs and occasional meat demands. Their curtailed interactions with the Fulße make them more able to define them as outsiders and restrict Fulße access to resources. Similarly, the local population now

¹⁰⁰ J.-L. Boutillier, "Irrigation et problématique foncière dans la vallée du Sénégal," Cahiers Sciences Humaines 25, no. 4 (1989), p. 471.

relies on marketed fish arriving from Saint-Louis, rather than on the catches by Subalbe. The Subalbe have little to offer other local residents today in terms of knowledge of the river, protection from water spirits or fish resources. Their historical position in Futanke society affords Subalbe little access to alternative resources, namely land for irrigation.

The precision of resource use and management rules varies according to the intensity of demand for the resource, the amount of investment required to exploit the resource and its relative scarcity. The definition of outsiders and insiders also alters in relation to these factors, but these definitions also are determined by those who hold the power to do the defining. Who, in other words, are the insiders at the most critical junctures? In the Senegal River Valley, historic land holders remain insiders according to almost all definitions. In particular circumstances, the state defines itself as the insider, designating all others, including local resident land holders, as outsiders in terms of resource access and control. Fulbe often are designated as outsiders by local residents and the state, and Subalbe have been defined out of existence through the elimination of their resource base.

The definition of insiders and outsiders in relation to control over and access to forest resources is complex and ambiguous. Inside users of forest resources, other than for the production of charcoal, include all local residents. This definition is self-assigned and accepted by the state, at least as far as forest resource use limited to household consumption. Local residents and state agents also concur that charcoal producers are outsiders. They diverge, however, in the power and rights of access that these outsiders should possess. For local residents, the designation of outsiders has always implied that they have no rights or claims to the resources without express permission from the local residents. The Forestry Service maintains that the Service, not the local residents, has the power to assign rights of access. Furthermore, local residents disagree among themselves as to the status of these

forest resources. Some argue that the trees constitute common property and others maintain that the trees are private property; both positions ignore the fact that the trees are actually state property.

The state has tended to conflate place with people in terms of identifying resource user groups with specific locations within the physical landscape, segmenting and fragmenting the use space. This parallels their tendency to displace problems, either temporally or spatially, by assigning single groups to bounded spaces. For example, the floodplain corresponds to irrigation agriculture; herding, forest uses, traditional agriculture have been assigned other spaces. Spatial definition of sectoral concerns fragments spaces and blinds administrators from seeing the multiple uses and overlapping rights. Intergroup relations and local strategies – regulated, fragmented and manipulated by an external administration – are becoming less and less adaptive.

CHAPTER VIII

SHIFTING SPACES AND TRANSFORMED RELATIONS

THE CHANGING NATURE OF OVERLAPPING RIGHTS

Regional political ecology, as an approach seeking insights into some of the most fundamental aspects of human/environment relationships, attempts to discern the evolving discourse and practices through which people gain access to, control over and manage the natural resource base in the context of changing economic, social, political and environmental conditions. During the century of natural resource management interpreted in this study, social and physical factors interacted in ways which brought about transformations in all of the local resource management systems. The preceding chapters of this dissertation attempted to detail one interpretation of the interactions and reactions between nature and society, factors determining natural resource use and the consequences of resource depletion and deterioration. These issues were addressed by examining the local knowledge of those actually making decisions, the political economic conditions at different scales and the implications of changing institutional forms of management of essential natural resources.

The resource use systems that have evolved over time can only be understood in relation to the overall patterns of resource access and control. The political, economic, social and ecological realities in the Senegal River Valley have been changing throughout the twentieth century, endlessly affecting the reflexive interactions between society and nature in the locale. There existed, and continues to be, considerable variation in local natural resource

use and in the precision of management rules. Three principal factors account for this variation: 1) the intensity of demand for the natural resource; 2) the investment required to exploit the natural resource; and 3) the relative scarcity of the natural resource. The local population as well as the state, faced with difficult political and economic conditions in a degraded environment, has had few alternatives to delay their own destruction other than to exploit the natural resources, even if this leads to further degradation.

It is widely accepted that as scarcity increases, due to environmental changes, population pressures, and market demands and with the incorporation of rural communities into larger politico-administrative structures, the private and common tenure systems become more institutionally elaborated and jurally defined. This study reveals that most natural resource access and use rules had become clearly delineated over time if demand for the resource was significant. Evidence also indicates that, more recently, respect for the management rules increasingly has been disregarded, to the point where open access systems prevail.

While local resource access rules and traditions do not guarantee that the agreed upon rights are respected they do function as culturally legitimate points of leverage in the on-going discourse and process of negotiation.¹ The essential functions of the local natural resource management systems were weakened in the twentieth century, however, when outsiders dictated alternative resource access, use, and management rules. The laws, regulations, plans and programs that have been imposed on the local scene interacted with already contested domains of power. Eventually the leverage once provided by the local rules diminished, while that of many of the new rules and regulations has remained marginal. In an environment of political and economic change, and with the deterioration of a functional

¹ P. Peters, "Embedded Systems and Rooted Models."

management system, conflicts among competing users and over different rights have increased.

This study examined the impact of social, political and economic changes that have occurred in the Senegal River Valley on the natural environment and the local natural resource management systems. The account explores the important links that exist between the political economy and the environment by considering "the impacts of the actions of colonial and post-colonial states on the actions of resource users and the effects of their actions in turn on the ground."²

Social and physical changes have brought about the redefinition of key relationships and a revision in the ways various resource users interact with the natural resource base and with each other. This process of transformation affects the nature of overlapping rights which are related to issues of competition, scarcity, control and responsibility. Over the century natural resource use in the Senegal River Valley has moved toward incompatible use systems.

The case study revealed that: 1) historically rooted haal-Pulaar social relations help explain current patterns of access to and control over resources; 2) non-local circuits of accumulation and surplus extraction and non-local ideologies have affected local resource use and misuse; 3) many of the multiple uses and overlapping rights to local natural resources have become mutually exclusive in the face of change; 4) the deterioration of indigenous management strategies and the failure to replace them with effective alternative systems has had negative environmental impacts; and 5) the local population, faced with difficult social and economic conditions in a degraded physical environment, has few alternatives but to satisfy short-term subsistence requirements that lead to further environmental degradation.

Changes, be they ecological, political, economic or social, have occurred in all of the

² W. Adams, Green development, p. 106.

natural resource use and management systems in the Senegal River Valley over the course of the twentieth century. The changes in one domain set in motion changes in the others. Inside as well as outside, local as well as national and international changes have occurred.

Members of the same resource user group and members from different groups increasingly are pursuing production and investment strategies that are resulting in contradictory and conflicting resource use. The process of transformation has involved dissension and revision of the meanings of key terms and redefinition of key relationships.

The local arena is important in shaping the interpretation, enforcement, and operational meaning of new institutional arrangements and power structures. The initial distribution of power has an important impact on the kinds of new institutional arrangements that are supplied subsequently.³ Imposed management systems have proved to be largely ineffective and resources come under increasingly serious threat due to lack of management. Institutional stalemates at the center have left the arena open to local action but at the same time villages lost their power of independent activity. In such an environment individual resource use and control strategies dominate.

Agencies of Change

There have been various agencies of change in natural resource management in the study area throughout the century; some have worked from within the local arena while others have functioned from outside the region. The accumulative and progressive trend of these changes has been toward a loss of local autonomy in natural resource control and management.

³ James T. Thomson, David Feeny, and Ronald J. Oakerson, "Institutional Dynamics: The Evolution and Dissolution of Common-Property Resource Management," in Making the Commons Work, p. 132.

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Resource management was not centralized under the Almaamis; the pre-colonial state lacked the political power to command control over resource use. To consolidate control over the area and to develop its economic potential, Almaami Abdoul embarked on a land redistribution program, and collected nominal taxes. Intervention in natural resource management under the Almaamis was limited to the distribution of land rewards to collaborating families. But once these lands were redistributed he, and the Almaamis who followed, in all likelihood, lacked sufficient power to wield control over even the regular collection of taxes. Land was employed as an instrument of domination in the local society and access to and distribution of *waalo* land in Fuuta Toro was bound to the power structures and social organization of the haal-Pulaar.

The Almaamis made no attempt to disrupt or control the natural resource management systems that functioned in the region. They did not have, as later ruling regimes would, a sense that they could control, dominate, or manipulate natural resources or that they possessed knowledge of a management system superior to that of local resource users. The individuals and families associated with the Almamate remained more strongly attached to the local community rather than to a centralized state entity. Historic systems of management and patterns of use remained intact.

Under this system of weak central rule the local communities of haal-Pulaar and Fulße were left to manage their own resource bases and function according to their own rules. Together the local populations combined cultivation, stock raising, fishing and forest use in an integrated production system. Access to and the use of each of the first three resources -- land, animals, fish/water -- was regulated by local resource managers. The resource managers of the different resource bases were not necessarily the holders of wider political power or authority, but their role as managers was recognized and respected throughout the

region. Although some resources, particularly land and animals, were not equitably distributed throughout the population, fishing, grazing, forest, and some land resources were considered common pool resources, given by Allah for all (believers) to use. Most interactions between more or less specialized resource users occurred without extreme competition, but rather functioned in an atmosphere of mutual cooperation.

The power holders were the politico-religious leaders functioning at the regional and local levels. Large land holding families, who controlled substantial numbers of *Maccuße*, were important political actors in limited spheres of influence. Their political influence did not greatly affect resource use, nor did they alter the resource management systems. Throughout this era the central state remained weak and local autonomy in resource control and management was strong.

The French and current Senegalese state authorities approached the study area in a similar fashion. The Senegal River Valley was to be brought into the central state's sphere of control. Nature was seen as something to technologically dominate and exploit for the benefit of the state. Central policies did not reflect a sense of local realities and removed or limited local-level discretion in dealing with resource management.

Local management systems were not even recognized, much less respected. The resource use economies were fragmented into separate parts – herding, forest use, agriculture, and fishing – with no apparent recognition that their interaction was a keystone to the sound functioning of each of the parts. The division of authority between resources meant that the ecosystem was no longer managed as an integrated entity.

The central control of the colonial regime was stronger than that of the previous rulers and far more interested in regulating the natural resource base for the profit of the state and metropole. Natural resources were considered part of the state's wealth, to be taxed and

exploited for sale in wider markets. A new outward orientation to resource exploitation and use developed, with an emphasis on surplus production.

From the colonial era to the present central authorities have placed little value on natural resource endowments in the Valley other than land and labor. Water resources were considered valuable only to the extent that they could be controlled for intensive agricultural use or could be tapped to permit sedentary animal raising in the *jeeri*. The local fishing and herding economies were deemed neither efficient nor effective uses of the natural resources.

The colonial state attempted a wide array of control and enforcement strategies to manage the natural resources. Enforcement pressures were strong enough to cause fear and withdrawal on the part of locals. Besides the state codes designed to manage resources from the center, the authorities carried out effective campaigns such as the ones to kill herd predators and eliminate crop pests. Furthermore, the central administration actively encouraged expanding agricultural production and adoption of specific crops and technologies. Forest and water resources in the zone were policed, at least later in the colonial era. Herds were vaccinated and wells dug. All of these interventions wrought change on the local resource use and management systems.

At the local level, the Torooβe (and fewer Seββe) families who held political power in the previous regime were co-opted into the colonial administrative hierarchy. Their position in the colonial administration protected their individual interests, including their hold on land resources. The Fulβe, Subalβe and Nyeenyβe, and their resource use systems, were largely marginalized at this time and these groups were subordinated to the control of Torooβe and Seββe who were assigned posts within the colonial bureaucracy. The Fulβe were further marginalized because of their lack of a clear coherent socio-political territorial base.

The colonial administration brought their rules and agendas to the local populations through these families, who no longer served only their own interests but those of the state, often times to the detriment of the local community. The local elites who controlled positions of power within the colonial administration recognized that their power did not stem solely from the local community any longer but was significantly bolstered by the central state.

The local resource management systems and institutions were repudiated by the colonial administration as ineffective, inefficient, and even destructive. Failing to understand the local resource management systems and the colonial administration's own role in disrupting these local systems, many of the authorities believed that the local inhabitants did nothing to reduce risk or manage their resource base. The problems were considered beyond the local population's ability to solve. Resources became subject to management at the colony level, with the policing of access and use of resources one of the administration's primary management strategies. In addition to the direct hand the colonial authorities employed in attempting to manage natural resources, they instituted many other economic policies and political constraints that diminished local autonomy and increased the power of the central state. Although many elements of the imposed management system did not serve their intended purpose, at the same time villages lost their ability to act independently. Technical, political, economic and social changes set in motion processes that destroyed long-standing institutional arrangements. The local power holders did not have the capacity or legitimacy to carry out locally designed policy, only the central administration's agenda.

At the local level this meant that most of the resource management institutions deteriorated or failed to evolve to meet changing needs. Central rules and policies, when applied to local situations, often manifested themselves as something far different than their original intent. Rather than one system replacing another, the changes effected during the

colonial era diminished the integrity of the local system yet the administration failed to install a viable management system in its place, thus creating an institutional void. The central authority's presence diminished the power, decision-making ability, and independence of the local managers and institutions. The state-imposed rules weakened and eroded local organization. The local resource managers such as the *jom leydi*, *jom ndiyam*, *arɔo*, and *jaaltaado* no longer had authority over violators of locally devised resource use rules since the local management rules were not sanctioned within the colonial legal system. In this current of change individual users sought to secure their own reproduction, with little regard for long-term sustainable use of the resource base or for community interests. Greater differentiation between resource users began to develop. The growing individualization of concerns and strategies explains the increasing incidence of resource disputes among local users.

The colonial and post-colonial states were strong enough and the regional economy was changing enough to affect change on local society but not sufficiently in control to replace local structures with wholly new ones. In many regards, this left the control in the hands of individual local power holders. But it would be wrong to assume that this *de facto* local control that has endured to the present has preserved local resource use and management systems or is not subject to the higher control of central state authorities. The local power holders gained a level of mastery over their changing world and have survived in large part because they have upheld many of the rules of the central authorities, sacrificing the local society's integrity to maintain their own. The local power holders, in the presence of this powerful (but not powerful enough) state, were in the position to recast the central laws and policies in their own terms, to their own advantage.

The colonial policies toward local resource use and management functioned to turn regulated and sustainable systems into open access situations. Although the local management

systems were still intrinsically suitable strategies to manage local resource use, they lost their legitimacy and effectiveness in the face of central control. The local communities no longer had the prerogative to manage the local resources.

