Nigeria
Poverty—Environment Linkages
in the Natural Resource Sector

Empirical Evidence From Nigerian Case Studies with
Policy Implications and Recommendations

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ACRONYMS

ACM	adaptive co-management
ADP	Agricultural Development Project
ARES	Africa Region Environment Strategy
CREED	Collaborative Research in the Economics of Environment and Development
EC	European Community
FORMECU	Forestry Management, Evaluation and Co-coordinating Unit
FOS	Federal Office of Statistics
GDP	gross domestic product
GNI	gross national index
HDI	Human Development Index
HN	Hadejia-Nguru
LEEMP	Local Empowerment and Environmental Management Program
LGA	Local Government Authority
LUV	Land Use and Vegetation Assessment
MDG	Millennium Development Goal
NEAP	National Environmental Action Plan
ND	Niger Delta
NRM	natural resource management
NTFP	non-timber forest product
PQLI	Physical Quality of Life Index
PRA	Participatory Rural Appraisal
PRSP	Poverty Reduction Strategy Programme
UNDP	United Nations Development Programme
WBES	World Bank Environmental Strategy

Vice President	:	Callisto Madavo
Country Director	:	Mark Tomlinson
Sector Manager	:	Richard Scobey
Task Team Leader	:	Indumathie Hewawasam

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Papka, Peter. 2002. "Review of Some Donor-Assisted Interventions in Natural Resources and Environmental Management in Nigeria." Background report, AFTES, World Bank.

Ruitenbeek, H. Jack. 2002. "Poverty/Environment Linkages: General Lessons from the Literature with Implications for Nigeria." Background report, AFTES, World Bank.

PREFACE

This study explores the international development community's understanding of poverty and illustrates how it is related to environmental degradation. The study relies on three sources: a comprehensive general literature review, a review of past donor interventions in Nigeria, and original empirical evidence. The linkages found between poverty and environmental degradation are based on 240 household surveys analyzed by income quintiles investigated at two sites in Nigeria: the Hadejia-Nguru Wetlands (HN) in the north and the Niger Delta (ND) in the south.. The policy conclusions and recommendations that follow are intended to inform Nigeria's development efforts, such as its initiatives in natural resource management and its Poverty Reduction Strategy Program (PRSP).

Over the past decade, Nigeria's performance has been characterized by low per capita economic growth, persistent impoverishment and environmental degradation. Experience with natural resource management projects supported by the government and the donor community suggests that, in the design and implementation of these projects, inadequate attention was paid to income diversification, ensuring the long-term financial sustainability of infrastructure projects, and addressing and following up the environmental externalities associated with development assistance. Perhaps most seriously, recent trends in resource management have de-emphasized local management and have exacerbated open access conditions, contributing to rent dissipation, deeper poverty, and persistent environmental degradation.

Empirical evidence from the study sites sheds further light on the linkages. First, rural households are highly dependent on environmental resources. The poorest half of the sample obtain 39 percent (HN) to 60 percent (ND) of their incomes from such sources, confirming the frequently cited result that environmental degradation has a greater impact on the poor than on the relatively well off. Second, poverty is better understood in the context of vulnerability to income shocks, which we measure through considering the diversity of income sources. The richest households in the sample typically had up to five or more income sources. Among the poorest households, 42 percent (ND) to 58 percent (HN) derived their incomes from only one source. Third, at times, the variability in incomes places the poorest households in situations of extreme dis-saving. In the Niger Delta, for example, for the poorest quintile, expenditures over the survey period were 270 percent of incomes. Fourth, the poor have less of an impact on environmental resources than do the relatively better off. In Hadejia-Nguru, the most well off quintile was responsible for 65 percent of all expenditures on environmental goods and services (water, fuelwood), while the poorest 2 quintiles (40 percent of the households) were responsible for only 4 percent.

These results reaffirm the need to tackle the poverty-environment linkages through programs that target environmental safeguards for the resources on which the poor rely. Part of this approach will include greater reliance on decentralized management. However, these results also point to two other complementary strategies: (1) diversification of income sources for the poor to improve their resilience and decrease their vulnerability to environmental degradation and (2) programs targeted to all households, but particularly the most well off, to reduce their negative impacts on the environment and provide appropriate incentives to invest in maintaining the natural resource base.

EXECUTIVE SUMMARY

What is poverty? What is the relationship between poverty and environmental degradation? What can we do – if anything – to alleviate poverty and improve environmental quality? Policymakers in many developing countries are asking such questions. And there is a great urgency to obtain meaningful answers. With each passing year, environmental resources – land, air, and water – are being degraded or depleted, while the poor are becoming more numerous.

Nigeria is no exception. As one of the most densely populated countries in the world, its future prospects depend inextricably on the integrity of its resource base and on the well-being of its citizens. Questions of "poverty and its relationship to the environment" are of utmost concern. Nigeria has abundant natural resources, in particular, nonrenewables such as oil and natural gas. From 1990 to 2000, per capita growth in Nigeria averaged only approximately 0.3 percent. During this period, Nigeria's reliance on its natural resources has been tremendous. Oil and gas notwithstanding, renewable resources have been the mainstay of much of the population, and as this study shows, particularly of the rural poor, for providing food and fuel resources.

In part due to this low per capita economic growth, poverty levels continue to increase. The poor have been forced to "dis-save" by consuming their natural resource base with little or no re-investment to maintain the natural capital stock. At the national level, the exploitation of nonrenewable resources – oil and gas –likely has contributed to the slightly positive average per capita growth over the past decade. However, total wealth is clearly in decline since the rents from this natural capital have not been invested in any other form of capital. As a result of policies contributing to negative savings rates, poverty incidence in Nigeria is at an unprecedented high: 67 million Nigerians are considered poor under conventional definitions. Furthermore, environmental degradation is progressing at an unsettling pace and has been linked to a wide range of social ailments including poor nutrition, poor health, and heightened social conflict.

Role of This Study: Digging Deeper

It is no easy task to address the problems engendered by concurrent poverty and environmental degradation. Theoretical arguments can readily be constructed that blame the poor, the rich, outsiders, or bad luck for both the persistent poverty and the ongoing environmental decay. Likewise, theoretical constructs can be found that argue for trickle-down economic development, bottom-up development, a hands-off approach, or sweeping property rights reforms. However, the reality of any of these interpretations or prescriptions is that their correctness and effectiveness depend entirely on local conditions. In Nigeria, in fact, remarkably little is known about the dynamics of the complex interactions between poverty and the environment.