The dynamics of land and forest product use changed little early in the colonial era. The colonial administration's position *vis à vis* local land holders remained ambiguous and, therefore, ineffective. Although they opposed the inequitable distribution of productive land resources in the region, the French had invested the local large land holders with political power and depended on them to execute colonial policies on the ground. Therefore the administration could not afford to alienate these local power holders. The interactions that occurred over forest product use remained largely nonconflictual because different demands for the resource were not yet competitive. The management system governing forest resource use remained passive during the early colonial era since the colonial administration lacked the financial and human resources to carry out its policing strategy, with the exception of controlling herders' movements in protected areas. The fishing and herding management systems experienced greater degeneration under French rule. The impact of the introduction of the *gußal* net was keenly felt in the fishing management system because it occurred at the same time the local institution was losing its legitimacy regarding, and therefore its authority over, individual resource users. Moreover, the colonial authorities actively attempted to redefine the Fulße pastoral system. In reaction, herders adopted individual survival strategies, largely abandoning their common property management system.

Since early in the 20th century forest resources have been considered state property to be protected to serve eventual state needs. The value of wood products has rapidly increased since the late 1970s as energy demands from urban populations have continued to mount. A common strategy throughout much of Senegal by the mid-1970s was the introduction by the

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central government of donor-funded woodlots. Financial and technical resources were invested at the local level as it became clear that even local demands for wood resources were not being met. None of these programs were initiated in the study villages, but where they were created in neighboring villages the local residents viewed them as government property and not for their own use or benefit. The remaining stands of naturally occurring trees in the study area are highly valued by insiders and outsiders alike. With control in the hands of the central authorities, their interests, and not the interests of local population, are served. The central authorities have sanctioned outsiders to exploit the resource base in the study area for state interests.

Since independence the state has increased its presence in the region through assigning people to prefectural and sub-prefectural level agriculture, pastoral, fishing, and forestry offices. Policing efforts were expanded after independence although persistence in this operation has waned over the years. Although these state authorities were viewed with suspicion and were not considered fair or reliable mediators of local conflicts, there were few alternative institutional structures available to local resource users.

During and after the 1968-1973 drought it was international aid, rather than water, that flowed through the Valley. The Senegalese state and various international donors were adamant about finding a technological fix to the natural resource "problem" in the high risk environment of the Senegal River Valley. They believed that controlling and improving nature was within their power and that the states in the region could no longer leave themselves vulnerable to climatic fluctuations. More than ever, the administration and donors viewed the local situation with wider state and regional interests in mind. National and multinational actors, with the construction of the Diama and Manantali dams, have determined, in a way heretofore unprecedented, the future direction of resource use in the

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Valley. For the first time, central management of one resource use system has directly jeopardized the co-existence of the other resource systems in the zone.

The state has made the most significant inroads into the Valley through SAED, the parastatal charged with developing irrigation infrastructure and through several bilateral and multilateral funded projects. The state also demonstrates its power and authority by installing projects where it wants without consulting local populations. The only NGO functioning in the area during recent years has been involved with working with PIV cooperatives, filling the gap left by the state's withdrawal from irrigation activities in accordance with its current ideology.

Through the colonial era into the 1990s the senior members of large land holding families in the study area have maintained a hold on local power and managed to keep important land resources in their clutch. Other very recent local political actors are villagers who have returned home after achieving economic prestige and political power through entrepreneurial endeavors and/or service in the state administrative hierarchy outside of their home region. Access to land resources was not guaranteed for these individuals based on the historic land tenure system, but other means of gaining access to the resource base may finally be opening up. Lacking only land, and willing to challenge the local power holders on this front, these returning native inhabitants are best situated to change the local power equation. With state law on their side and the central government firmly behind these efforts, the local power base may be meeting its first real test.

The last stage in the progression between central authority and local autonomy has actually been a step back toward local autonomy through greater decentralization of political and economic authority and natural resource management. Although legislation to begin this process was passed in the 1972 it was not until 1990 (*Loi n° 90-34 du 8 Octobre 1990*), at the

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completion of this research, that the central state awarded the local governing bodies (*Communauté Rurale* councils) control over significant financial resources. Local resource users in general have had limited access and influence in the political system and few instrumentalities of local government or local association to ameliorate resource management problems. As a result of decades of central management controls and codes, devising new local political solutions to management problems became a much more difficult and expensive process.⁴ A current attitude prevalent on the local level is the desire to consume or use the local resources before others come in to usurp direct control over them. There is also growing opposition between competing resource users on the local scene, with new and shifting lines being drawn between insiders and outsiders.

Centralization versus Local Control

The dominant trend throughout the century, until very recently, has been toward centralizing power and centralized natural resource management. In many cases pertaining to natural resource management, the inability to carry out as intended the agenda of centralization has led to even greater management fragmentation than what existed prior to centralization efforts. Lack of a clear program, political strength, and financial means all prohibited the French colonial and independent states from directly dominating the affairs at the local level.

Under the Almaamis' rule there were no evident attempts to alter the local natural resource management systems, which were left to function according to their internal rules. The colonial and post-colonial governments, on the other hand, strived actively to alter and control resource management. Even though many of the central natural resource management

⁴ Ibid., p. 139.

policies did not succeed, the colonial and independent states wielded enough power to disrupt and diminish the efficacy of many of the local systems.

The disintegration of the local natural resource management systems that began early during the colonial era left a void in resource management. Some elements of the centralized policies took hold and certain aspects of the local systems have remained functional. But many facets of natural resource management have fallen between the two systems, leaving anarchy in resource use. Individuals or groups of resource users exploit the remaining resources according to whatever combination of local and state rules and regulations best suits their demands. There are few motivations, at the local level, to protect and manage the natural resources for long-term use by the state and people living outside the immediate zone. When the population does unite into a larger group to fight for common interests, it is to prevent outsiders from using the local community's resources. The insiders tend to rely on local, historic claims to their resources and the outsiders refer to centralized state laws and policies to support their rights.

Most often management does not occur because neither the centralized system nor the local system function and management is left in a chasm between the two. Numerous examples have been given throughout the later chapters of this thesis showing that at various times and in different situations elements of both the centralized and the local systems operate -- not consistently and not as part of a coherent system, but to serve the immediate interests of a few actors.

Land rights is the one realm that all of the centralized states in the region have attempted to control, with little success by any of them to abolish the local tenure system. Although over the years new actors have sought and gained access to land resources in the area, the historic land holding families have maintained their grip on most of the productive

waalo land holdings.

The state perpetrated even greater central authority in resource management after independence, primarily by investing more resources in its policing measures and rewriting the state land law, forest code and other legislation concerning resource access, use and management. Centralized decisions concerning other geographical regions and economic sectors increasingly affected resource use in the Senegal River Valley as the local economy and society became more enmeshed within a state and international hierarchy.

The Upper Middle Valley has been more difficult to control from the center because of its distance from Dakar and Saint-Louis, the regional capital. The sub-region has not been as much a focus of national and international assistance as places further down river where population densities are higher, rainfall during the past twenty-five years has been lower, and logistics between the center and the periphery are easier. The Delta region has been viewed as an open, empty space with little to hinder its appropriation and development by the state.

The irrigation parastatal, SAED, has been active in the study area since the mid-seventies with the view that irrigation is the only viable resource use possible in the region. The central government, with the financial assistance of numerous international donors and NGOs, has directed all of its resources into this activity.

Rainfall in the hands of Allah made resource use risky and unpredictable in the Senegal River Valley, but the local inhabitants have realized that control of the flood waters in the hands of multiple central governments is even more perilous. No amount of local management and organization can make the distant authorities open the flood gates. At the same time the central government is devolving authority and power to the local level they have taken control of water distribution in the Valley through the construction of the dams. Thus, the local resource users remain subject to central authority, and in this case the decision

rests with three different central governments.

The post-colonial government has thus far failed to construct an effective system to replace the local institutions that were disrupted and weakened by ninety years of central government policies. The state has proved a poor manager of the resources it has appropriated, failing to develop a system for sustainable and efficient use of the resources. There has been an ideological shift in resource management from a top-down approach to one that is people-centered and locally based, with decentralization of development program planning and empowerment of local management institutions.

Most accounts show that local control over natural resources is essential for efficient and effective management. The Senegalese state has made efforts to bring this devolution about, most recently in 1990 (*Loi n° 90-34 du 8 Octobre 1990*). Rather than seeing this as a move away from central authority back to local control, it is perhaps more realistic to recognize that this newest policy is an effort to move natural resource management out of an abyss of no organized, functioning management system. In the struggle between centralization and local systems there have been no clear winners with very many losers.

Patterns of Degradation

Each of the resource bases has experienced different patterns of degradation through the century. Recognizable degeneration occurred earliest within the fishing resource system. Technological changes initiated a process of institutional and environmental degradation. Shortly after new equipment was introduced into the region, the local management system was rendered powerless through central control. Resource managers lost the prerogative they had once had to control the behavior of local users and had little ability to force colonial authorities to take account of local conditions. Whereas the local system may have been able

to adapt to the technological changes in an otherwise unaltered environment, the system lacked the capacity to counter central control at the same time it was experiencing technological change. Internal power shifts, the abandonment of the common property management system for greater private control, and the center's claimed control over the resource base, caused a collapse of the resource management system early in the century.

The rules and regulations imposed on the fishing society by the colonial administration had little effect on the creation of an operative management system and the resource base continued to be exploited to the point of deterioration. Increasingly, common property resources were captured by individuals to serve self-interests. Economic and social changes added to the current of change the Subalfe were experiencing.

With the demise of the common property management system and private ownership of portions of the fish resource base not feasible, effective management disappeared and it became an open-access system. Over-fishing was not only technologically possible for the first time, it was probable in light of the absence of an effective management system. Individual use of the resource base, with no long-term sustained use in mind, became the norm. The central authorities did not value the resource base sufficiently or have the resources or power to assure that over-fishing did not occur.

The climatic shifts in the post-independence era were the final blow to the fishing economy, as the lack of flooding caused the disappearance of many fish species. Desperation in the face of change led the remaining fishing families to harvest immature fish, further reducing the resource base.

Subalfe, left with nothing to fill their nets, either abandoned the Senegal River Valley or turned to concentrate on agriculture and other resource use activities. As they shifted toward agricultural production the Subalfe soon found their resource base limited yet again.

When land was distributed during Almamate rule, the fishing people received only minor tracts of land, since their economy was so wholly focused on fishing. Today, with irrigation being the sole remaining viable resource use system, access to land resources is critical.

The colonial and post-colonial states took numerous steps to stop degradation of the dryland environment thought to be caused by herding activities. Herders had the advantage of mobility and could move away from many of the active controls focused on them and resisted change whenever feasible. The vast expanse of natural resources that they exploited and their relatively low population densities until the second half of the century meant that the growing non-adherence to the common property management rules did not immediately translate into resource degradation.

The French came in with a clear notion of eliminating the pastoral management system as it existed. The view was that investing in certain inputs and enforcing particular regulations would transform the herding economy. Although administrators achieved little success in realizing their overall goal of wholesale conversion to ranching and animal production for the export market, they did manage to disrupt the resource use patterns of the Fulße thus making them more vulnerable to natural fluctuations that regularly occur in their environment. Several of the efforts made by the central administration to change herding practices actually led to herd size increases and diminished seasonal movement, thus narrowing their usable resource base. In this case the political economic agenda of the colonizers precipitated some of the most significant changes in the Fulße economy in this century. Certain changes, such as increased security, better communications and technical innovations, temporarily improved the herders' situation. At the same time, however, they were experiencing a loss of ecological and economic flexibility, they were being forced into a market economy and their internal management rules and mechanisms were disintegrating.

By the time of the 1968-1973 drought, the Fulße resource use and management system had been transformed to a degree that diminished their capacity and flexibility to respond to the crisis.

The pastoral management system remains largely open access although the rapidly growing dependence on purchased inputs has greatly altered the nature of the relationship between herders and their physical environment and with other resource users. Growing scarcity of fodder and water sources increases competition among animal owners and raises the cost of production. New sources of competition have resulted from the growing numbers of Torooße, Seßße and Subalbe who keep herds.

A diminished resource base that has never regenerated, an increasingly restricted space to exploit and a change in herd composition toward greater numbers of goats which are more destructive of the environment are all factors that have led to spiraling levels of degradation. The longer that patterns of resource use focus on satisfying immediate needs, the greater the possibility that the changes being rendered on the environment will not be easily reversed even under improved rainfall conditions. Although chronically feared as the most environmentally destructive resource use activity, herding and the dryland environment has proven incredibly resilient.

Discernible degradation of the cultivated land resources is only becoming apparent to the local resource users as they convert from extensive to intensive production. The relative abundance of productive land, the regular occurrence of the flood to restore soil fertility to *waalo* and *falo* land, and relative lack of detrimental technologies functioned until recently to assure restoration of the resource base.

During and subsequent to the 1968-1973 drought years cultivators noticed that trees were no longer regenerating on their fallow fields and that soil fertility was declining. The

areas where rain-fed and recession cultivation are possible have become more and more limited, causing users to exploit these areas more intensively. Irrigation techniques, relatively new on the scene, are causing novel forms of degradation that are bound to expand as reliance on irrigation grows.

In contrast to a series of slow shifts that had transpired during the pre-colonial and colonial eras, the 1968-1973 drought episode thrust the agricultural system into a rapid succession of changes, emanating from both the local setting and the "outside" world. In desperation to secure their livelihood, the population scrambled to reap what they could from the desiccated land. Resource management rules became obsolete, and interest in community welfare or future generations of resource users has been lost from the minds of most resource users.

The state and international community responded to the crisis by insisting on irrigation in the Senegal River Valley. An agricultural system that had once depended on access only to land and labor now demanded significant monetary inputs for entrance into production. The irrigation policy responded to regional ecological changes, as well as to national economic demands and political priorities.

For the first time, one resource use system in the Senegal River Valley was pursued to the detriment of the other systems. Irrigation has marginalized pastoralism, guaranteed the final eradication of fishing and greatly diminished the remaining forest resource base. Systems that once co-existed have become mutually exclusive. Furthermore, the spaces available for other forms of agriculture have shrunk with the drought. The drought, and the government's response to it, has concentrated resource use along the narrow strip of land flanking the river that can be irrigated.

Central authorities' concern over degradation of forest resources in the Senegal River

Valley appears to have preceded concern about the condition of other resources. Contrary to the intent of the central policies, enforcement of severe cutting and use rules may have influenced local resource users to resolutely clear their land of small seedlings in a way they never had before in order to avoid retribution for cutting trees later when it came time to clear their fields for cultivation.

As with land and grazing resources, deterioration of the forest resources became most manifest during and after the 1968-1973 drought. Trees did not regenerate as they once did and today vast stands of dead *Acacia nilotica* bear witness to changed environmental conditions. Regeneration, even under increased rainfall conditions, is becoming increasingly unlikely since the flood waters are now held behind the Manantali dam and more and more areas are being denuded of all vegetation thus exposing the topsoil to water and wind erosion. Ecological changes have caused a new type of scarcity, one that temporarily has been circumvented with clandestine actions and payoffs. But the tree die-offs due to the lack of rainfall and flooding have been dramatic and soon even furtive access to the forest resources will not be an option.