Hence, the role of this study, first and foremost, is to shed light on the actual linkages between poverty and environment in Nigeria. To keep the study tractable, it focuses on natural resource sectors in a rural setting. This focus covers the majority of Nigerians (75 percent are rural dwellers) and almost all of the landscape. The study is informed by experience elsewhere, historical experience with donor interventions within the country, and – most significantly – by two site studies specifically designed to answer the questions at the opening of this summary. While the case studies here are based on a small sample of 240 households, they provide insight on resource use patterns and dependency on natural resources by the rural poor. It is hoped that understanding the nature of this dependency, through this study and future studies, will inform Nigeria's policies

relating to poverty reduction and environmental quality improvement. The Government of Nigeria has stated its commitment to reduce poverty and to protect the environment. Improving environmental quality is also an important goal captured in Nigeria's National Environmental Action Plan (NEAP). Poverty alleviation is being addressed through the Poverty Reduction Strategy Programme (PRSP). At the World Summit on Sustainable Development in September 2002, the political leadership of Nigeria pledged to safeguard the environment while promoting economic interventions to reduce poverty.

Lessons from the Past

We know from experience elsewhere that few textbook answers are available for tackling poverty and environmental degradation. Thus, our report relies on a range of experiences noted in the literature that we augment with an analysis of programs and projects in Nigeria and with empirical evidence from study sites.

What We Know about Poverty and the Environment

Experience shows that, in some circumstances, the poor contribute significantly to environmental degradation, while in others, the rich are responsible. Evidence also suggests that as societies become even more well off, they are able to invest in environmental improvements but that they also become larger consumers of natural resources. The roles of the poor and the wealthy often are context-dependent. What we do know with greater certainty is that poverty itself often is brought about by increased vulnerability and the absence of choices or freedoms to pursue individual needs. Insecurity or uncertainty of tenure, gender-based discrimination, or sudden external shocks all can deepen poverty. The fact that environmental degradation reduces choices undermines the individual and social resilience that is inherent in the human condition and essential for poverty alleviation.

What We Know about Nigeria

Over the past decade, Nigeria's performance has been characterized by low per capita economic growth, with persistent impoverishment and environmental degradation in the natural resource sector. Experience with natural resource management projects shows some successes in reducing poverty through provision of infrastructure, such as boreholes or rural feeder roads. However, efforts frequently have failed to leave any lasting legacy for a number of reasons. First, projects often have focused on single-sector revenue generation – *Gmelina* in the forestry sector and maize in agriculture are examples – paying inadequate attention to diversifying income. Second, long-term financial sustainability of infrastructure projects often has been neglected: infrastructure falls into disuse or decline, and potential productivity gains are lost. Third, although environmental safeguards are in place at project inception, follow-up has not occurred, and environmental externalities typically go unaddressed. Spontaneous settlement and unsustainable harvesting in the wake of improved feeder road networks is a well-known example of this phenomenon. Another example is that the development of irrigated agriculture in the north actually caused a loss of overall welfare to society by failing to account for downstream externalities. Finally, and perhaps most seriously, recent trends have de-emphasized the need for local management and have undermined traditional social structures. The resultant destruction of social capital has exacerbated open access conditions, thus contributing to rent dissipation, deeper poverty and persistent environmental degradation.

What We Know about General Policy Directions

Although "win-win" policies may be difficult to find, a significant amount of work has been done to support the identification of appropriate policy choices within any given context. The EC/UNDP Poverty and Environment Initiative suggests a menu of potential practices and interventions. Those that are of greatest potential relevance within a developing country setting such as Nigeria include (1) empirical research, (2) conceptual and operational shifts, (3) access to assets, (4) asset improvement, (5) appropriate infrastructure and technology, (6) employment and compensation for the poor, and (7) market and planning reforms. In addition, through all of these practices, the principles of fostering self-sufficiency, promoting precautionary safeguards, and supporting adaptive co-management (ACM) all can have a beneficial impact on poverty alleviation and on environmental protection.

Study Sites

The Niger Delta in the south and the Hadejia-Nguru Wetlands in the north were chosen based on the criteria that they (1) represent fragile ecosystems that are globally and locally important; (2) support a significant population, predominantly rural in nature; and (3) support productive and consumptive activities that are dependent on the healthy functioning of the ecosystems. The aim of the survey instrument in these areas was to collect household level data on income, expenditure, natural resource use, and other socioeconomic characteristics of the household. Health and education questions were also included to determine the level, quality, and demand for services in these two sectors, which have important implications for productivity and income generation. The survey was conducted in the dry season to be able to find households at home (agricultural work is generally minimal during this period) and to capture the dependency of households on natural resources during a particularly harsh time period. A random selection of 30 sample households was taken from 4 villages at each site, giving a total of 240 sample households.

The mean household sizes in Hadejia-Nguru and in the Niger Delta are 8 and 7 persons respectively. The educational level of households indicates that only 20 percent of the households in Hadejia-Nguru had completed at least primary education. By contrast, in the Niger Delta, 60 percent of the households had completed at least primary education. The low educational levels in Hadejia-Nguru explain the predominance of farming, in which traditional practices are associated with low input technology, as the primary occupation. The survey revealed that approximately one-third of the household population in both regions had fallen ill in the previous month.

Average annual incomes in the regions are US\$278/capita in Hadejia-Nguru and US\$360/capita in Niger Delta.[1] Analysis of the subsamples by quintile showed a high degree of income inequality. Aggregating the 2 sample areas, the richest 20 percent of the households earned 44 percent of the aggregate income; while the poorest 20 percent of the households earned 2 percent of the aggregate income.

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[1] The authors calculated these figures based on information on how non-marketed environmental resources contribute to consumption and expenditure income. Hence, these figures cannot be compared to the national figure of US\$260/capita, which is computed by using a more traditional definition of income. Without accounting for environmental income, these figures would be approximately \$222 (HN) and \$234 (ND).

Findings 1: Natural Resource Dependence of the Poor

The empirical results show that, although mean incomes are above the national average, rural households are strongly dependent on environmental resources. In aggregate, between 20 percent (HN) and 35 percent (ND) of household incomes come from environmental resources. The poorest half of the sample obtains 39 percent (HN) to 60 percent (ND) of their incomes from such sources, confirming the frequently cited result that environmental degradation will have a greater impact on the poor than on the rich. If crop income is classified as environmental income, dependencies are even higher: 55 percent (HN) and 69 percent (ND). Environmental income then would constitute 100 percent of the income for the lowest 2 quintiles at Hadejia-Nguru.

Findings 2: Poverty as Vulnerability

Poverty is best understood in the context of vulnerability to income shocks, which we measure through considering the diversity of income sources. An income dispersion and concentration analysis was undertaken to show the number of sources of income that contributed to 100 percent, 80 percent, and 50 percent of the incomes in each income quintile. While many households had up to five or more income sources, the patterns of concentration clearly showed that the poorest households generally had fewer options and that a large portion of their incomes was dependent on only a single source. For example, among the poorest households, 42 percent (ND) to 58 percent (HN) of the households derived income from only a single source and 71 percent (ND) to 75 percent (HN) were dependent on 1 or 2 sources.