Long-time prohibitors of deforestation, the central government is now behind the most sweeping tree cutting efforts in the zone. Charcoal producers have moved into the area, under the sanction of the central authorities, to clear cut forested land for the production of charcoal destined for urban consumption. Wood resource supplies do not meet the current demands of the local population on a sustainable basis. Under such circumstances, exporting forest resources out of the area is totally untenable.

Suitability of the Local Management Systems

In the pre-colonial era the local management systems were suited for the natural resource use occurring in the region. The human-environment dynamic in Fuuta Toro at this time was distinguished by its reproducibility. Users relied on spatial movement and seasonal use of a number of ecological niches in the area. Interactive systems functioned simultaneously, with a greater or lesser degree of definition of access and use rules depending on the relative availability of and demand for the resource. Resource use specialization functioned to stabilize resource use but did not prohibit individual users from moving in and out of various activities, nor did territorial control prohibit movement of resource users between zones. The resource use systems remained supple and relied on cooperation and interdependence between the resource user groups. Even though hierarchical differentiation existed within haal-Pulaar society, no group of resource users was wholly excluded from access to resources and no resource was used to the detriment of the others.

The resource use system relied on flexibility and diversity, to account for seasonal and inter-annual fluctuations. Resource users possessed a broad and integrated understanding of the local environment and its resource endowments and their systems did not attempt to control or significantly manipulate nature. The welfare of one resource use system was dependent on the sound functioning of the other resource use systems and resources were managed both for resource protection and social order.

During this period common property management systems dominated, with only *waalo* land being held privately. Forest resources were managed passively due to relative abundance of these resources in relation to the demand for them. Rules evolved as the demands on the resource changed, with more active management emerging when deemed necessary by the local resource users. The local populations had the institutional capacity and

intimate knowledge of the environment necessary to manage their resources.

The coexistence of diverse resource user groups in the Senegal River Valley has always implied a certain amount of competition over access to and control of natural resources. In recent decades, however, competition has increased between these groups, while the complementary interaction between the different resource use strategies has declined. Some of the resource use strategies and overlapping rights have become mutually exclusive. Intergroup relations and local strategies have become less adaptive.

At no point does any group with major autonomy take cognisance of local experience built up over generations and place value on it. Not the colonial regime, the independent state, or the donor funded development projects. The colonial and independent states have consistently rejected the experiences of the indigenous user groups in resource management.

In the Senegal River Valley, the agricultural system was historically divided between common property dryland cultivation and privately controlled floodplain production. Shifts were experienced in the agricultural management system upon the institution of certain colonial policies (*i.e.*, abolition of slavery, out-migration, encouragement of alternative crops, collection of taxes, introduction of new equipment, etc.) but the system remained largely intact. The most significant management change may have been the breakdown of certain communal practices, with a movement towards a greater individualism expressed in resource management decisions.

Cultivators have become significant animal owners over the years, and this trend has only increased with the introduction of irrigation. Animal herding is no longer the reserve of the Fulɓe and as this shift has evolved the cooperation between Fulɓe and cultivators has diminished. Cultivators rely less and less on such interactions, combining both resource use systems into a single household. Interestingly enough, however, at the same time cultivators

have become animal keepers, their agricultural system usurps spaces important for their growing herds. This can occur, in part, because their animal husbandry management system has become more intensive, based on pen-feeding. So as cultivators increase their herds they are becoming less dependent on interactions with other resource user groups. Furthermore, intensive pen-feeding implies that the animal owning cultivators do not require large expanses of natural pasture land and space outside of their control for their growing herds.

In contrast, pastoralist Fulbe struggling to survive and the remaining Subalbe, who have forsaken fishing for cultivation, grow more dependent on historical land holders or the state for access to the only resource base that still holds promise. Their interactions are no longer reciprocal, thus increasing the land holders' power over other resource user groups.

The Fulbe were the principal herd owners at the turn of the century. They relied on an extensive resource use pattern that remained open access for the most part, with only minor closure rules surrounding their encampments. Internal disputes of resource use surely have existed within the pastoralist society, as they do in all resource user groups, since time immemorial. Those with larger herds use more of the available resources and the objective of each and every herder has been to increase herd size. It is largely agreed, however, that in the pre-colonial era growth in herds was contained both naturally and through various social controls. The lack of investments and the non-alteration of the natural environment assured that the seasonally variable resource base would set a limit on herd size.

At the same time that herding is becoming ever more closely linked to irrigation, as irrigators depend on animal sales to raise the cash for irrigation inputs and herders purchase growing amounts of rice stubble to sustain their herds, irrigation demands a greater spatial separation between the two production systems. Furthermore, as pastoralists have become more dependent on agriculture, they become less mobile and therefore less responsive to the

pressures on the pasture. In the past the pastoral and agricultural production systems were controlled largely by two distinct groups but overlapped in space. Today the two resource use activities often are held in the hands of one individual but the system demands greater spatial separation of these activities.

The fishing resource management system was well developed prior to colonial rule, regulating use of the common pool resources by all members of the fishing society. This resource use activity demanded significant investments in equipment, a factor which accounts for the high degree of precision of local natural resource management rules. Although the definition of the local management system gave prominence to egalitarian principles, the power to operationalize nominal rights was unevenly distributed. In the fishing economy, the possession of superior equipment set one person apart from the others.

Forests that constituted part of a village *leydi* were treated as open access resources until colonial administrators began closing, classifying and regulating this resource base. Throughout history the forest resources have been used by all resource user groups for diverse purposes. The forest has never been the domain of any one group and use by one group or individual did not conflict with the activities of other users.

In quick reversal of this situation, the colonial administration claimed the forest domain as its own, the property of the state. Certain local users and uses were prohibited for the benefit of the state. Non-competitive local interactions were replaced with local individual resources users struggling against outsider users and government authorities for access to a resource base that had become bounded off and set aside.

The new level of scarcity of forest resources has increased the economic value of some products prompting the development of markets. Increased scarcity and the development of forest product markets has moved the once open access system from state

control to where private access and use rights are being asserted. Individuals are claiming extralegal private ownership of trees and villages are closing their wooded lands to outside users. Conflicts increase as private rights are avowed and the state seems unable to capture clear control of the management system.

Local resource users have shifted from being quite highly specialized in their resource use to being less exclusive today. One central factor which accounts for this change is the degradation of the resource base, and the consequential need for greater risk reducing strategies. Diversification in natural resource use functions to protect local users from complete loss at any one moment in time. Social changes, most significantly the tendency towards greater individualization in resource access, use and management, also account for increased individual diversification. Mutually beneficial resource use and management activities have fallen into disuse, requiring individuals to meet more of their needs independently. As intergroup relations became regulated increasingly by external rules, the local institutions became less adaptive to changing resource management circumstances.

Continuity in the Control of Land

Altering the control of land, taking it out of the hands of historic land holding families and awarding it to others, has been a strategy of every state regime beginning with the Deeniyankooße. Control of the land has been seen as the key to controlling the population and natural resource extraction. Earlier regimes were interested in land redistribution as a way to diminish the power of particular families and as a way to reward collaborators and supporters. The colonial authorities justified their redistribution policy on the basis of 1) favoring a more equitable smallholder agricultural system and 2) claiming that land redistribution would lead to significant increases in production that would directly benefit the

state. Regardless of repeated efforts to break down the system, the influence of custom and tradition in the realm of land tenure remains profound and acts as a real block to change.

After independence the state followed closely in the path of the colonial regime and claimed state ownership of all land resources, rationalizing this policy using very similar arguments as the previous regime. Not only aimed at giving land to local inhabitants who hold no historic rights to the most productive land (Macuuße and Nyaanyße), the policy was also geared toward securing outside investments from private, national and international sources.

The resource management system that has been in the hands of private individuals or families throughout the century has been most able to resist change, even with the state directing vast amounts of energy and resources to bring about change. This gives some credence to the argument in natural resource tenure and management theory that private rights are most durable and thus a greater guarantee for sustainable resource management.

Maintaining one's grip on individual land holdings in the Senegal River Valley, however, has not translated into land management with long-term use in mind. Holding onto the land, regardless of its future productive capacity, has been at times the sole objective of the land owners. The land holders recognize the power they maintain just by continuing to assert their claim, even if they do not have the financial or technological capacity to put it into production today.

Since independence the state has had some success in taking land holdings out of the hands of local land holders and been able to gain control over land resources to the extent that donor financial and technical resources have permitted it to appropriate land holdings "in the interest of the state." This has been achieved through a multitude of project activities following the drought of 1968-1973. Small-scale village perimeters (PIVs) were constructed

and managed through SAED, the parastatal financed through bilateral and multilateral assistance programs. Currently the trend has been toward construction of larger-scale irrigation infrastructure. Resistance to these state/donor initiatives on the part of local inhabitants is largely overpowered by the state. Primary control of the agricultural land base presently is split between historical land holding families and the state.

What is most remarkable is the resilience of the local tenure system. Historic land holding families have continued to hold onto their land rights and have captured the majority of benefits for state and donor irrigation investments.

Neither herders nor fishers had a stake in resources sought after by new power holders and political authorities and thus they have had little bargaining power. Control of land, on the other hand, has been a lasting objective of the state. Even when the state has outrightly claimed land for SAED or other donor-funded projects the historic land holders have had to be dealt with, and most often these people have been able to command some retribution for their land losses.

Some new actors are coming into play and they seem to be the most feared by the historic land holders. As was described in Chapter VII, people are returning to their native villages with the financial means for developing the land. Primarily younger men, but some older government bureaucrats and entrepreneurs, seek land where they have no prior claims. The gerontocratic power holders in the village are resisting these demands with new vigor. For the first time control of land is being challenged by fellow villagers, by insiders, and the historic land holders recognize this for what it in all likelihood is — a real and powerful threat to their enduring control of land.

Drawing Boundaries

The people, the land and other natural resources of the Middle Senegal River Valley have been divided, subdivided, circumscribed, bounded and fragmented in recurring sequences. Past and present ruling regimes have organized and rearranged this space, in one and yet another pattern, searching for the best fit. The best fit is defined according to the interpretation and for the purposes of the dominating party. Such analytical and administrative delimitations gain natural properties as they are imbued with meaning.

The present study made no attempt to specify a closed unit for the purposes of research. The intent was to ascertain the spatial extent of past and present interactions between resource users and their physical environment. The complexities of multiple resource user groups, transhumant populations, political and administrative boundaries fragmenting resource bases, and seasonal fluctuations mock efforts to solidify spatial boundaries.

Analysis of historical and current divisions of the space provide insights into the strategies of control and management of society and resources. Circumscribing territories has been alternately envisioned as a tactic for subjugating the local population or empowering them -- limiting or assuring access to resources, for fragmenting a powerful social group or uniting an interactive population.

For over a century preceding French colonial rule, the land was subdivided into *leydi* which were, in part, distributed by the ruling Almaami to loyal factions of the Islamic regime controlling the Fuuta prior to French conquest. These divisions provided the basis on which to distribute agricultural land, delimit transhumance movements, manage other resource use and collect and redistribute land payments and religious tithes. Access to land and other resources was organized and controlled through the *leydi* territorial system, which functioned as the base of a resource management strategy. "As groups gained a flexibility in their

mobility, their occupation of space revealed a division ordered according to fractional divisions, each one controlling a *leydi* and holding the priority rights over the available resources in that space."⁵ The principal functions of the head of the *leydi* included organizing the annual cycle of agro-halio-pastoral resource exploitation and managing the agro-pastoral space. The authority (or authorities) who governed the region, of which the *leydi* were part, held the responsibility for interterritorial relations. The policy towards "strangers" or outsiders was an essential component of the socio-spatial organization; the pasture, forest and water resources were open for use by members of other territories. Territorial divisions in the traditional society were part of a system to govern the population, but also formed the spatial base for a natural resource management strategy.

The colonial administrative divisions of the Fuuta served a variety of bureaucratic and controlling functions. The most significant attempts to set spatial boundaries on activities in the region occurred with the authorities' efforts to restrict pastoral movements and the classification of forests. Whereas sedentary inhabitants appeared to be easily assigned to bounded spaces, pastoralists defied such definition. Resource use strategies of sedentary cultivators also proved, however, to challenge the colonial administration's neat spatial packaging. Fields of any one family could be found on either side of the Senegal River, divided between the administrative jurisdictions of Senegal and Mauritania. Similarly, one individual may have had fields dispersed throughout an extensive area, either within the person's village territory or traversing boundaries. Fishing people moved much like the transhumant herders, and these movements also spurned bureaucratic divisions. In a variety of ways, the colonial authorities made efforts to rearrange and bound the indigenous inhabitants in the Senegal River Valley, for the purposes of administering, dominating, and

⁵ Oussouby Touré, "Les sociétés peul du Ferlo: continuité, changements, menaces," p. 4.

managing the population. Adopting a territorial strategy to manage wisely the natural resource base figured far less prominently in the authorities' minds, however, than did employing such a strategy for tax collection and conscription quotas.

Since political independence in 1960 the Senegalese government has adopted a hierarchy of administrative territorial units similar to that of the colonial authorities. In a more innovative vein, the 1972 administrative reforms instituting the *Communauté Rurale* implemented territorial circumscription as a means of creating meaningful local collectives. The definition of a *Communauté Rurale* attempts to imitate the idea of the *leydi* in the Fuuta. Article 1 of the law stipulates that the *Communauté Rurale* is meant to be a "natural unit," composed of a certain number of villages united by a sense of solidarity resulting from sharing the same resource use space and possessing the resources necessary for their development."⁶ Although the *Communauté Rurale* is meant to evoke notions of the traditional *leydi* and therefore be a powerful concept, this is problematic because the two concepts differ in spatial extent, as well as ideologically and judicially. The area incorporated in each *Communauté Rurale* is much more vast, rendering difficult the application of the *leydi*'s spatially based natural resource management role. Contrary to the understanding of policy makers and planners, the larger land area encompassed in the *Communauté Rurale* does not eliminate the need for permeable borders, but such flexibility and suppleness is largely unacceptable to the current administration. Unlike the administration of the *leydi* system, the autonomy of the *Communauté Rurale* is very limited and has been placed under the tutelage of the *sous-préfet*. Furthermore, the *Communauté Rurale* is more closed, with less of an open policy towards "stranger" resource users than the *leydi* system.

When *Loi 72-25* was first enacted, the stated intent of the law was to assure the

⁶ *Loi 72-25 du 19 avril 1972. Relative aux reforme de l'administration territoriale et locale.*

efficient and just management of Senegal's natural resources. By 1980 the amendments to the 1972 legislation no longer employed or gave a central place to the natural resource management objective. In contrast the law emphasized the classic administrative formula of local French law: "The rural council regulates through deliberation the affairs of the *Communauté Rurale*."⁷

The creation of the *Communauté Rurale* was, in part, intended to evoke a sense of responsibility amongst community members dwelling within its borders. Since the circumscribed area has no historical social significance it is not evident that the inhabitants will feel allegiance to it, nor is it apparent that the leaders will procure the authority imperative for effective management and development.

The various definitions of the resource users' space and how these bounded units have affected resource access, use and management have been explored throughout the chapters of this dissertation. Both the administrative systems and the local responses to internal and external, and to physical and social changes have tended to solidify boundaries and separate use spaces. Actual resource use is consistently more flexible than the boundaries of administrative units but this does not signify that the resource users, or at least certain members of the local society, have not had their own divisions and boundaries for controlling resource use. But fixing exogenous models of spatial organization on the local society has greatly affected the local populations' relationship to their space, and consequently their use and management of natural resources.

⁷ Monique Caverivière and Marc Debène, Le droit foncier sénégalais, p. 178.

Coping With Change

Throughout the dissertation I have attempted to outline the changing strategies of all of the resource user groups. The general trend has been toward more individualistic efforts in the struggle to survive. Each household has diversified into multiple natural resource activities, and perhaps more important to their reproduction, families have sent members out of the region to earn cash income and to diminish their dependence on the local natural resource base. In all resource use systems the attitude of reaping what one can while it lasts seems to dominate presently. There is no sense of conserving for the group's future interests because most local resource users are convinced that the resources will be used by others if they fail to exploit them. Furthermore, arrangements that are extralegal by national standards have become increasingly legitimate in local eyes over the decades and are taking on new relevance in individual resource strategies.

The cumulative impact of the changes that occurred in the local setting was to diminish the local institutions' effectiveness. This was not felt as much in the resource systems where local supply exceeded demand and where enforcement of central rules was lax. During and after the 1968-1973 drought years the impact of deteriorated resource management became acutely apparent to local users and central actors alike. One of the most striking aspects of local society today is the discord and diversity of agendas, rather than solidarity, pertaining to resource access, use and management. Members of the local population are seeking alternative means to gain greater autonomy from both indigenous power structures and state control.

The common property management system of the Subalße disappeared decades ago and those who continue to fish "mine" the river and tributaries for all that is left. The state, since the colonial regime, has not valued the fishing economy and has done little to support it.

Fishing people have diversified into agriculture and animal raising and moved out of the region as their principal coping strategies. Individuals compete between themselves and villagers regard their neighbors as outsiders as each party struggles to control what is left of the resource base.

Herders have diversified also, into irrigated agriculture and the cash economy. Families separate to allow diversification, sending herds and herders on distant treks of the sort that Fulße in the Valley have not partaken in for generations. Those who remain are adopting a strategy long advocated by state authorities – pen-feeding of animals, relying on rice stubble and purchased grasses. Fulße changed their herd composition after the 1968-1973 drought, orienting it toward goat production for the market.

Cultivators, under the direction and subsidy of the state, have diversified into irrigated agriculture since the 1970s. All groups – Torooße, Seßße, Fulße, Subalße, Nyaanyße and Macuuße – have entrance into this new form of agriculture. Some have simply extended the historic strategy of cultivating dispersed fields in different ecological niches to incorporate rice fields. Those individuals with more political power and greater financial means have all but abandoned dryland and recession agriculture and depend wholly on rice production and irrigated gardening. Ironically this monodevelopment policy, total reliance on irrigation, is being advocated by the state and donors and pursued by the local population during an era when many socio-ecological research findings support replication of the diversity and complexity found in natural systems.

The contemporary dynamism in the zone lies in development and control of an agro-pastoral resource use strategy based on irrigated agriculture and pen-feeding of herds. In the study area extensive pastoralism and fishing are no longer viable resource activities.

In some regards a clear winner over the decades, the central administration recognizes

that it risks becoming the biggest loser as a result of the demise of the local management institutions and the degradation of the natural resource bases. Recognizing its inability to control and manage the local resource base, the state has decided to devolve power to the local level. This situation promises to become more dynamic in the near future for several reasons. First, the state has given the local political unit, the *Communauté Rurale* council, control over its own budget. Second, out-migrants are returning to the village with capital to invest. They seek only secure access to land. The state has put a legal system in place to guarantee such land seekers access to resources and these returnees, often more familiar with the existing state legal structures than the resident villagers, are working to take advantage of the existing political and legal apparatuses. What the state has been unable to alter or manipulate very effectively from outside appears possible for returning villagers. The returning villagers know better, however, than to reject or oppose outright the historic and lasting power holders of the village. But as members of the local society, possessing adequate financial and technological resources, they are in the best position to play off elements of both the local and state systems.

By looking at the dynamics over time we may find a way to a more applicable policy decision that takes into account and responds to both local realities and needs and central state demands. This study has shown that historic resource management strategies relied on complex interactions between various resource user groups within an extended resource use space. Unidimensional development strategies currently pursued greatly increase the social, economic and ecological risks associated with natural resource management in the region. Taking an historical approach and examining natural resource access, use and management at the local and the extra-local scales allows us to identify the origins, paths and interconnections of many of the existing dynamics. As actors at the center and on the international scene are

coming to accept the need to devolve power to the local level, studies into the pre-existing local management systems help to identify their strengths and weaknesses, yielding information that can be incorporated into the re-creation of local institutions. An integrated study on all natural resource uses and management systems has helped to reveal that some of the strategies are being pursued at the expense of others and that discrepancies between various laws and policies and local realities prohibit integrated local management of natural resources. The swiftness and degree of transformation of multiple forms has drastically reduced the ability of local users to respond and adapt, thereby devaluing and threatening the integrity of local environmental knowledge systems. Throughout the study it has been made clear that it is not just a matter of reinstating the indigenous management system, however, since changed environmental, political, economic and social conditions have rendered some aspects of the local strategies inappropriate for today's circumstances.

EXAMINING THE INTERPRETATION

...our accounts are refractory representations.... Neither imaginatively nor empirically can it ever "capture" their reality.... [We do] not speak *for* others but *about* them.⁸

Geographic research has recently called for a return to the local, maintaining that it is the optimal scale for observation of practices and strategies, of processes and systems of social relations. Yet, the danger associated with an inductive approach is that it fragments and obscures reality. How do we recover these fragments? What scale of analysis is appropriate and sound? Throughout this dissertation it has been emphasized that analysis must move between spatial scales and through time for the account to be meaningful.

The political ecology approach was adopted for this work because it attempts to link local society, political economy and the environment in a single framework. As such, the

⁸ J. Comaroff and J. Comaroff, Ethnography and the Historical Imagination, p. 9.

political ecology approach moves beyond the limitations of both human ecology and political economy; the former being too focused on individual rationality and ahistorical and the latter lacking a concern about the physical processes and failing to attribute an active role to local resource managers and users. The regional political ecology approach reasserts the significance of contextuality, or time/space in social theory.

In this case study two sets of specificity have been explored, that of the physical system and that of the socio-economic system. In the words of Blaikie and Brookfield,

An omission of the first would lead to a failure to specify the physical processes, their spatial variability and interaction, and the immediate causal variables. The omission of the second leads to a purely technocratic and physical study of the processes of environmental degradation and perhaps the immediate resource uses leading to it, without any analysis of the political economic relationships at the local, regional and international scales which determine the actions of the land user in the affected area.⁹

Mortimore maintains that social processes can be both the cause and effect of degradation, or both, or neither.¹⁰ He goes on to argue that the interpreter's selection of the social factors to consider and the links to untangle prejudices the explanatory hypothesis, thereby confusing descriptive and explanatory modes. Ignoring social processes in the analysis of environmental degradation, however, is no less a prejudgment of the explanation. This thesis has argued that explanation must be sought through examination of both social and physical processes without selecting a closed or predetermined set of explanatory factors.

To strengthen the analysis, causes and effects have been examined from various angles and from different time perspectives and at distinct levels of geographical resolution. This study attempted to consider the multiple and changing links between nature and society by avoiding reliance on a deterministic hierarchical model and exclusive categories. The

⁹ Blaikie and Brookfield, Land Degradation and Society, p. 15.

¹⁰ M. Mortimore, Adapting to Drought, p.18.

interpretation found local resource users to be both victim and agent. Explanation moved through time and between multiple spatial scales striving to find the connections and contingencies between social, political, economic and environmental variables. Nature/society interactions were interpreted within progressively wider contexts.

Moving from the specific to the general and from one spatial or temporal scale to another, and accounting for the discrepancy between political economic and ecological time scales, remain difficult transition points and continue to present obstacles for analysis. Greater insights into the functioning of the ecosystem and social systems, and through examining progressively wider contexts of human/environment interactions, reduces the risks of oversimplifying perceptions of the interactions between nature and society.

Simplification is inevitable, however, when exploring such a complex and multifarious theme as the relationship between nature and society in a particular locale but this does not mean forfeiting exploration of the dialectic quality of the relationship. This dissertation bears the imprint of contemporary debates in that it separates local communities from global systems and then attempts to redeem the fragments by reconnecting the parts to the totality within an historically determinate environment. As Comaroff and Comaroff point out, we can only achieve a "historically situated mode of understanding historically situated contexts."¹¹

The case study approach has facilitated exploration at the level of interconnections, between the local and the global, past and present, and the physical and social. The place-specific and geo-historical approach adopted in this study has advanced the exploration of 1) the relations between access rights to natural resources and patterns of resource use and management and 2) the changes in the economic, social, political and environmental conditions that have reinforced or altered the processes and patterns of resource access, use

¹¹ J. Comaroff and J. Comaroff, Ethnography and Historical Imagination, p. 9.

and management and environmental degradation.

This political ecological study of physical and social processes and their interactions was able to identify many of the characteristic scales of process and important cross-scale influences. The research addressed issues of scale, and recognized the need to move between different scales, between generality and specificity and between cause and effect, in an effort to re-unite the analysis of nature and society. Avoiding the division between nature and society in exploring resource management issues in the Senegal River Valley has helped to reveal the reflexive and dialectic quality of human-environment interactions.

GLOSSARY OF SELECTED PULAAR WORDS

GLOSSARY OF SELECTED PULAAR WORDS

arɔo: Title of local political leader in Fulbe society.

assakal: Originally a religious tithe of ten percent of the harvest, came to equal a form of land rent.

awluɓe: Entertainers, Oral historians.

bayti: Crown lands.

cambil: A large fixed net used for fishing.

cootigu: A repurchase payment, made to the land owner to obtain the deceased's right to cultivate.

douru: Type of fishing equipment.

ɔoɔftal: Day of work owed to the land owner by the cultivator.

dulinge: Fishing equipment, long line with hundreds of hooks.

falo: Riverbank land.

fonde: A land zone between the *waalo* and the *jeeri*, does not flood.

fulɓe: Free status, herders.

guɓal: A type of very large fishing net, introduced in the study zone in the late 1800s or early 1900s.

haal-Pulaar: Pulaar speakers.

hiinde: Clan.

hollalde: Clay-rich, valuable agricultural soils.

hoore kosam: The calabash of milk paid every Thursday to the land owner by animal owning cultivators.

horum: Grazing zones, surrounding herding encampment, of restricted use often marked with

fencing.

imam: Religious leader.

jaagaraf/jaagaraaße: Tax collector.

jaaltaado/jaaltaaße: Political leader and resource manager in the fishing community.

jagoode: Provincial leader during Almamate rule.

jawamße: Free status, political counsellors.

jeejegol: A moist but rarely flooded zone on the edge of the *jeeri*.

jeerti: Sandy, dry land zone.

jom caatngol: Master of the a water course in the floodplain.

jom kollade: Owner of a highly productive zone of the floodplain.

jom leydi: Master of the land.

jom ndiyam: Master of the water.

jom wuro: Village head.

jowli: Type of fishing equipment.

jowre: Family held lands.

karawal/kartulowel: Eroded crusty soils.

kawngal: Payment of fish made to the owner of the land bordering the fishing zone.

lappi: designated animal paths.

lawße: Wood workers.

leydi: politico-ecological territorial division.

leydi jakre: Sediment rich soils located along river banks and drainage channels.

maabuße: Weavers.

maccuße: Slaves.

mawdo/mawße ndiyam: Water resources overseer(s).

nafoore: Services and gifts given to the land owner by the cultivator.

njatigi: Village host.

njoldi: Annual payment to the land owner for the right to cultivate.

nyeenyɓe: Casted people.

pelle: Age groups.

poosafusoode: Eroded soil with new wind deposited accumulations.

rem-peccan: Sharecropping arrangement, harvest is divided in half.

rimɓe: People of free status.

sakkeeɓe: Leather workers.

sangre: Ecological zone, ferruginous dry land area.

satigi: Title of local political leader in Fulbe society.

seɓɓe: Free status, warriors.

seeno: Sand.

subalɓe: Free status, fishers.

toccoonde: Eroded termite mounds.

torooɓe: Free status, clerics or koranic scholars/teachers.

waalo: Floodplain land.

wambaaɓe: Entertainers, oral historians.

wayilɓe: Blacksmiths, goldsmiths.

weendu/beeli: Lakes, usually seasonal.

ɾital: The share of animal the land user bestows on the land owner at when an animal is slaughtered on the borrowed land.