Findings 3: Saving and Dis-saving

Another measure of vulnerability is associated with income variability and the ability to generate surpluses. Many studies confirm that, in fact, the poor are willing and able to invest in environmental assets if they have such surpluses. In our sample, at times, the variability in incomes places the poorest households in a situation of extreme dis-saving. In the Niger Delta, for example, expenditures over the survey period were 270 percent of incomes for the poorest quintile. For the sample set of 240 households as a whole however, the aggregate expenditure: income ratio is 71 percent, indicating that there is a net generation of wealth occurring in these areas. This ratio suggests that, if incentive and credit structures were working properly, substantial savings would be available locally for re-investment. Such investment has occurred elsewhere in the country; for instance, many communities have invested locally in boreholes to improve water supply. However, addressing the high rate of dis-savings among the poorer households will require programs aimed at improving their access to credit and markets. With increased savings, these households, too, must be encouraged to invest in their natural resource base.

Findings 4: Role of the Relatively Wealthy

While we have not investigated the sustainability of resource use patterns in the study sites, our results clearly show that the poor consume fewer environmental resources than do the rich. In Hadejia-Nguru, the richest quintile was responsible for 65 percent of expenditures on environmental goods and services (water, fuelwood), while the poorest 2 quintiles (40 percent of the households) were responsible for only 4 percent of such expenditures. The mechanisms for this dynamic occur through two different routes, one of which may partially alleviate poverty. In some cases, consumption of environmental goods and services by the wealthy has a direct impact on the resource, and this has immediate negative consequences for the poor. In other instances, however,

this consumption may also generate income for the poor (for example, resale of natural products), in which case it may have negative environmental impacts, but it has some direct positive benefits in income generation. Nevertheless, the offsetting effect is relatively small. Our survey suggests that such income to the poorest quintile are, at most, 3 percent of the total expenditures in the sample.

Results also show that expenditure and consumption of own collected natural resources increase as households become relatively wealthier. An impact of this is reduced resources for the relatively poorer households; it also suggests that dependency on natural capital is unlikely to diminish as households get richer. Consequently, improving the stock of natural capital is important, because the poorest households are 100 percent dependent on natural resources and the richest households continue to derive up to 12 percent of their total incomes from natural resources. At the same time, other pressures, such as urban demand for natural resources (especially fuelwood) need to be more fully investigated to understand their impact on the overall resource demand from rural areas.

Recommendations

The results reaffirm the need to tackle the poverty:environment linkages through a variety of mechanisms. Two of these mechanisms are relatively conventional and are the mainstay of many current programs:

1. *Programs that promote environmental safeguards for resources on which the poor rely*

2. *Programs that place greater reliance on decentralized management.*

Both of these are intended to reinforce the positive feedbacks that exist between the poor and natural resources. As the study shows, dependence on natural resources among the rural poor is high. Furthermore, the lack of any evidence of environmental management plans at the village or community level suggests a need for greater community management of natural resources. Such plans would improve resource management based on the use patterns of communities, who can also take greater responsibility for the maintenance of these resources.

Increased evidence of conflicts over the use of natural resources further suggests that social unrest is being fuelled by economic hardship and scarcity of natural resources. Government schemes and externally funded programs have, often unwittingly, increased inequality in resource use. As a result, community relationships have become strained. Such tensions create tremendous constraints to sustainable resource use and will need to be addressed.

The empirical work also points to two other dimensions that are increasingly being addressed by natural resource policies:

1. *Diversification of income sources for the poor to improve their resilience and decrease their vulnerability to environmental degradation*

2. *Programs targeted to the wealthiest households that reduce their negative impacts on the environment by inducing them to invest in maintaining the natural resource base.*

Income diversification is an important aspect of poverty alleviation, and environmental resources can play a central role in providing a greater diversity of options to all users. However, to do so, it will be critical to evaluate marketing opportunities and the sustainability of markets. For example, under the agricultural expansion programs in the north, the lack of market outlets is demonstrated by the numerous road-side vegetable sellers visible along highways. Villages farther away from roads often do not have this option. However, it is also important to note that poorer households

lack the ability to engage in activities that offer higher returns either due to high costs of entry into these activities or restricted access. Diversification of income from sources other than natural resources will also be required to reduce both poverty and pressure on natural resources.

Furthermore, wealthier households, which put the most significant stress on environmental goods and services, can be targeted through a number of mechanisms ranging from being induced to substitute away from "environmental goods" to reinvesting some of their substantial savings in environmentally beneficial asset improvement. Removing inappropriate agricultural price supports and perverse subsidies that result in inefficient resource use is a critical step in creating incentives and management systems that motivate households to invest in maintaining natural capital and using resources more efficiently. Associated with this is the equally important aspect of increasing access to resources for poorer households.

Finally, the results of the empirical work and the review of natural resource programs suggest that a more complete understanding of resource use patterns and poverty-environment linkages is critical for informed policy development. *Therefore, it is a strong recommendation of this study that the poverty reduction strategy for Nigeria should reflect the nature of this fundamental linkage between natural resources and rural poverty.* While this study provides information on the nature of this linkage in the case study sites, we recommend similar studies to be carried out in each of Nigeria's six geopolitical zones to improve the understanding of these issues in the context of the economic and environmental variation across the country. In addition, the study is restricted to evaluating resource use patterns during the dry season as a basis of its empirical data. A longer term study, able to capture seasonal trends, and using a larger sample of households, will undoubtedly provide valuable information for the formulation of policies aimed at attacking rural poverty.

Summary Comment

To some, it seems anomalous that a country such as Nigeria, well endowed with natural resources, could still experience persistent resource degradation and poverty levels of 67 percent. Yet, this is the classic "resource curse" faced by many countries that fail to re-invest earnings from their natural capital in other assets: human capital, physical capital, or natural resources. At the national level, policies have failed to make these investments, resulting in an unsustainable draw-down of natural capital. At the grassroots level, directly and indirectly, wealthier households are the greatest consumers of environmental goods and services but appear to make few investments in maintaining the natural capital stock. Poorer households, sometimes as agents but always as victims of any resultant environmental degradation, remain impoverished and highly dependent on natural resources. This picture is likely repeating itself throughout the rural economy, and potentially even in urban centers, in which reliance on natural resources is likely to be high but poorly understood.

Therefore, the challenges for Nigeria are to (1) evaluate the nature of the poverty-environment linkage at the national, regional, and local levels and (2) ensure that the use of natural resources is sustainable and contributes to economic growth and to a lasting improvement in the livelihoods of the poor.