APPENDICES

Appendix I. Vegetation Found in the Study Area

Latin name	Pulaar name	Life Form	Location
<i>Acacia albida</i>	<i>caski</i>	tall tree	J,Jg,F,W
<i>Acacia ataxacantha</i>	<i>gogorlaawi</i>	tall shrub	J,F,
<i>Acacia macrostachya</i>	<i>ciidi</i>	tall shrub	J
<i>Acacia nilotica</i>	<i>gawdi</i>	tall tree	Jg,F,W
<i>Acacia raddiana</i>	<i>ciluki</i>	tall tree	J,Jg,F,W
<i>Acacia senegal</i>	<i>pattuki</i>	short tree	J,Jg,F,W
<i>Acacia seyal</i>	<i>bulbi</i>	short tree	J,Jg,F,W
<i>Acacia sieberiana</i>	<i>alluki</i>	tall tree	J,Jg,F,W
<i>Achyranthes aspera</i>	<i>moondere</i>	annual forb	W
<i>Adansonia digitata</i>	<i>bokki</i>	tall tree	J,F
<i>Adenium obesum</i>	<i>darbokki</i>	short shrub	J
<i>Alysicarpus ovalifolius</i>	<i>mbaammto</i>	annual legume	J
<i>Amaranthus graecizans</i>	<i>siina moongel</i>	perennial forb	J
<i>Ammania senegalensis</i>	<i>bujurbajara</i>	annual forb	J
<i>Anacardium occidentale</i>	<i>darkasi</i>		J,Jg,F
<i>Andropogon amplexus?</i>	<i>gol/golbel</i>	annual grass	J
<i>Andropogon gayanus</i>	<i>celal</i>	perennial grass	J,Jg,F,W
<i>Andropogon pinguipes</i>	<i>bayeeje, hudo wayo</i>	annual grass	J,F
<i>Annoma senegalensis</i>	<i>ndukum</i>		J
<i>Anogeissus leiocarpus</i>	<i>kojoli</i>	tall tree	J
<i>Aristida longiflora</i>	<i>buudel/selbere</i>	annual grass	J,Jg,W

J : Jeeri
 Jg : Jeejegol
 F : Fonde
 W : Waalo

Latin name	Pulaar name	Life Form	Location
<i>Aristida longiflora</i>	<i>sirilingo saro saroond</i>	perennial grass	J
<i>Aristida mutabilis</i>	<i>laaci dawangel, laaci rawaandu, ciwgal</i>	annual grass	J,W
<i>Aristida stipoides</i>	<i>buudel gaynaako</i>	annual grass	J
<i>Balanites aegyptica</i>	<i>murtook</i>	short tree	J,Jg,F,W
<i>Bauhinia reticulata</i>	<i>barkeew</i>	short tree	J,Jg,F,W
<i>Bauhinia rufescens</i>	<i>namaadi</i>	short shrub	Jg,F
<i>Bergia suffenticosa</i>	<i>lppere, nipere</i>	annual forb	F,W
<i>Blepharis linariifolia</i>	<i>grngal</i>	annual forb	J
<i>Blepharis maderaspatensis</i>	<i>takko takkongel</i>	annual forb	J
<i>Boerhavia diffusa</i>	<i>furere</i>	annual forb	J
<i>Boerhavia graninea</i>	<i>koppi gelood</i>	annual forb	F
<i>Bombax costatum</i>	<i>jooyi/bantink eew</i>	tall tree	J
<i>Borassus aethiopium</i>	<i>duɓɓi</i>	tall tree	F,W
<i>Borreria radiata</i>	<i>camtarle</i>	annual forb	J,W
<i>Boscia senegalensis</i>	<i>giile</i>	tall shrub	J,F
<i>Brachiaria distichophyllo</i>	<i>balbande</i>	annual grass	W
<i>Brachiaria sp.</i>	<i>paggari</i>	annual grass	F,W
<i>Cadaba farinos</i>	<i>ceɲseɲi</i>	short shrub	J
<i>Calotropis procera</i>	<i>bamamm</i>	tall shrub	J,Jg,F
<i>Capparis corymbosa</i>	<i>guumi ballew</i>	tall shrub	J,Jg,F
<i>Capparis decidua</i>	<i>guumi ndaneew</i>	tall shrub	J,Jg,F
<i>Cassia italica</i>	<i>falayel</i>	annual legume	J
<i>Cassia occidentalis</i>	<i>aljanaaje</i>	annual legume	F

J : Jeeri
 Jg : Jeejegol
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Latin name	Pulaar name	Life Form	Location
<i>Cenchrus biflorus</i>	<i>hebbere</i>	annual grass	J,Jg,F
<i>Centaurea perrottetii</i>	<i>kodde bamdi</i>	annual forb	J
<i>Cerathotheca sesamoides</i>	<i>laalo dane</i>	annual forb	J
<i>Chloris robusta</i>	<i>selbere</i>	annual grass	F,W
<i>Chrozophora tinctoria</i>	<i>fol fol</i>	annual forb	W
<i>Cissus quadrangularis</i>	<i>enndu ilwa</i>	liana	J
<i>Combretum aculeatum</i>	<i>lawannde</i>	short shrub	J,Jg,F
<i>Combretum glutinosum</i>	<i>dooki</i>	short tree	J,Jg
<i>Combretum micranthum</i>	<i>kinjeliga/telli</i>	short tree	J
<i>Combretum nigricans</i>	<i>buski/ dooki-ngori</i>	short tree	J,Jg
<i>Commelina forskalaei</i>	<i>waalwaalnde</i>	annual forb	J,F
<i>Commiphora africana</i>	<i>baddi</i>	short tree	J
<i>Corchorus olitorius</i>	<i>laalo-baali</i>	annual forb	F
<i>Cordia rothii</i>	<i>meelli</i>	short tree	F
<i>Cordia sinensis</i>	<i>meelli</i>	short tree	J
<i>Cordylla pinnata</i>	<i>duuki</i>	short tree	F
<i>Cratera religiosa</i>	<i>nayki</i>		J,F
<i>Cynodon dactylon</i>	<i>burgal colel</i>	annual grass	J,F
<i>Cyperus conglomeratus</i>	<i>laaci bewa</i>	annual sedge	J
<i>Cyperus tuberosus</i>	<i>hiisel</i>	annual sedge	J,W
<i>Cyrotosperma senegalensa</i>	<i>nofel baali</i>		J
<i>Dactyloctenium aegyptium</i>	<i>takkel poolel</i>	annual grass	W
<i>Dalbergia melanoxylon</i>	<i>jalammbaani</i>	tall tree	J
<i>Dichrostachys glomerata</i>	<i>burli</i>	tall shrub	J,F
<i>Digitaria gayana</i>	<i>beybuuli</i>	annual grass	J

J : Jeeri
 Jg : Jeejegol
 F : Fonde
 W : Waalo

Latin name	Pulaar name	Life Form	Location
<i>Digitaria occidentalis</i>	<i>muusaa ladel</i>	annual grass	J
<i>Diospyros mespiliformis</i>	<i>duunuɓe</i>	tall tree	J,Jg,F,W
<i>Echinochloa colona</i>	<i>ndiriri</i>	annual grass	J,Jg,W
<i>Echinochloa pyramidalis</i>	<i>ndiriri beeli</i>	annual grass	W
<i>Echinochloa schoenoides</i>	<i>paggari</i>	annual grass	W
<i>Echinochloa sp.</i>	<i>burgal colel</i>	annual grass	J,F
<i>Echinochloa staguina</i>	<i>diidere, haasoonde, njaawri</i>	annual grass	J,Jg,F,W
<i>Eragrostis sp.</i>	<i>paggari</i>	annual grass	F,W
<i>Eragrostis tremula</i>	<i>bowbowre, solgoppo yial olngal</i>	annual grass	J
<i>Euphorbia aegyptiaca</i>	<i>en-ennde</i>	annual forb	J,W
<i>Euphorbia basamifera</i>	<i>badakareewi</i>	annual forb	J,Jg,F
<i>Euphorbia sp.</i>	<i>ledde pure/bodi</i>	annual forb	J
<i>Feretia apodanthera</i>	<i>commbi</i>	short shrub	J,F,W
<i>Fimbristylis exilis</i>	<i>paggari colel</i>	annual sedge	J
<i>Gardenia erubescens</i>	<i>dinɗali</i>	short tree	J,Jg,W
<i>Gardenia ternifolia</i>	<i>dinɗaali</i>	short tree	F,W
<i>Glinus lotodes</i>	<i>jacce pure</i>	annual forb	F,W
<i>Grewia bicolor</i>	<i>kelli</i>	tall shrub	J,F
<i>Guiera senegalensis</i>	<i>gelooki/baali aamaa</i>	tall shrub	J,F
<i>Gymnea sylvestris</i>	<i>kardafɗi</i>		W
<i>Heeria insignis</i>	<i>keeleeli</i>	tall tree	F,W
<i>Heleochloa schoenodes</i>	<i>mbiddi</i>		W
<i>Heliotropium bacciferum</i>	<i>jaccere</i>	annual forb	W

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Latin name	Pulaar name	Life Form	Location
<i>Heliotropium ovalifolium</i>	<i>ndane</i>	annual forb	W
<i>Hygrophila auriculata</i>	<i>kodde bamdi</i>	annual forb	J,Jg,F,W
<i>Indigofera diphulla</i>	<i>guri bamdi</i>	annual legume	J
<i>Indigofera oblongifolia</i>	<i>babboruuje</i>	annual legume	J,Jg,F
<i>Ipomea aquatica</i>	<i>bootere</i>	annual vine	F,W
<i>Ipomea pestigridis</i>	<i>tirde-paabi/ dibiribi</i>	annual vine	J,F
<i>Ipomea repens</i>	<i>ababo</i>	annual vine	F
<i>Ipomea sp.</i>	<i>tirde</i>	annual vine	W
<i>Khaya senegalensis</i>	<i>kahi</i>	tall tree	F
<i>Lepidagathis anobrya</i>	<i>uggetal</i>	annual forb	J
<i>Leptadenia hastata</i>	<i>capatoowl</i>	annual vine	J,Jg,F,W
<i>Leptadenia pyrothenica</i>	<i>selewlewo</i>	annual vine	J
<i>Loeseneriella africana</i>	<i>delbi</i>	short tree	J,F
<i>Lotus arabicus</i>	<i>balamaawal</i>	annual legume	W
<i>Loudetia togoensis</i>	<i>selbere</i>	annual grass	J
<i>Maerua angolensis</i>	<i>bagi</i>	short tree	J
<i>Maerua crasifolia</i>	<i>deggeewi</i>	annual forb	J
<i>Maerua oblongifolia</i>	<i>lelelli</i>	annual forb	J,F
<i>Maytenus senegalensis</i>	<i>gial goodi</i>	tall tree	J,Jg,F,W
<i>Merremia aegyptiaca</i>	<i>layti leebel</i>	annual forb	J
<i>Merremia sp.</i>	<i>tire koobi</i>	annual forb	J
<i>Mimosa pigra</i>	<i>gaannji</i>	short shrub	F
<i>Mitragyna inermis</i>	<i>koyli</i>	tall tree	J,Jg,F,W
<i>Monsonia senegalensis</i>	<i>ndusurna</i>		J
<i>Nymphaea lotus</i>	<i>dmaame, ndayri</i>		J,W

J : Jeeri
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Latin name	Pulaar name	Life Form	Location
<i>Oryza barthii</i>	<i>naare</i>	annual grass	F,W
<i>Panicum anabaptistum</i>	<i>siwko</i>	annual grass	J,Jg,F,W
<i>Panicum turgidum</i>	<i>paggiri</i>	annual grass	J
<i>Paspalum vaginatum</i>	<i>dildere</i>	annual grass	J
<i>Pennisetum violaceum</i>	<i>wuuluunde</i>	annual grass	J
<i>Phragmites vulgaris</i>	<i>teere/taade</i>	annual grass	J
<i>Phyllanthus pentandrus</i>	<i>korojel</i>	annual forb	W
<i>Portulaca foliosa</i>	<i>takel polel</i>	annual forb	J
<i>Portulaca oleracea</i>	<i>takel polel</i>	annual forb	J
<i>Pterocarpus erinaceus</i>	<i>bani</i>	tall tree	J,F
<i>Pterocarpus lucens</i>	<i>canj</i>	tall tree	J,Jg,F
<i>Pupulia lappacea</i>	<i>nakadoodel</i>	annual forb	W
<i>Salvadora persica</i>	<i>guddi</i>		F
<i>Schizachyrium exile</i>	<i>garlabal</i>	annual grass	J
<i>Schoenefeldia gracilis</i>	<i>selbere</i>	annual grass	J,Jg
<i>Sclerocarya birrea</i>	<i>eeri</i>	tall tree	J,Jg,F
<i>Sesbania plachycarpa</i>	<i>gaandi</i>	annual forb	F
<i>Setaria pallidifusca</i>	<i>butalel</i>	annual grass	W
<i>Sphaeranthus senegalensis</i>	<i>deepte</i>	annual forb	F,W
<i>Sterculia setigera</i>	<i>boɓori</i>	tall tree	J,F,W
<i>Strychnos spinosa</i>	<i>dantakuluje</i>	short tree	J
<i>Tamarindus indica</i>	<i>jammi</i>	tall tree	Jg,F
<i>Trianthema portulacastrum</i>	<i>furere</i>		J
<i>Tribulus terrestris</i>	<i>tuppere</i>	annual forb	J,Jg,W
<i>Tripogon minimus</i>	<i>waare ndamdi</i>	annual grass	J
<i>Typha australis</i>	<i>yooteeji</i>	annual grass	J

J : Jeeri
 Jg : Jeejegol
 F : Fonde
 W : Waalo

Latin name	Pulaar name	Life Form	Location
Urochloa sp.	<i>baraawo/paggiri</i>	annual grass	F
Vetiveria nigriflora	<i>seembaan</i>	perennial grass	J,Jg,F,W
Walteria indica	<i>kafaf</i>	annual forb	J
Ziziphus mauritiana	<i>jaabe</i>	short tree	J,Jg,F
Ziziphus mucronata	<i>ngulumaaqe</i>	tall shrub	J,Jg,F
Ziziphus sp.	<i>jabuule/jaabe</i> <i>pobbi</i> <i>jaabe keele</i>	tall shrub	J,F
Ziziphus spina christi	<i>caabsaabi</i>	short shrub	F
Zornia glochidiata	<i>dengo</i>	annual legume	J,Jg,F,W
[Numerous species]	<i>jacce</i>	annual grass	J,Jg

J : Jeeri
 Jg : Jeejegol
 F : Fonde
 W : Waalo

Appendix II. Analysis of Soil Samples from the Study Area

Soil Description	% sand silt clay	pH BpH	P	K	CA	MG	N	C
<i>Jeejegol</i> field (0-10 cm)	74.5 10.1 15.4	5.8 7.3	20.0	88.5	440	128.0	9.80	119.46
<i>Jeeri</i> field (0-10 cm)	88.6 6.2 5.2	6.7	19.9	40.1	245	43.2	5.92	61.96
<i>Naerawal</i> slope bottom (0-10 cm)	61.4 13.4 25.2	7.7	33.0	156.0	3,055	528.0	16.35	247.71
<i>Naerawal</i> slope bottom (25-35 cm)	57.8 12.4 29.8	7.5	25.0	81.5	3,055	636.0	14.23	272.84
<i>Hollalde naalde</i> field (0-10 cm)	32.0 21.1 46.9	5.4 6.8	16.5	280.0	2,045	984.0	42.53	373.52
<i>Hollalde naalde</i> field (30-50 cm)	34.4 18.0 47.6	6.8	3.0	224.0	2,089	384.0	12.32	100.29
<i>Leydi Baleere</i> (0-10 cm)	48.9 26.3 24.8	7.6	102.0	228.0	2,134	384.0	52.57	571.43
<i>Leydi Baleere</i> (25-35 cm)	64.3 12.0 23.7	6.9	13.0	755.5	1,474	340.0	8.50	77.79
<i>Seeno Baleejo</i> eroded (0-10 cm)*	48.4 15.6 36.0	8.2	17.5	44.5	3,059	249.5	8.20	177.55
<i>Seeno Baleejo</i> eroded (30-40 cm)	75.6 12.5 12.0	6.8	80.0	53.5	680	198.0	10.13	130.56
<i>Seeno Baleejo</i> cultivated (0-10 cm)	83.8 10.1 6.1	7.5	53.5	49.0	440	112.0	9.26	92.58
<i>Seeno Baleejo</i> cultivated (30-40 cm)	78.1 6.9 15.0	7.5	42.0	75.5	1,011	200.0	8.67	105.36