1 INTRODUCTION

Background

The majority of the poorest people in Nigeria depend directly on natural resources for their livelihoods. In addition, the society and the national economy depend on services provided by natural resources. These services – agriculture, livestock, water supply, forests, fisheries, and nonrenewable energy – are the foundation of Nigeria's economy. Ecological processes support Nigerian rural life and the local economy through the protection and maintenance of soil productivity, the recycling of nutrients, the cleansing of air and water, and the maintenance of climatic cycles. At the genetic level, diversity found in natural life forms supports the breeding programs necessary for the improvement of cultivated plants and domesticated animals to enhance food supply and security. Wild flora forms the basis of a very significant pharmacological industry and the traditional use of medicine for human and livestock needs, as well as other non-timber forest products (NTPF) critical to local communities.

However, unsustainable land-use practices, over-exploitation of natural resources, and ineffectively managed protected areas and their support zones all pose serious threats to the maintenance of ecosystem and habitats. In the oil and gas sector, ineffective institutional mechanisms and capacity constraints exacerbate the environmental and social issues arising from pollution of surface and groundwater sources. In the Niger Delta, much of the social conflict stems from pervasive poverty and lack of development in the delta, despite the significant wealth generated by oil and gas production. The environmental and social issues in the delta comprise direct and indirect causes for the lack of security in the area.

Although clear from a broad perspective, the links between poverty and natural resource management have not been studied systematically. The last such assessment, the Bank's formal input to Nigeria's *National Environmental Action Plan* (NEAP) process, was carried out more than 10 years ago. This study resulted in a formal "Gray Cover" report, "Towards a National Environmental Action Plan for Nigeria" (World Bank 1990.) In it, the costs of environmental degradation were estimated to be in the region of US$5 billion annually. This was a broad estimate based on available data on impact on natural resource integrity and impacts on populations (health, productivity). The long years of neglect, institutional inefficiencies, abuse of common property, and unsustainable resource use would lead us to assume that the costs of environmental degradation today are of a much higher magnitude.

Poverty Trends

In comparison to the environment, trends in poverty have been studied to a greater extent. Using conventional definitions, 66-67 million Nigerians are poor. Analyses show that the poverty rate increased significantly in Nigeria from a level of 27.2 percent in 1980 to 46.3 percent in 1985 to 65.6 percent in 1996. In absolute numbers, the population below the poverty line increased from 17.7 million in 1980 to 34.7 million in 1985 to 67.1 million in 1996. The impact of this trend is that the Human Development Index (HDI) in Nigeria has remained rather low. Average life expectancy is 51 years while approximately 33.8 percent of Nigerians are unlikely to survive until the age of 40

years. In terms of Physical Quality of Life Index (PQLI), Nigeria recorded 38 percent in 1990. In 1998, the HDI was 0.391, ranking the country as 142 out of 174 countries surveyed. This HDI situated Nigeria behind Cameroon, Ghana, and Zambia. In the year 2000, the HDI for Nigeria was 0.439, reducing the country's position to 151 out of 174 countries. This low figure reflects the fact that poverty has spread from year to year. Table 1 provides relevant statistics for Nigeria.

Table 1. Selected country information: Nigeria

Exchange rate (May 2002)	113 Naira:1 US$
Population (2000)	127 million
Life expectancy at birth (2000)	51.07 years
Under-5 mortality rate (2000)	153 per 1000
Child malnutrition (est.)	27% underweight
Access to improved water sources (2000)	57%
Prevalence of HIV, female (1999)	5.12% ages 15-24
GNI (2000)	US$260/capita

Source: 2002 World Development Indicators database, World Bank, April 20, 2002.

From 1990 to 2000, per capita growth in Nigeria averaged only approximately 0.3 percent. In part due to this low per capita economic growth, poverty continues to increase in the country while the poor have been forced to "dis-save" by consuming their natural resource base with little or no re-investment in maintaining the natural capital stock. At the national level, the exploitation of nonrenewable resources – oil and gas – has likely contributed to the slightly positive average per capita growth over the past decade. However, total wealth is clearly in decline since the rents from this natural capital have not been invested in any other form of capital. As a result of policies contributing to negative savings rates, poverty incidence in Nigeria is at an unprecedented high. Benefits from the low levels of economic growth have excluded many individuals while natural capital has been mined.

The implication of this background is that, in tackling the problem of poverty, intervention programs must include a variety of groups:

- Low income individuals, groups and communities living below the Federal Office of Statistics (FOS) accepted poverty line

- Communities that lack basic infrastructure and services such as qualitative education, adequate health care facilities, potable water and other social services

- Disadvantaged groups including women, children, persons in destitution, disabled persons, the unemployed, and other marginalized groups.

The Interim Strategy for Nigeria notes that the Bank's role is to help Nigerians build their capacities to manage their own resources effectively. A better understanding of the status, issues, and threats to the environment and the direct and indirect links to the welfare of the people is essential for policy decisions to manage natural resources in a sustainable and effective manner.

Trends in Natural Resource Degradation and Land Use

What we know with considerable certainty is that the natural resource base in Nigeria is under constant siege. For example, the major findings of the Land Use and Vegetation (LUV) assessment for the period between 1976/78 and 1993/95 reflected massive degradation throughout the country (see maps in Appendix C). Desertification has shifted southward from 12°30' to 10°30'. Land brought under agricultural production expanded from 503,000 km^2 to 585,000 km^2, an increase of 82,040 km^2, representing 4560 km^2 per annum (map 1, Appendix C). In addition, siltation is affecting rivers and lakes, culminating in the drying up of these water bodies immediately after rainfall. Typical of these are the receding of Lake Chad beyond the territorial boundary of the country, huge silt deposits threatening the two major river systems of Benue and Niger (with implications on the Niger Delta are (a), and the reduction of once perennial rivers to annual water bodies. Furthermore, gully erosion, which hitherto was not a major threat, has increased and is threatening 18,400 km^2 of land (compared to only 122 km^2 in 1976/78). Sand dunes have increased from 820 km^2 to 4,830 km^2 over the period.

In 1976/78, the extent of forest gazettement reflected approximately 10 percent cover. However, this scenario has changed substantially. Most of the recorded forest reserves or forest covered areas are nothing but "land reserves" or degraded lands. The loss of forest reserves could be attributed to (1) urbanization where forest reserves nearer urban areas have been converted to settlements, (2) over-exploitation and unsustainable harvesting practices, and (3) conversion to farmlands.

Undisturbed forest decreased from 2.9 percent, or 26,000 km^2, to 1.3 percent, or 12,110 km^2, representing more than 50 percent loss, while disturbed forest increased from 14,570 km^2 (1.6 percent) to 18,990 km^2 (2.1 percent) representing an increase of approximately 4,420 km^2 (map 2, Appendix C). More than 30 percent of forest conversion was attributed to agricultural expansion, while in some cases urbanization led to de-reservation of protected areas that were remotely associated with urban settlements. This urbanization is attributed to the creation of additional states and local governments. The area brought under urban development has increased by more than 250 percent.