Soil Description	% sand silt clay	pH BpH	P	K	CA	MG	N	C
<i>Dopere</i> "fertile" (0-10 cm)	66.8 14.8 18.4	7.3	72.5	188.0	1,305	287.0	29.65	325.45
<i>Dopere</i> "fertile" (30-40 cm)	68.1 9.4 22.5	7.0	80.0	113.5	1,778	344.0	13.92	197.83
<i>Leydi daneeri</i> (0-10 cm)	74.5 14.3 11.2	7.4	60.0	105.5	1,095	140.0	26.57	289.24
<i>Leydi daneeri</i> (30-40 cm)	70.1 10.1 19.8	5.9 7.2	13.0	80.0	1,083	310.5	10.50	96.20
<i>Jeejegol</i> new, burnt field (0-10 cm)	67.7 19.5 13.2	6.8	45.5	151.5	800	156.0	20.98	178.34
<i>Jeejegol</i> cultivated (0-10 cm)	66.1 20.7 12.8	7.1	41.0	156.0	842	164.0	24.82	240.07
<i>Jeeri, karawaal</i> field (0-10 cm)	80.3 13.3 6.4	5.9	26.2	37.0	274	46.0	5.61	63.52
<i>Jeejegol</i> new, burnt field (0-10 cm)*	63.6 23.9 12.4	7.6	92.5	377.0	1,348	192.0	27.66	253.92
<i>Jeejegol</i> new, burnt field (25-35 cm)	70.5 18.0 11.5	6.3 7.3	13.5	66.5	560	184.0	10.33	97.14
<i>Jeejegol</i> new, burnt field (45-55 cm)	73.3 11.6 15.1	6.4 7.3	10.5	44.5	720	208.0	7.84	80.13
<i>Jeejegol</i> 2 year old field (0-10 cm)	63.3 22.4 14.3	7.6	31.0	228.0	1,179	216.0	25.10	231.57
<i>Jeejegol</i> 2 year old field (25-35 cm)	71.0 12.7 16.3	5.8 7.2	5.0	62.0	800	263.5	10.68	100.86

Soil Description	% sand silt clay	pH BpH	P	K	CA	MG	N	C
<i>Jeejegol</i> 2 year old field (45-55 cm)	65.9 13.3 20.8	6.8	3.5	58.0	1,095	297.0	9.14	90.26
<i>Kartalowel</i> (0-10 cm)	83.2 10.2 6.7	5.8 7.3	92.5	13.5	200	22.0	5.23	65.42
<i>Kartalowel</i> (25-35 cm)	82.3 9.7 8.0	5.9 7.1	123.5	13.5	200	44.5	4.53	60.61
<i>Seeno Baleejo</i> eroded (0-10 cm)	84.0 10.1 5.8	7.3	49.0	44.5	320	62.0	7.62	93.40
<i>Seeno Baleejo</i> eroded (35-45 cm)	50.0 14.0 36.0	8.0	15.5	44.5	2,918	192.0	8.99	174.92

P, K, CA, MG, N and C are expressed in ppm.

*Reactive to 1NHCL

Appendix III. Air Photography Interpretation and Analysis, 1954 & 1980

Vegetation Type	Area, ha 1954	Area %	Area, ha 1980	Area %	% Change 1954 -1980
Dense Forest	29.09	0.12	0.00	0.00	-0.12
Open Forest	2,399.06	10.28	648.73	2.78	-7.50
Gallary Forest	688.68	2.95	587.30	2.52	-0.43
Thicket	298.05	1.28	171.75	0.74	-0.54
Tree Savannah	5,494.70	23.54	3,236.56	13.86	-9.68
Bush Savannah	7,665.80	32.84	4,300.30	18.42	-14.42
Grass Savannah	4,500.74	19.28	12,380.01	53.03	+33.75
Cultivated Zone	1,562.05	6.69	1,838.17	7.87	+1.18
Irrigated Perimeter	0.00	0.00	50.12	0.21	+0.21
Sand Accumulation	14.35	0.06	34.73	0.15	+0.09
Bare Ground	693.30	2.97	98.20	0.42	-2.55
Total	23,345.84	100.00	23,345.87	100.00	

ha = hectares

Appendix IV. Fish Species Found in the Region, Past and Present

Latin name	Pulaar name	Past	Today
<i>Altes dentix sethente</i>	<i>glccal/gicce</i>	x	x SR
<i>Altes imberi</i>	<i>debbeere/debbeeje</i>	x	- J
<i>Altes nurses</i>	<i>kummba kadalal</i>	x	*x SR - J
<i>Altes sp.</i>	<i>anndoonde</i>	x	x SR
<i>Auchenoglanis biscutatus</i>	<i>ngurlo</i>	x	x SR
<i>Chrysistichis nigrodigitatus</i>	<i>lumma/luuba</i>	x	
<i>Citharinus citharus</i>	<i>rimmbeere</i>	x	- J
<i>Citharinus citharus</i>	<i>wettoore/rimmbeere</i>	x	- J
<i>Clarias anguillaris</i>	<i>ɓalew</i>	x	
<i>Clarias submaginatus</i>	<i>ndaawa</i>	x	- J x SR
<i>Clarias submaginatus</i>	<i>woore</i>	x	x SR
<i>Gymnarchus niloticus</i>	<i>beeso</i>	x	-
<i>Heteretis niloticus</i>	<i>bala</i>	x	x SR
<i>Heterobranchus longifilis</i>	<i>raafulde</i>	x	
<i>Hydrocyon somonorum</i>	<i>seendu/ceeli</i>	x	x SR
<i>Hyperopsis bebe occidentalis</i>	<i>fadduru, paddi</i>	x	x SR
<i>Hyperopsis sp.</i>	<i>ndeelaw</i>	x	- J
<i>Hyperopsis sp.</i>	<i>paru ciŋku</i>	x	
<i>Hyperopsis sp.</i>	<i>paru meeburu</i>	x	-

- x : present, in all zones
 x SR : present, Senegal River
 x J : present, Jaamal
 * : fished today but not in the past
 < : presently fished when very small
 - : cited as having disappeared
 : (blank) no information

Hyperopis sp.	<i>paru tontorru</i>	x	x SR
Labes senegalensis	<i>janndere</i>	x	x
Labes senegalensis	<i>janndere</i>	x	*x
Lates niloticus	<i>supeece/sompeere</i>	x	x SR
Normyrus rume	<i>enu</i>	x	- J
Pagrus bayad macropterus	<i>cafdi/safdu</i>	x	x < SR
Polypterus senegalus	<i>gajjal/gajje</i>	x	
Schilbe mystus	<i>ngeello seese</i>	x	x
Schilbe sp.	<i>ngeello baleejo</i>	x	x
Synodontis batensoda	<i>bool/hoddaandu bool</i>	x	
Synodontis sp.	<i>feya haada</i>	x	
Synodontis sp.	<i>koddaadi</i>	x	x SR
Synodontis sp.	<i>uumata</i>	x	
Tedrodon fahaka strigosys	<i>duddu</i>	x	
Tilapia galilea	<i>sidere/cide</i>		
Tilapia nilotica	<i>sidere/cide</i>	x	*x SR

Other water creatures, all of which have greatly diminished in occurrence or disappeared:

Crocodylus cataphractus	<i>nooroo/norwa/noodi</i> (crocodile)
Geochelone sp.	<i>heende/keede</i>
Pelomedusa sp.	<i>heende/keede</i>
Python sp.	<i>ngaandaata</i>
Varanus niloticus	<i>gundo</i> <i>elo</i>

**Appendix V. Average Tree Densities in Three Micro-Ecological Zones
Around NDulumaaji Dembe**

Location	< 25mm diameter	25-95mm diameter	> 95mm diameter	Total Trees/ Hectare
<i>Fonde, NW of NDulumaaji Dembe</i>	41.16	38.60	8.22	87.98
<i>Fonde, NE of NDulumaaji Dembe</i>	30.60	48.20	20.90	99.70
<i>Fonde, SW of NDulumaaji Dembe</i>	70.80	82.30	29.90	183.00
<i>Fonde, SE of NDulumaaji Dembe</i>	66.40	51.60	45.60	163.60
<i>Jeejegol, SE of NDulumaaji Dembe</i>	121.30	211.70	85.00	418.00
<i>Jeejegol, S of NDulumaaji Dembe</i>	107.70	213.80	24.30	345.80
<i>Jeeri, S of NDulumaaji Dembe</i>	23.06	61.96	6.62	91.64

Appendix VI. Population Data for Villages in the Study Area

Population of Nabaaji Siwol *Communauté Rurale* Villages

Village	1896	1957	1976	1979	1982	1988	1990
Binke	—	—	—	8	18	—	—
Boki Sabbudu	—	181	265	306	340	468	446
Boynaaji Runde	—	527	795	877	1013	795	—
Boynaaji Sinthiou	—	640	1166	—	1216	1343	—
Diandioly Dienga	—	73	122	171	228	356	—
Fété Niébé	—	91	423	163	248	889	—
Gourel Moussa	—	7	96	8	25	34	—
Koundel	—	233	388	468	600	351	—
Mogo Yalalbe	—	133	193	153	193	239	—
NDulumaaji Dembe	571	789	1468	1843	2004	2125	2188
NDulumaaji Funebe	217	422	924	731	1010	1178	1816
NGueyenna Teiba	—	175	464	241	305	1081	—
Sinthiou Bara	—	45	61	54	84	98	—
Nabaaji MBal	—	147	167	257	296	539	—
Nabaaji Siwol	—	749	—	1019	1130	1940	—
Oudourou	447	521	1618	811	1180	2003	—
Outorfe	41	95	295	170	250	187	—
Pampinafe	—	69	136	87	117	94	—
Saraaji	—	—	—	27	54	44	—
Seedo Abasse	145	218	400	455	553	634	1000
Seedo Sandarafe	61	6	14	8	19	—	—
Seedo Sebe	520	719	1059	706	833	1805	1000
Sinthiou Mogo	44	445	627	722	811	733	—
Sinthiou Tapsiru	—	101	163	54	196	94	103
Thiarène	237	256	629	400	543	1471	1588
Thioubalel Nabaaji	—	—	399	289	320	468	—
Tiguéré Ciré	—	363	855	589	480	1012	—
Tiguéré Yéné	—	172	370	385	420	469	—

Population Data for Other Villages in the Study Area

Name of Village	1896	1976	1979	1982	1988
Bokijaabe	1321	—	—	—	3657
Canton de N'Guenar	14281	—	—	—	—
Diéoul	543	—	—	—	239
Dolde Diaobe	525	43	—	—	1767
Dondou	1116	—	—	—	2541
Doungo Wuro Alpha	398	—	—	—	1792
Gaoudal (I + II)	104	712	—	—	1103
Katote	524	—	—	—	423
Kawel Jallube	737	531	—	—	1471
Kédéle	107	—	—	—	161
Mohou	44	193	153	193	233
NGuiguilon	1724	—	—	—	2178
Pade Baïougoul	180	—	—	—	181
Sadel	433	1672	—	—	2004
Samba Touna	95	—	—	—	45
Sara Kouro Jaloë	184	—	—	—	436
Thiarene	237	629	—	—	634
Thioutine Koë	200	—	—	—	165

Sources: ANS 22 G 39, 22 G 46, 22 G 47 and 2G series. Becker, C.; Merlin, V.; Schmitz, J.; Chastenet, M. "Les Premières Recensement au Sénégal et Évolution Démographique, Partie I." ORSTOM, March 1988. Ministère de l'Économie, des Finance et du Développement de la Prev et de la Statistique, "Repertoire des Village, Région de Saint-Louis," 1988. Population Data From Village and Arrondissement Archives.

Appendix VII. Reported Crop Yields for Matam Cercle (tons)

Year	Millet	Corn	Niebe	Rice	Cotton	Peanut	Patat
1921	—	—	—	—	—	—	—
1922	105,000	—	—	250	—	—	—
1923	117,000	—	—	286	—	—	—
1924	31,000	—	—	500	—	350	—
1925	31,540	5,600	490	710	1,020	1,085	54
1926	31,540	5,600	490	710	1,020	1,085	79
1936	39,000	5,000	600	30	—	—	—
1937	45,000	5,000	1,000	100	280	1,500	—
1938	30,400	8,000	1,500	60	—	2,800	—
1939	33,000	5,250	500	50	150	2,000	—
1940	28,000	3,500	600	100	950ha	1,500	—
1941	42,000	1,500	600	50	—	—	—
1942	28,000	450	—	70	—	—	—
1943	30,000	500	—	45	—	—	—
1944	16,200	750	—	160	156	—	—
1945	20,000	1,060	1,500	—	169	—	1,250
1946	32,500	2,000	1,800	160	—	1,080	—
1947	34,500	2,000	1,800	160	1,100	1,100	—
1948	35,000	2,000	1,500	120	1,000	1,080	—
1949	34,000	—	1,500	120	—	800	—
1950	27,000	—	1,500	2,500?	—	—	—
1951	35,000	3,000	1,100	100	—	—	1,250
1952	30,000	2,800	1,200	50	—	—	1,200
1953	25,000	3,600	2,100	50	—	—	750
1954	24,000	2,700	2,000	60	—	500	750
1955	29,000	2,250	1,750	60	—	—	600
1956	28,500	3,700	770	40	—	700	600
1957	31,000	9,300	900	75	—	1,000	750
1958	20,870	4,500	2,270	200	—	2,480	210
1959	32,100	3,389	4,295	200	—	1,900	750
1960	23,823	3,252	462	200	13	2,882	750
— = no data available.							

Source: Annual reports, Matam Cercle, ANS series 2G.

Appendix VIII. Reported Numbers of Domestic Animals for Matam Cercle

Year	Horses	Cows	Donkeys	Sheep/ Goats
1912	458	125,000	—	21,850
1919	1,330	68,977	3,450	115,133
1925	1,965	43,800	4,624	63,714
1927	2,128	41,442	4,709	57,238
1928	2,150	41,520	4,700	57,230
1929	3,017	51,455	7,091	96,978
1930	2,953	50,067	6,992	97,061
1931	2,933	51,359	7,363	107,279
1932	2,907	49,395	7,337	102,526
1933	2,883	48,454	7,269	101,898
1934	2,645	44,636	6,563	122,629
1935	2,595	44,592	6,563	102,629
1936	2,696	54,598	6,563	102,629
1937	1,616	19,046	2,974	large -
1938	1,759	23,631	3,399	small +
1939	1,685	24,631	3,096	small +
1940	1,840	27,251	3,592	steady +
1941	2,035	30,921	4,190	102,629
1942	1,837	29,474	3,765	101,898
1943	2,046	31,094	4,190	103,000
1944	1,641	29,592	3,883	—
1945	1,554	32,391	3,989	55,877
1946	1,320	34,808	3,555	56,260
1947	1,355	43,228	3,395	46,390
1948	1,380	37,481	3,461	56,248
1949	1,370	39,754	3,378	59,079
1950	1,257	44,659	3,556	68,540
1951	1,452	45,193	3,889	58,816
1952	1,295	46,497	3,480	46,760
1953	1,270	45,903	3,466	48,326
1954	1,236	47,214	3,455	52,346
1955	1,227	45,510	3,317	47,982
1956	1,119	41,687	2,935	44,691
1957	1,119	41,685	2,935	44,695
1960	1,045	45,908	2,603	51,318
1981	19,422	176,064	25,865	394,931
1989	23,000	115,000	38,000	390,000

+ = increase, but no numeric data given
 - = decrease, but no numeric data given
 — = no data available

Source: Cercle and service annual reports, ANS 2G series for all years listed in the table.