Coastal vegetation has witnessed a decrease in fresh water swamp of 1,820 km^2, while mangrove forest decreased slightly (map 3, Appendix C). Siltation due to upland erosion and exploitation of mangrove forest for furniture materials has contributed to these changes. The greatest change of land use (60 percent) occurred in the guinea savanna zone, which has decreased from 17 percent to 9 percent, representing a decrease of 69,900 km^2. The bulk of this change is attributed to agricultural expansion. The Sudan savanna zone has decreased by 32,200 km^2 (map 4, Appendix C). The changes in the Savanna zones are attributed to an increase of degraded land of 23,000 km^2 between 1976/78 and 1993/95. These were attributed to agricultural expansion, fuelwood exploitation and overgrazing (map 5, Appendix C). Fuelwood constitutes the major source (80 percent-90 percent) of domestic and cottage industry energy. The bulk of fuelwood sources are forest reserves or open community woodland, and the majority of schools, bakeries and suya (barbeque) spots rely on fuelwood for cooking. The current trends of fuelwood exploitation, its inefficient use, and its lack of affordable alternatives continue to place pressure on already depleted resources.

Degraded lands, which are areas that have substantially lost their productive potential—gully-threatened areas, sand dunes, and rock outcrops—increased from approximately 3,000 km^2 in 1976/78 to over 26,000 km^2 in 1993/95 (map 6, Appendix C). Gully-erosion-threatened areas have

expanded from approximately 0.1 percent, or 120 km^2, in 1976/78 to approximately 2 percent in 1993/95.

The total area of integrated plantation development projects in the country doubled from 2455 km^2 in 1976/78 to 4370 km^2 in 1993/95. Most of these plantations were established in gazetted forest reserves, while the shelterbelts mapped as plantations were established in the northern fringe of the country to arrest desertification. These plantations were mainly donor-assisted initiatives.

The land use and vegetation study revealed a dramatic increase (50 percent) in the area of water reservoirs from 1320 km^2 in 1978 to 2630 km^2 in 1993/95 (map 7, Appendix C). The construction of small earth and large dams as a strategy to address the water resources requirements and to boost food production through efforts of River Basin Development Authorities located throughout the country is largely responsible for this.

Poverty/Environment Linkages

While both poverty incidence and resource degradation are persistent, the poverty–environment relationship is complex, dynamic, and difficult to comprehend in all its ramifications. The World Bank (2000) has shown that a useful question to raise in preparing a poverty reduction strategy is how do environmental factors impact the lives of the poor and poverty reduction efforts? To answer this question, it is increasingly accepted that poverty reduction strategies should aim to:

- Improve people's health by reducing their exposure to environmental factors such as indoor and urban air pollution, water- and vector-borne diseases, and toxic substances.

- Enhance the livelihoods of the poor who depend on land, water, forests, and biodiversity by helping them secure access to resources and creating circumstances in which they can manage these resources sustainably.

- Reduce people's vulnerability to environmental risks such as natural disasters, severe weather fluctuations, and climate change through providing information to poor communities and empowering them to adapt.

Government Commitment

The Government of Nigeria has made commitments to reduce poverty and to protect the environment. Improving environmental quality is an important goal captured in Nigeria's National Environmental Action Plan (NEAP). Poverty alleviation is being addressed through the Poverty Reduction Strategy Programme (PRSP) At the September 2002 World Summit on Sustainable Development, the political leadership in Nigeria pledged to safeguard the environment and natural resource base while promoting economic interventions to reduce poverty.

In addition, through stakeholder workshops and discussions held in August 2001, the Government of Nigeria identified a number of critical cross-cutting issues that affect the depth and distribution of poverty.[2] At a national workshop to discuss the final draft of this report, the Federal Minister for Environment emphasized the need for broader understanding of poverty–environment linkages in the government's initiatives to reduce poverty. It is evident that the complexity of interactions will

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[2] <www.worldbank.org/wbi/sustainabledevelopment>.

require a multifaceted approach in policy design and related interventions. These issues include (a) governance and how it relates to access to natural resources, (b) gender and cultural issues around resource use and how they either reinforce or mitigate trends of increased poverty incidence, and (c) in the longer term, the migration of populations arising from social conflicts linked to environmental degradation.

Objectives and Outline of Study

This study is organized around the following elements:

- *Lessons (chapter 2).* Lessons relating to "Causality and Linkages" explore various perceptions of how poverty "causes" environmental degradation, how environmental degradation "causes" poverty, or how other offsetting or reinforcing factors may influence the linkages between poverty and environmental quality. A central finding from this review is that no clear linkages are evident from the more general literature and that one should not presume that poverty and environmental degradation either reinforce or negate each other. The findings in this chapter provide an entry for a more detailed review of general policy issues that affect environment and poverty in Nigeria, building on a review of natural resource management projects over the past decade. The review focused on experience in the agricultural, livestock, forestry, and environmental management sectors.

- *Empirical Findings (chapter 3).* The empirical findings from the two study sites provide the primary basis for subsequent policy recommendations. Chapter 3 outlines the site selection process, summarizes the methods used, and provides detailed descriptive statistics for the two sites. The chapter concludes with an interpretation of key findings.

- *Policy Recommendations (chapter 4).* This chapter commences with a general discussion of available policies and strategies, including issues relating to self-sufficiency, precautionary principle, and adaptive co-management. In addition, it builds on specific best-practice policies identified by the EC/UNDP initiative relating to the design of "win-win" policies regarding poverty/environment linkages (Ambler and others 1999a, b). Specific recommended strategies for Nigeria are based on the empirical findings from the case studies. An agenda for incorporating these strategies within ongoing Nigerian and donor initiatives concludes this chapter.

2 LESSONS ON LINKAGES BETWEEN ENVIRONMENT AND POVERTY

The general objective of this chapter is to provide a context for examining some of the empirical poverty/environment linkage issues that we investigated at the case study sites.

In undertaking this review, a few opening observations are in order. First, an explanation is provided of some aspects of poverty that are considered by this study. Chapter 8 of the World Bank's *World Development Report 2000: Attacking Poverty* underlines the need to broaden the definition of poverty to encompass more than just the standard ideas of consumption, education, or health. That chapter argues that policy plays an important role in managing and reducing risk. The vulnerability of the poor is well acknowledged. They are more vulnerable to illness and injury. They are more vulnerable to crime. They are more vulnerable to harvest failure, to food price fluctuations, to unemployment, and even to old age as their income earning capacity decreases.