APPENDIX IX

A PARTIAL LIST OF NATURAL RESOURCE MANAGEMENT LEGISLATION FOR SENEGAL

I. Land Tenure Laws and Associated Legislation

5 novembre 1830. French Civil Code applied to AOF, along with all land tenure rules. No provisions for Islamic law or indigenous tenure systems.

1 janvier 1861. Damel of Cayor grants France rights to all lands not in use.

Circulaire du 1894. The idea that captives for life were allowed to become tenant farmers after 10-12 yrs of work is accepted in principle, advocated by Gov. de Lemothe.

Circulaire Ponty, 1 février 1901. Suppresses the right to hold captives; abolishes the right of master to recuperate a former captive.

Décret du 20 juillet 1900 relatif au régime de la propriété foncière au Sénégal et dépendances. IORE (1900): 736.

Décret du 10 novembre 1903. Recognizes some indigenous land tenure practices but forbids payment of *assakal*.

Décret du 23 octobre 1904 confirms state appropriation of "terres vacantes et sans maîtres" without clarifying what this meant or without recognition of indigenous land tenure systems.

Arrêté du 10 janvier 1905 au sujet des terrains cultivés sur la rive droite du Sénégal par les indigènes habitant la rive gauche.

Décret du 12 décembre 1905. Established fines and imprisonment (for 2-5 yrs) for any one continuing to hold slaves.

Décret du 24 juillet 1906 portant organisation du régime de la propriété foncière dans les colonies et territoires relevant du gouvernement général de l'AOF. BOC (août 1906), p. 681. Article 58 recognizes the existence of indigenous forms of tenure and provides for their transformation into legal property through immatriculation.

Décret du 8 octobre 1925 instituant un mode de constatation des droits fonciers des indigènes en AOF. Attempted to record and legalize traditional land holdings. BOC (octobre 1925), p. 1647.

Décret du 29 septembre 1928 portant réglementation du domaine public et des servitudes d'utilité publique en AOF. IOAOF (septembre 1928), p. 783.

Décret du 3 décembre 1931. To codify the customary tenure rules. Instituted customary tribunals.

Décret du 26 juillet 1932 portant réorganisation du régime de la propriété foncière en AOF. IOAOF (29 avril 1933), p. 426.

Décret du 20 décembre 1933 portant constatation des droits fonciers des indigènes en AOF. BOC (janvier 1934), p. 1740.

Décret du 15 novembre 1935. More precise meaning given to "terres vacantes et sans maître" as lands not immatriculated in accordance with earlier decrees or lands not exploited or occupied for more than 10 yrs. IOAOF (novembre 1935), p. 1066.

Arrêté N° 2903 AP promulgant en AOF le décret du 15 novembre 1935, abrogeant le décret du 23 octobre 1904 sur le domaine et portant réglementation des terres domaniales en AOF. IJS N° 1841 (9 janvier 1936), pp. 18-20.

Arrêté N° 275 FOR du 16 janvier 1952. Concerning land taxes. IJS N° 2736 (31 janvier 1952), p. 82.

Décret du 20 mai 1955 portant sur la réorganisation foncière et domaniale en AOF et AEF. Instituted the *livret foncier* and accepted traditional tenure provided it was exercised on non-immatriculated lands and provided that appropriation of lands was not allowed if traditional tenure rights on it existed. IORE (18 juillet 1956 et rectificatifs du 17 août et 15 septembre 1956) promulgated 7 septembre 1954.

Arrêté général N° 6083/EF du 7 novembre 1950 portant la création de la commission du fleuve. The commission was composed of both local/traditional and colonial authorities.

Loi N° 60-014 du 2 août 1960, established the right of state to appropriate land (art. 3), and provided procedures for registration of lands held under individual customary tenure (art 4).

Loi N° 64-46 du 17 juin 1964 relative au domaine national. IORS n° 3692 (11 juillet 1964), pp. 905-906.

Décret N° 64-573 du 30 juillet 1964 fixant les conditions d'application de la Loi N° 64-46 du 17 juin 1964 relative au domaine national. IORS (29 août 1964), pp. 1123-1126.

Décret N° 64-574 du 30 juillet 1964 portant application de l'article 3 de la Loi N° 64-46 du 17 juin 1964 relative au domaine national, autorisant, à titre transitoire, l'immatriculation au nom des occupants ayant réalisé une mise en valeur à caractère permanent. IORS (5 septembre 1964), pp. 1167-1169.

Décret N° 72-1288 du 27 octobre 1972 relatif aux conditions d'affectation et désaffectation

des terres du domaine national comprises dans les communautés rurales. JO RS n° 4260 (18 novembre 1972).

Décret N° 66-858 du 7 novembre 1966 portant application de l'article 5 de la Loi N° 64-46 du 17 juin 1964 relative au domaine national. JO RS (19 novembre 1966), p. 1118.

Loi N° 76-66 du 2 juillet 1976 portant code du domaine de l'Etat au Sénégal. JO RS (20 septembre 1976), pp. 1478-1486.

Loi N° 76-66 du 2 juillet 1976 relative à l'expropriation pour cause d'utilité publique et aux autres opérations foncières d'utilité publique. JO RS (28 juillet 1976), p. 1118.

Décret N° 77-563 du 3 juillet 1976 relative à l'expropriation pour cause d'utilité publique et aux autres opérations foncières d'utilité publique. JO RS (30 septembre 1977), p. 990 and s.

Loi N° 80-14 du 3 juin 1980, giving the rural councils the right to distribute and repossess land and define land use.

Décret N° 81 557 du 21 mai 1981 portant application du Code de Domaine de l'Etat en ce qui concerne le domaine privé. JO RS (5 septembre 1981).

Décret N° 87-720 du 4 juin 1987 transférant les zones pionniers en zones du terroirs.

Projet de Arrêté interministériel fixant la composition du dossier et registre fonciers par communauté rurale.

II. Legislation on Local Political and Territorial Organization

Décret du 10 novembre 1903 relatif à l'Afrique Occidentale Française. Reduced the judicial powers of "indigenous chiefs" by naming *tribunal indigènes*.

Arrêté N° 87 du 11 janvier 1935 portant réorganisation de l'administration indigène, to show greater respect of local custom in selection of *chef de canton*. I.O. Sénégal (1935), p. 46.

Arrêté N° 3215 du 13 novembre 1937. Selection of local political representation.

Décret, 1944. Reversed the 1903 décret by assigning traditional chiefs and notables to the *tribunal coutumiers*.

Décret du 21 mai 1919 portant organisation de conseil des notables.

Décret N° 60-448 du 28 décembre 1960 portant dissolution du fonds commun des S.P. et S.M.P.R. du Sénégal. JO RS N° 3427 (7 janvier 1961), p. 6.

Décret N° 70-445 du 20 avril 1970 portant création et organisation d'un comité de coordination en matière de formation rurale. JO RS (9 mai 1970), pp. 454-455.

Décret N° 72-1390 du 4 février 1972 portant réorganisation des centres d'expansion rurale. JO RS n° 4267 (23 décembre 1972), p. 755.

Loi N° 72-25 du 19 avril 1972. Relative aux reforme de l'administration territoriale et locale. JO RS (13 mai 1972), p. 755.

Décret N° 72-636 du 29 mai 1972 relatif aux attributions des chefs de circonscription administrative et chefs de villages. JO RS n° 4230 (17 juin 1972).

Décret N° 72-1288 du 27 octobre 1972 relatif aux conditions d'affectation et de désaffectation des terres du domaine national comprises dans les communautés rurales, modifié par le Décret N° 80-1051 du 14 octobre 1980. JO RS (18 novembre 1972), p. 1894.

Décret N° 73-724 du 6 août 1973 portant création du Conseil national de développement des collectivités (modifié par le Décret N° 74-208 du 5 mars 1974).

Loi N° 80-14 du 3 juin 1980 abrogeant et remplaçant certaines articles de la Loi N° 72-25 du 19 avril 1972. Land distributions to be made by the entire rural council, but must be approved by *sous-préfet*. JO RS (20 septembre 1980), p. 1102.

Décret N° 85-146 du 9 février 1985. Le Comité National de Planification, de coordination et du suivi du développement planifie initie dans cette zone.

Décret N° 86-445 du 10 avril 1986. Moves vetoing power of rural council's land decisions from the *sous-préfet* to the *préfet*.

Loi de 25 septembre 1990 modifiant la Loi N° 72-25 du avril 1972 relative aux communautés rurales.

Projet de Décret instituant le Comité de gestion des eaux du fleuve Sénégal, de ses affluents et défluent ainsi que du Lac de Guiers.

III. Forestry Legislation

Circulaire du 1894 édictant les règles suivant lesquelles les coupes devaient être faites dans la vallée du fleuve Sénégal. Decrees and Arrêtés were passed in 1896, 1897 and 1898 concerning cutting regulations.

Circulaire du 12 février 1897. Autorization from *Cercle* administration required for cutting trees.

Décret du 20 juillet 1900 relatif au régime forestier du Sénégal et Dépendances. Source: Gov. Gen. de l'A.O.F. colonie du Sénégal, Service de l'Agriculture et des Forêts, *Reglementation Forestière* (Saint-Louis: Imprimerie du Gov., 1916). JO RF, 1900, pp. 736 et s.

Arrêté N° 24 du 18 février 1907 relatif à la coupe et l'arranchage de bois du domaine colonial. JO S N° 322, 28 février 1907, p. 99.

Arrêté du 14 septembre 1907 parmi les infractions. Applies only to non-French.

Décret du 24 février 1908 (revised 22 octobre). Charcoal and wood tax imposed. IOS N° 372, 19 mars 1908.

Décret 20 juillet 1909, art. 8, 2° alinea. Région de Matam. Creation of two forest reserves in the Matam region.

Arrêté N° 241 du 15 février 1913 créent deux reserves forestières au Sénégal. IOS, N° 636 (6 mars 1913), p. 311.

Arrêté N° 130 du 9 février 1916 réglementant l'exploitation et la circulation des bois dans la colonie.

Arrêté du 25 juillet 1923 portant sur la création d'un cadre d'agents forestiers indigènes.

Circulaire N° 1278 du 25 juin 1925 au sujet de la propagation des essences forestières et fruitières. IOS N° 1278 (25 juin 1925), p. 450.

Arrêté N° 26 SE réglementant l'exploitation des gommiers dans la colonie du Sénégal. IOS N° 1685 (19 janvier 1933), p. 47.

Circulaire N° 26 SE sur la politique forestière. IOS N° 1689 (16 février 1933), pp. 142-144.

Arrêté N° 2514 AGR portant modification de l'arrêté N° 130 du 9 février 1916, réglementant l'exploitation et la circulation des bois dans la colonie. IOS N° 1732 (7 décembre 1933), p. 871.

Arrêté N° 1768 SE réglementant l'exploitation des gommiers dans la colonie du Sénégal. IOS N° 1768 (16 août 1934), p. 670.

Arrêté N° 619 AE fixant certaines mesures en vue de prévenir le déboisement du Sénégal. IOS N° 1807 (16 mai 1935), p. 329.

Arrêté N° 1312 SE constituant des réserves boisées le long des routes et pistes de la colonie du Sénégal. IOS N° 1812 (20 juin 1935), pp. 447-448.

Décret du 4 juillet 1935 sur le régime forestier de l'A.O.F. IOS N° 1819 (8 août 1935).

Arrêté N° 1704 AP du 24 juillet 1935 promulgant en AOF le décret du 4 juillet 1935, sur le régime forestier de l'AOF. IOS (8 août 1935), pp. 599-606.

Arrêté N° 2195 SE du 28 septembre 1935. Arrêté définissant la limite sud de la zone sahélienne et réglementant l'exploitation des forêts. IOS n° 1829 (17 octobre 1935), p. 791-793.

Arrêté N° 295/AGR du 1 février 1937. Specific forest use and classification conditions for Senegal. IOS (18 février 1937), p. 114.

Arrêté général du 10 février 1937. The forestry service was detached from the agricultural service. IORS (29 juillet 1937), p. 540.

Arrêté N° 3386 SE abrogeant certains arrêtés portant créations de réserves boisées au Sénégal. IOS N° 195 (3 février 1938), p. 918.

Arrêté N° 3579 SE 1938 du 27 octobre 1938. Organisation du Service des Eaux, Forêts, et Chasses en A.O.F. Charged with the study and protection of forests. Assigned to search for fuel alternatives. IORS (12 novembre 1938), p. 1353.

Arrêté N° 3782 SE du 15 novembre 1938 réglementant les exploitations industrielles des bois de feu et à charbon. IORS (26 novembre 1938), p. 1401.

Arrêté N° 355/FOR du 3 février 1939. Arrêté portant réglementation des cultures sur sol forestier après défrichement et incinération des arbres dans les Cercles de Matam et de Linguéré. IORS (9 février 1939), p. 116.

Circulaire N° 69 SE au sujet du programme de guerre des services forestiers (feux de brousse). IOS N° 2087 (27 juin 1940), p. 420-21.

Arrêté N° 2092/FOR du 28 juillet 1941. Arrêté fixant les modalités d'application dans le territoire du Sénégal de l'arrêté N° 3782 SE du 15 novembre 1938 réglementant les exploitations industrielles des bois de feu et à charbon. IORS (7 août 1941), p. 443.

Arrêté N° 2088/FOR suspendant l'expédition par Saint Louis du bois de gonaké dans la vallée du fleuve Sénégal jusqu'à nouvel ordre. IOS N° 2147 (7 août 1941), p. 444.

Arrêté N° 3037/FOR fixant le prix d'achat à la production du charbon du bois. IOS N° 2161 (13 novembre 1941), p. 616.

Arrêté N° 4552 SE du 22 décembre 1942. Arrêté interdisant toute circulation, en dehors des routes, sur les parcelles de forêts classées en voie de régénération.

Arrêté N° 86/FOR du 11 janvier 1943. Arrêté précisant les conditions de récolte des gousses du gonaké et du Nep-Nep et réglementant leur conditionnement. IORS (14 janvier 1943), p. 11.

Arrêté N° 1214 SE du février 1943. Illegal to hunt in classified forest domains, but not applicable to Senegal. IORS (3 mars 1943), p. 283.

Arrêté N° 1499/FOR créant au Sénégal une carte spéciale de commerçant en charbon de bois. IOS N° 2253 (29 juillet 1943), p. 216.

Arrêté N° 4294 SE du 22 décembre 1943. Arrêté organisant la conservation des réserves naturelles intégrales en A.O.F. Placed under scientific control of Muséum National d'Histoire Naturelle.

Arrêté N° 3429 réglementant certaines conditions d'exploitation des bois d'œuvre. IOS N° 2384 (27 décembre 1945), pp. 514-518.