Environmental risks impose a particular type of impact to the extent that they often affect a group of individuals or a community in concert, such that normal social safety nets (for example, friends and relatives) are unavailable during crises because they, too, are affected. In such cases, an important role of the state is to ensure the continued existence of social safety nets, while removing barriers that prevent individuals and groups of households from using their own risk management mechanisms. Sen (1999) emphasizes the importance of promoting substantive freedom in the context of economic development. Freedom, he argues, has both a *process aspect* and an *opportunity aspect*, both of which have a great deal to do with reducing vulnerability and with enabling a person's active participation in his or her eventual well-being. For environmental resources, we interpret this freedom as security of access to environmental services and assets. From Nigeria's perspective, we note that various initiatives are already aimed at maintaining environmental quality and at providing opportunities for sustainable access to environmental resources. However, the main lesson to draw from this discussion on freedoms is that substantial reforms are still necessary to ensure that *transparent and accessible processes* exist that will permit meaningful individual involvement. In addition, it is likely that, if the most vulnerable are to be given secure access to such resources, proactive programs will be required. The first step in this process is to identify the vulnerable populations–something that has yet to be comprehensively or consistently achieved. The implication for subsequent empirical work is that studies need explicitly to consider how to measure and address vulnerability.

In the empirical work carried out for this study, we investigated the nature of poverty in rural areas of Nigeria (focusing on the study sites) based on income and expenditure levels. There are many different definitions and concepts of well-being. This study focuses on three aspects. First, it compares household income, consumption, education levels, health status, and other attributes across the two study sites. Second, the study looks at inequality in the distribution of expenditure and income/consumption within each site, since the relative position of individuals or households in society is an important aspect of household welfare. Third, the study considers the vulnerability dimension of well-being. Vulnerability has been defined as the probability or risk today of being in poverty, or falling deeper into poverty, in the future. Therefore, this study uses a dispersion analysis to look at the number of income sources available to households across expenditure quintiles. The hypothesis is that fewer income sources or higher dependence on a few income sources suggest higher vulnerability.

This study's focus is on understanding the nature of natural resource use and dependency among the rural poor. A substantial literature has developed recently in the area of poverty/environment/ population linkages, and many comprehensive reviews and papers have already summarized some of the lessons from these studies (box 2.1). The intent of this chapter, therefore, is not to replicate such reviews but to extract some key lessons from this work. In particular, the lessons it tries to draw out are those that may be counterintuitive, or expose preconceived myths relating to poverty/environment interactions. Second, very little case study or empirical work has been undertaken relating to these topics in Nigeria. For this reason, we also review donor experience in the natural resource sector in past decades.

Box 2.1. Crash course in environment/poverty linkages

The following provides a partial list of syntheses and survey pieces relevant to Environment/Poverty linkages.

Ambler and others. 1999ab. "A better life with nature's help: Attacking poverty while improving the environment: toward win-win policy options." UNDP/EC Poverty and Environment Initiative. Includes 6 companion publications. United Nations Development Programme, New York, and European Commission, Brussels. Publication relates to a multiyear synthesis that explores lessons from poverty/environment linkages and attempts to identify opportunities for policy interventions that alleviate poverty and improve environmental quality.

Boyce, J. K. 1994. "Inequality as a cause for environmental degradation." *Ecological Economics* 11:169-78. Seminal paper reviews the conditions under which inequality in income and political stature may contribute to environmental degradation.

Department for International Development, United Kingdom (DFID), Directorate General for Development, European Commission (EC), United Nations Development Programme (UNDP), The World Bank. July 2002. "Linking Poverty Reduction and Environmental Management Policy Challenges and Opportunities." Paper prepared as a contribution to the 2002 World Summit on Sustainable Development defines the links between poverty and the environment, and demonstrates its importance in achieving the Millennium Development Goals.

Duraiappah, A. K. 1998. "Poverty and environmental degradation: A review and analysis of the nexus." *World Development* 26 (12):2169–79. Literature review summarizes empirical evidence that attempts to shatter the myth that poverty itself is a direct cause of environmental degradation.

Panayotou, T. 2000a. "Economic growth and the environment." CID Working Paper 56, Harvard University, Center for International Development, Cambridge, Ma. The author surveys the literature to describe how economic growth and environmental quality are related, addressing both macro- and microeconomic perspectives; issues relating to poverty are included where relevant.

Panayotou T. 2000b. "Population and environment." CID Working Paper 54, Harvard University, Center for International Development, Cambridge, Ma. The author surveys the literature to describe how population growth, fertility, and environmental quality are related; issues relating to poverty are included where relevant.

Pillar P. 2001 (May 18). "Poverty, environment and sustainable development: A thematic working paper." Unpublished. World Bank Institute. Survey piece provides a partially annotated bibliography of over 100 papers along 13 thematic areas.

Rothman D. S., S. M. de Bruyn. 1998. "Probing into the environmental Kuznets curve hypothesis." Introduction to *Ecological Economics* Special Issue. *Ecological Economics* 25:143–45. Short paper provides a summary and overview of a special issue of the journal dedicated to exploring the relationships between income and environmental degradation through the environmental Kuznets curve hypothesis.

Lessons from Elsewhere: Causality and Linkages

While the scope of this review is not limited to Nigeria or the natural resource management sector, the final implications and lessons are intended to relate to natural resource management in Nigeria.

In addressing environmental degradation issues, we often are confronted with the promise of "win-win" scenarios in which economic growth and environmental quality improvements go hand in hand. Indeed, win-win was a central theme of the World Bank's *World Development Report 1992: Environment and Development*, which provided specific examples of how certain policy reforms could provide such outcomes even though trade-offs might be required. In some cases, we have made both huge economic efficiency gains and improvements in environmental quality and human health. Examples are removing agrochemical subsidies, reducing fuel subsidies, providing incentives for industrial waste management, and removing incentives for round-log exports.

However, we also have learned that many policy interventions are not so simple, and that, as the 1992 WDR outlined, numerous "tough choices" must be made that involve real trade-offs between economic growth and environmental quality.

Most of the literature relating to poverty/environment linkages attempts to address presumed causal links along one of three lines. In all instances, the analyses attempt to answer a question such as "How are poverty and environmental quality related?" First, at a *macroeconomic* level, they usually take on the tone of traditional development arguments that illustrate trade-offs or complementarities between economic growth and environmental quality in general. For example, clear-cutting forests provides an instance in which assets (the forest) are transformed directly into income (exports), thus contributing to gross income as defined by GNP, albeit at the potential expense of environmental quality if proper safeguards are not followed. In this case, the argument suggests that poverty may in fact diminish if mechanisms exist that transform the gain in national income into direct improvements for the poor in the country.

Second, at a *microeconomic* level, the analyses often focus on the role of a specific source of income from an environmental asset. The vast literature on non-timber forest products (NTFPs) in developing countries provides an excellent example. In such cases, it is asserted that cash income or subsistence food, medicine, and materials provide significant services to local populations living close to the forest. Positive constructive linkages arise when such products are harvested sustainably and they contribute to poverty alleviation while providing incentives to look after the resource base. Linkages may also arise – in which poverty causes degradation – if unsustainable pressures from starving, short-sighted local populations put relentless pressures on the resource base. Clarifying the nature of the linkages is usually the topic of empirical research studies that examine local resource use

Finally, a third and more general approach involves a recognition that the causalities are, in fact, not that simple and that poverty and environmental quality co-exist as traits of a *complex system* that is influenced by microeconomic, macroeconomic, and a variety of institutional, political and cultural factors that may either mitigate or reinforce the persistence of either poverty or environmental degradation. Such analyses usually take the simple causal linkages (between poverty and environmental quality) as a point of departure and extend the empirical analysis to see what other factors may influence such linkages.

Many of the lessons we have learned come from investigating how income levels and environmental degradation are related. Environmental degradation also provides a direct corollary

to poverty when poverty is characterized in its more limited economic dimension. For example, it is often hypothesized that as a country gets richer, its environmental quality decreases to a certain point, after which – the richer it gets – environmental quality steadily improves because of lower per capita pressure on the environment.[3] Similarly, such a relationship might apply to an individual or a household. Very poor individuals have very low environmental impact; their detrimental impact increases as their income grows, but eventually their detrimental impacts fall again as their substantial incomes progress beyond a certain point. Originally, the support for this hypothesis was based on a number of presumptions about behavior that seemed to be compelling and intuitive arguments. Principally, or so the story goes, growing income may be positively correlated with environmental degradation because the income is in fact derived from divestment of environmental resources or because higher income leads to higher environment-degrading consumption. At a certain point, this trend is offset because wealth permits substitution with cleaner technologies or less environmentally degrading activities. Today, however, most empirical evidence does not support this simple idea, and the general conclusion is that conditions vary significantly from site to site or country to country. The following paragraphs summarize some of the key conclusions from the literature review.

Income: Poverty Does Not Cause Environmental Degradation

The starting point of the hypothesis asserts that very low levels of income correspond to low levels of environmental degradation. Most empirical studies and surveys agree on this basic point, and many authors have shown that poverty itself is not a legitimate "cause" of environmental degradation (Martinez-Alier 1995, Duraiappah 1998, Reardon and Vosti 1995). Indeed, Broad (1994, 1997) asserts that the poor often are friends of the environment to the extent that they have built-in incentives to look after the natural resource base that supports them. From any country's perspective, it is regarded as overly simplistic to blame the poor for destruction of the environment.

Inequality: Distribution of Environmental Assets and Income Plays an Indeterminate Role

Some authors originally argued that income equality should lead to less environmental damage, because of political economy effects that make it easier to achieve a consensus on optimal levels of environmental services (Boyce 1994, Torras and Boyce 1998.) Most studies show that environmental incomes, through the provision of subsistence incomes or nonmarketed goods and services, play an important role in boosting absolute incomes. Cavendish (1999(a) cites work in South Africa that shows that such income is approximately one-third of total incomes; this result is quite common in other developing countries. However, environmental income does not influence overall inequality, because the activities undertaken by the poor often are quite marginal and have low returns in themselves. Other authors provide compelling suggestions for why, for simple technical reasons, one should not *a priori* expect decreases in inequality to improve environmental quality. Heerink and others (2001) argue that income dispersion is a critical third parameter in the overall understanding of whether redistribution will lead to more or less environmental damage. From Nigeria's perspective, this implies that income redistribution policies will not necessarily have a beneficial environmental impact, even though they will reduce poverty to the extent that they reduce inequality and increase the absolute income levels of the poor.

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[3] This is more specifically called the environmental Kuznets curve hypothesis. The background paper by Ruitenbeek (2002) provides an extensive discussion of this.

Environmental Assets: The Poor Will Protect Future Assets

A somewhat surprising empirical result from studies of the poor relates to their revealed rates of time preference. It is often assumed that the poor are myopic, meaning that their decisions are short-sighted and that they place low weights on future values. Another way of saying this, in economic terms, is that they have a high discount rate. Empirical findings are inconsistent with respect to this assumption. Wunder (2001) shows, for example, that the poor in Asia and the Americas regard forests as a social safety net for local populations and will try to protect them. Studies by Moseley (2001) in Africa provide evidence that the poor often take extreme measures to protect future productive assets (cows), even if these measures result in current starvation of some family members. Work in Nigeria by Watts (1983) and Corbett (1988) relating to famines shows similar evidence. These findings refute the idea that only the wealthy will invest in environmental resources and that some minimum level of income or wealth must exist before such resources will be better managed. We often see that rural dwellers will consistently invest in improvements such as soil erosion control, tree planting, or clean-up initiatives even in the absence of outside financial assistance. From Nigeria's perspective, these realities suggest that policies might be designed to recognize and encourage the inherent incentives that the poor have to protect long-term environmental assets.

Macro Effects: Trade and Population Have Indeterminate Effects

It is often presumed that trade will beneficially influence both environmental quality and economic growth because of improved investment opportunities and efficiency gains (Lee and Kirkpatrick 2000). Similarly, lower population densities are thought to have win-win consequences. However, Stern and others (1996) and Magnani (2000) show that, generally, population density and trade are not empirically relevant, while Selden and Song (1994) find similar insignificance of population density. From Nigeria's perspective, this implies that trade and population policies are not likely to have any clear effects on the dual goals of poverty alleviation and environmental quality improvement. This implication is borne out by Nigeria's own experience that sustained macroeconomic growth over the past decade has failed to translate into a meaningful reduction in poverty incidence.

Complex Systems Effect: Other Factors Often Hide or Negate Presumed Causal Links between Poverty and Environment

Analysts who have seriously examined causal relationships within a broader complex systems context generally find that such causal links are specious. Cavendish (1998) argues that tenure arrangement will over-ride many other considerations. Panayotou (2000b) asserts that education is a pivotal factor in determining local relationships between poverty and environmental quality and that the "demand for children" among poor households may be a feedback loop that keeps families impoverished irrespective of external conditions. Magnani (2000) studied all OECD countries and considered income, environmental degradation, and income distribution. He hypothesized that, ultimately, the emergent political framework and policies were responsible for eventually decreasing environmental impacts. An important result is that increased inequality may lead to greater environmental degradation because of the way that policies are determined. Similarly, Ezzati and others (2001) argue that, in a dynamic complex setting, there are many relationships that may account for technology drift, policy variables, changes in consumption habits, health, and generalized socioeconomic variables. Gangadharan and Valenzuela (2001) show that causal

linkages are meaningless unless one also considers human health aspects. Health gains obtained from improved incomes can be significantly negated if negative impacts on the environment are ignored. More income may contribute to better health, but a poorer environment may contribute to poorer health. The net result may be degraded health, with degraded long-term income earning capacity. Duraiappah (1996) paints one of the most complete pictures of a complex system, in which he concludes that poverty is determined by at least three factors: access, income, and vulnerability. The importance of these three factors can differ from site to site or from sector to sector. Market and institutional failures are important external factors in forest and land issues. In water issues, property rights are the biggest matter of concern. He cautions against generalizing across sectors: water policy reforms need not be similar to land policy reforms. From Nigeria's perspective, this experience suggests that empirical work should focus not just on poverty and environmental quality but also on site-specific conditions relating to institutional factors, educational attainment, and tenure.