Arrêté N° 5742 SE/F. Arrêté portant classement de la Forêt de Diamel, subdivision de Matam. ANS 3R 124 (169).

Arrêté local N° 2906 du 14 octobre 1947 fixant les modalités de boisement des abords de certaines routes et pistes.

Arrêté 27 avril 1949. Prohibiting cutting trees in protected areas without authorisation. Seventeen classified tree species. Must leave 20 trees in cleared field.

Arrêté N° 5091 DSEPC interdisant, à compter du 1^{er} août 1956, les opérations de la traite de la gomme pour la campagne 1955-1956 sur toute l'étendue du territoire du Sénégal. IOS N° 3045 (2 août 1956), p. 720.

Arrêté N° 6868 fixant la période des feux précoces au Sénégal pour la saison sèche 1956-1957. IOS N° 3063 (1 novembre 1956), p. 1011.

Décret 20 mai 1955. All forested land designated as public property but not with open access.

Loi N° 65-23 du 9 février 1965 portant le Code forestier. Maintains the state's superior right to forested land.

Décret N° 65-078 du 10 février 1965 portant code forestier, partie réglementaire.

Décret N° 71-411 du 14 avril 1971 portant classement dans le domaine forestier et création du parc national des oiseaux du Djodj (Delta du Fleuve Sénégal) et d'une zone limitrophe. IORS n° 4163 (8 mars 1971), pp. 471-472.

Arrêté N° 10003 du 4 septembre 1972 portant création de la carte professionnelle d'exploitant forestier du Sénégal.

Loi N° 74-46 du 18 juillet 1974 portant code forestier, partie législative.

Arrêté N° 001599 portant l'organisation de la campagne d'exploitation forestière, 1989-1990.

IV. Agricultural Legislation

Circulaire du 18 mars 1897 portant la création des sociétés indigènes de prévoyance.

Décret du 29 juin 1910 autorisant la création des sociétés indigènes de prévoyance, de secours et de prêts mutuels agricoles.

Décision N° 615 nommant une commission pour l'achat de chevaux et de boeufs destiner au Service de l'Agriculture du Sénégal. IOS N° 643 (24 avril 1913), p. 477.

Arrêté N° 913 du 7 juin 1913 accordant une subvention de cent francs à la société de prevoyance de secours de de prêts mutuels agricoles du Cercle de Matam. IOS N° 650 (12 juin 1913).

Arrêtés N° 2071 et 2072 du 1913 portant l'organisation de l'apprentissage et de la vulgarisation agricole dans la colonie du Sénégal. Authorization for local agricultural agents.

Arrêté N° 2073 du 18 décembre 1913 portant création d'un cadre local d'agents indigènes de Service de l'Agriculture et des Forêts du Sénégal. IOS (6 mars 1913), p. 311.

Arrêté N° 105 rendant obligatoires au Sénégal, le déclaration de stocks de sorgho, de petit mil et paddy. IOS N° 842 (15 février 1917), p. 116.

Arrêté N° 1151 concernant les déclaration des stocks de sorgho et de petit mil. IOS (4 octobre 1917).

Arrêté N° 1300 du 13 novembre 1917 rapportant celui du 30 juillet 1917 N° 846, portant interdiction de la vente du mil par les cultivateurs dans le cercle de Matam.

Arrêté N° 527 du 2 mai 1918 prescrivant la déclaration des stocks de mil, maïs et de riz dans les cercles de Dagana, Podor, Salde et Matam. IOS (1918).

Arrêté N° 1255 du 28 septembre 1918 fixant le prix maximum de vente du petit mil dans la colonie. IOS (1918), p. 664.

Arrêté N° 889 du 27 mai 1919 rapportant l'arrêté 680 du 29 avril 1919 fixant le prix maximum de vente du petit mil dans la colonie. IOS (1919).

Décret du 4 juillet 1919 portant organisation des sociétés indigènes de prévoyance.

Décision N° 1694 du 10 octobre 1919 designant divers indigènes, chefs et notables, pour faire partie du conseil prévu par arrêté N° 1276 du 16 septembre 1911, en vue d'éviter la récolte prématurée.

Circulaire N° 54 au sujet de l'intensification des cultures vivrières dans la Colonie du Sénégal. IOS N° 1035 (28 oct 1920), p. 863.

Arrêté du 30 septembre 1925 autorisant en A.O.F. les achats sur simple facture, et jusqu'à

concurrence de 10,000 francs, de certains grains et fourrages. IOS N° 1295 (15 octobre 1925), p. 752.

Circulaire N° 346 AE au sujet de l'organisation de services locaux d'agricultures. IOS N° 1527 (23 janvier 1930), p. 94.

Circulaire N° 81 à Mesieurs les lieutenants des colonies du groupes sur l'intensification de la production agricole et pastorale en A.O.F. IOS N° 1534 (13 mars 1930), pp. 222-223.

Circulaire N° 149 AE du 14 avril 1931 au sujet de la lutte antiacridienne. IOS N° 1554 (30 avril 1931), p. 294.

Arrêté local N° 2576 du 26 octobre 1931. Organized the local population to fight against the cricket induced crop destruction. ANS 2G 31-48, Service de l'Agriculture et des Forêts, Rapport annuel, 1931.

Arrêté N° 2632 AP promulguant en A.O.F. le décret du 19 octobre 1931 relatif à l'amélioration et à la protection des cultures et de l'élevage en A.O.F. IOS N° 1625 (3 décembre 1931), p. 778.

Arrêté N° 2384 SE. Regulating production and sale of certain agricultural products. IOS N° 2144 (17 juillet 1941), p. 399.

Arrêté N° 2992 AGR fixant les mesures de protection contre les insectes des stocks de graines à usage vivrier, agricole ou industriel. IOS N° 2224 (7 janvier 1943), p. 5.

Arrêté N° 2086 AE rendant obligatoire la constitution de réserves de vivres au Sénégal et réglementant le fonctionnement des greniers de reserves. IOS N° 2262 (30 septembre 1943), p. 272-273).

Arrêté N° 2726 AE fixant le prix d'achat au producteur du mil de la récolte 1943 dans le colonie du Sénégal. IOS N° 2272 (2 décembre 1943), p. 341.

Arrêté N° 5272 SE du 7 décembre 1946 and N° 2265 du 21 décembre 1946. Instituted a permanent intercolonial commission for soil protection. Creates "bureau de la défense des sols." IOAQF (19 mai 1946), p. 4368.

Arrêté N° 3684 AGR portant création de circonscriptions agricoles. IOS N° 2442 (28 novembre 1946), p. 572.

Arrêté N° 10047 MEG interdisant provisoirement les sorties de mil dans le cercle de Matam. IOS N° 3252 (6 décembre 1958), p. 1175.

Loi N° 60-15 du 13 janvier 1960. Concerning the creation of *communautés rurales* and cooperative development.

Décret N° 60-20 du 27 janvier 1960 créent l'Organisation Autonome du Delta (O.A.D.)

Décret N° 61-119 MP du 22 mars 1961. Creating the Organisation Autonome de la Vallée (O.A.V.).

Décret du 20 mai 1960. Created *conseils d'intérêt rural*, replacing the CER and CRAD.

Loi N° 65-01 du 20 janvier 1965 portant création de la société d'Aménagement et d'exploitation du delta du fleuve Sénégal (SAED). IOS N° 3725 (13 février 1965), p. 138.

V. Pastoral Legislation

Arrêté N° 1278 du 8 novembre 1917 ouvrant la route Aéré Yang Yang Louga à l'importation des bovins, ovins, coprins provenant de la Mauritanie. IOS N° 842 (15 février 1917).

Arrêté N° 880 du 8 juillet 1918 interdisant sur tout le territoire de la colonie du Sénégal l'abatage des boeufs agés de moins de 4 ans et des femelles bovines aptes à reproduire.

Arrêté N° 2769 du 9 septembre 1920 fixant les frais de fourrière et de gardiennage des animaux mis en fourrière. IOS N° 1048 (27 janvier 1921), p. 30.

Arrêté du 19 Novembre 1921 portant fixation du tarif de la taxe sur les animaux. IOS N° 1101 (2 février 1922), p. 85.

Arrêté N° 27872 du 22 novembre 1929 interdisant le transport des animaux des espèces bovine, ovine, caprine et porcine ainsi que leur sortie des zones infectées sibit régoureusement interdits. IOS N° 1519 (28 novembre 1929), p. 820.

Arrêté N° 1666 Z déclarant infecté de pest bovine le Cercle de Matam. IOS N° 1712 (20 juillet 1933), p. 579.

Arrêté N° 2863 SE du 11 octobre 1937. Réglementation de l'exercice du droit de pâturage dans certaines forêts classées du Sénégal. This *arrêté* did not affect directly the River Region. IOS (16 octobre 1937), p. 1071.

Arrêté N° 2091 ZOO réglementant le commerce du bétail dans la colonie du Sénégal. IOS N° 2147 (7 août 1941), p. 442.

Arrêté N° 1025 déclarant infecté de péripneumonie bovine le canton de NGuenar (Cercle de Matam). IOS N° 2297 (18 mai 1946), p. 175.

Arrêté 8110 SE/F du 4 novembre 1953. Le classement des Réserves Sylvo-Pastorales sur le régime juridique de la forêt classée. ANS 3R99 (169), Plan des forêts classée envisagé au Service Géographique and ANS K12, Sénégal, Forêts Classées, Cercle de Matam.

Décret N° 62-258 de 5 juillet 1962 relatif à la police sanitaire des animaux. IOS N° 3540 (21 juillet 1962), pp. 1241-1249.

Décret N° 80-268/MDR/DSPA de 10 mars 1980 portant organisation des parcours du bétail et fixant les conditions d'utilisation des pâturage. JORS (1980), p. 443.

Décret N° 86-275 de 11 mars 1986 portant réglementation de la mise en fourrière des animaux errants.

Décret N° 86-320 de 11 mars 1986 réglementant l'élevage, l'introduction, la transhumance et l'utilisation des camélidés au Sénégal.

Arrêté portant l'application du Décret N° 86-320 de 11 mars 1986 réglementant l'élevage, l'introduction, la transhumance et l'utilisation des camélidés au Sénégal.

Circulaire interministérielle du 1 janvier 1984 visant à la création et la généralisation des comités de gestion de forages hydrauliques en milieu rural.

VI. Fishing Legislation

Arrêté N° 43 du 20 février 1903 interdisant la pêche par dynamite, poison et filets à petites mailles.

Arrêté N° 179 du 5 mai 1903 réglementant la pêche dans le fleuve du Sénégal. JOS N° 126 (30 mai 1903).

Arrêté N° 513 du 5 décembre 1903 sur la police de la pêche dans le fleuve du Sénégal. JOS N° 155 (19 décembre 1903), p. 718.

Arrêté N° 209 du 21 mars 1904 promulguant au Sénégal le décret du 27 février 1904, portant réglementation de la pêche dans le fleuve Sénégal. JOS N° 169 (26 mars 1904), p. 155.

Arrêté N° 1232 du 7 août 1924 portant interdictions en A.O.F. de la pêche pratiquée à l'aide d'explosifs de poisons ou d'autres drogues de nature à détruire ou à enivrer le poisson. JOS N° 1232 (7 août 1924), p. 622.

Arrêté général 1988 du 29 juillet 1934 portant interdiction en A.O.F. de la pêche pratiquée à l'aide d'explosifs, de poisons ou autres drogues de natures à détruire ou a enivrer le poisson.

Arrêté local du 4 Mai 1940. Regulating fishing in the Matam Cercle.

Arrêté local N° 1051 du 20 avril 1946 réglementent l'exercice de la pêche localement dans le Cercle de Matam. JOS N° 24 (2 mai 1946), p. 180.

Arrêté N° 4582 du 2 août 1955 réglementant l'exercice de la pêche.

Loi N° 63-40 du 10 juin 1963 réglementant la pêche dans les eaux continentales.

Décret portant application de la Loi N° 63-40 du 10 juin 1963 réglementant la pêche dans les

Eaux Continentales.

Décret N° 65-506 du 19 juillet 1965 portant application de la Loi N° 6340 du 10 juin 1963 réglementant le pêche dans les eaux continentales du Sénégal.

Décret N° 67-0128 du 1 février 1967 modifiant l'article 13 du décret N° 65-506 du 19 juillet 1965 portant application de la Loi N° 6340 du 10 juin 1963 réglementant le pêche dans les eaux continentales du Sénégal.

Arrêté N° 004692 du 18 avril 1969 portant création de conseils de pêche au niveau des secteurs de pêche de Matam, de Diamel et de Dolol. In Recueil des lois, décrets et arrêtés réglementant la pêche dans eaux continentales du Sénégal, p. 29.

Arrêté N° 697 du 14 janvier 1969 portant création de réserve de pêche de Nalal (Département de Matam). In Recueil des lois, décrets et arrêtés réglementant la pêche dans eaux continentales du Sénégal, p. 37.

Arrêté N° 3281 du 11 mars 1970 portant création de réserve de pêche de Koundel (Département de Matam). In Recueil des lois, décrets et arrêtés réglementant la pêche dans eaux continentales du Sénégal, p. 40.

Arrêté N° 3284 du 11 mars 1970 portant création de réserve de pêche de Dob (Département de Matam). In Recueil des lois, décrets et arrêtés réglementant la pêche dans eaux continentales du Sénégal, p. 43.

Décret N° 70-1423 du 28 décembre 1970 modifiant et complétant certaines dispositions du décret N° 65-506 du 19 juillet 1965 portant application de la Loi N° 6340 du 10 juin 1963 réglementant le pêche dans les eaux continentales du Sénégal.

Décret N° 76-853 du 24 juillet 1976 fixant la dimension des mailles et filets en usage dans les eaux sous-juridiction Sénégalaise.

VII. Other Natural Resource Legislation

Arrêté du 14 novembre 1913 portant réglementation provisoire de la chasse à l'éléphant dans la colonie de l'AOF. IOS n° 678 (25 décembre 1913), p. 1286.

Arrêté du 20 janvier 1914 portant fixation des droits à percevoir sur la chasse à l'éléphant dans la colonie du Sénégal. IOS (1914), p. 863.

Arrêté N° 1505 SE approuvant celui du 13 juin 1936 du lieutenant-Gouverneur du Sénégal portant fixation des périodes annuelles ouvertures et de fermeture de la chasse. IOS N° 1841 (9 janvier 1936), p. 625.

Décret de promulgation du 31 mai 1938. Ratification of the International convention for the Protection of fauna and vegetation. IOS (juin 1938), p. 6263.

Décret N° 45-1347 du 18 juin 1945. Establishment of a Conseil supérieur de la Protection de

la Nature aux Colonies charged with studying and proposing nature reserves.

Décret N° 62-0101 MER du 14 mars 1962 réglementant la chasse et la protection de la nature.
IOS N° 3522 (14 août 1962), p. 632-644.

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