Conflict: An Early Warning Sign?

Increasing work is being undertaken on the role of conflict and security as an issue that affects both environmental quality and poverty. Wars cause obvious environmental destruction, whether through poaching of animals, destruction of habitat, or pollution of waterways; and wars typically have the greatest personal impacts on the vulnerable (the poor). On the other hand, some suggest that conflict itself is a result of environmental degradation arising from diminished access to environmental entitlements (Ruitenbeek 1996, Cameroon) or from failures in collaborative management mechanisms as systems approach critical thresholds (Duraiappah and others 2000, Kenya). Low incomes and high inequality often seem to be coincident with such circumstances, suggesting that increases in conflict and migration may be early warning indicators of problematic poverty or resource degradation. Conflicts in the Niger Delta have also been attributed to high unemployment among the youth and inadequate reinvestment of rents from oil exploration in the economic and social development of local communities. Similarly, conflicts in the Hadejia-Nguru Wetlands have been exacerbated by uneven development and changes in use and access rights to natural resources used by agriculturalists and pastoralists in the region.

Poor People Have the Technical Knowledge to Manage the Environment

It often is assumed that the poor, with their concomitant low levels of formal education, do not have the requisite technical knowledge for sound environmental management. This assumption goes counter to the empirical findings that (1) technical management is not as difficult as might be presumed and (2) good management techniques are, in fact, already known by local populations. However, it should also be noted that traditional knowledge structures may have been weakened or eroded after many decades of institutional, political, and social uncertainties..

Lessons from Nigeria: Linkages in Natural Resource Projects

Prior to colonial rule in Nigeria, the responsibility for natural resource management (NRM) resided in the communities, which entrusted it to traditional leaders.[4] During the precolonial period, community leaders had the mandate to allocate resources and regulate their use, especially as it affected resources such as land, forest, grazing, and water. However, individual farmers had direct

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[4] This subsection is based on material presented in the background document prepared by Papka (2002).

responsibility to maintain their farmlands to sustain their productivity, even though shifting cultivation was heavily the practice. This phase of NRM could be regarded as *conservation by the people*. The population depended on natural resources as gatherers, hunters, and fishermen established in bands of families, clans, villages, and empires. Consequently, ownership and use of resources was based on traditional rights. A striking feature was the balance established among population, natural resources, and environment.

With colonization, a regulatory framework for resources use in the form of *reservation* was introduced, especially regarding forest and grazing lands. Consequently, areas identified as rich in timber and wildlife resources were reserved, and communities were restricted from free access. The colonial administration created political demarcation among communities, and power became centralized at district, provincial, regional, and national levels. This usurpation of power entailed compulsory forfeiture of traditional management practices. Policies and legislation were established at the center and passed down to other tiers of government for implementation. Communities who hitherto had earned their livelihoods from such resources became alienated. The NRM systems were those that guaranteed supply of raw materials to meet foreign demands, for example, timber, cash crops (groundnut, cocoa, rubber). As a result of government's direct involvement in marketing these products, realizing also that these resources had great potential to earn foreign exchange, the government became the custodian of NR management. This management system could be considered as *conservation for the people*

During the post-colonial era (that is, post-independence), the colonial administrative system was maintained with modifications that limited the tiers of government to local, state, and federal levels. Nevertheless, policies and legislation are still formulated at the central government level and passed down to other levels for implementation. Communities continue to be alienated, as most of the natural resource base (for example, forests) is still perceived by government as a means to augment local and state government revenues. This government control contributes substantially to the irresponsible manner in which resources are exploited. Despite government's responsibility to manage some of this resource base, it has provided no financial support for systematic management. As a result, forests are exploited without any inventory or management plan. In addition, no support is provided for enforcement of relevant legislation. This lack of financial support accentuates the problem, resulting in total breakdown of law and order. The citizenry have taken the law into their own hands with a resultant massive unregulated exploitation of resources. Consequently, the natural resource base has suffered its greatest setback and degradation after independence.

In compounding the existing bad situation, an astronomical increase in population has occurred with commensurate expansion of infrastructure, especially on creation of additional states and local government areas. Furthermore, in a quest to boost food production for the rapidly expanding population, government introduced various programs: Operation Feed the Nation, Green Revolution, River Basin Development Authorities, Agricultural Development Project (ADP), National Directorate of Employment, and National Agricultural Land Development Authority among others. All of these were meant to expand the land and water resources use. These programs contributed substantially to conversion of large areas of land/forests/watershed into agricultural lands. The majority of these schemes are no longer in existence, and many sites are abandoned.

Despite the good intentions of these programs, they were externally conceived, designed, and implemented with little or no consultation or input of targeted beneficiaries. The result has been ineffectiveness, limited success, or failures. While some successes exist, these efforts frequently failed to leave any lasting legacy for a number of reasons.

Some Successes

Experience with donor projects shows some poverty alleviation successes with infrastructure provision, such as boreholes or rural feeder roads. The rural feeder roads have boosted marketing of farm produce and delivery of farm inputs and extension services to farmers. As regards water supplies, provision of several boreholes and small dams has improved access to potable water for both domestic and livestock use. A factor in the relative success of these water supply programs has been that most communities have contributed to the operations and maintenance costs for what is clearly a critical resource.

Problems of a Single-Sector Focus

Although donor intervention in natural resources management has emphasized and planned for an integrated approach, these have not been achieved in practice. This failure could have been a factor in the continued decline of the productive capacity of natural resources. Integration was adopted and introduced in agricultural development approaches with the first generation ADPs, which incorporated forestry, fisheries, and livestock rearing in farming systems. After 30 years of this type of intervention, a marked improvement or increased production in other subsectors apart from crops should have been apparent. However, this improvement in other subsectors has not taken place, because other subsectors are considered "add-ons" while the primary emphasis remains on crop extension technologies and rural infrastructure. Nevertheless, these add-ons are critical for ensuring food security, environmental stability, and general well-being of rural populations. Tree planting and animal husbandry have been an integral part of Nigeria's traditional farming system. However, the weakness in institutionalizing these linkages–between crops, trees, and livestock within government and donor-led interventions–reveals an inherent inability of these programs to provide for the needs of rural populations.

Projects often have focused on single-sector revenue generation and given inadequate attention to diversifying income. *Gmelina arborea* in the forestry sector and maize in agriculture are examples. Rather than reducing vulnerability, such projects have inadvertently increased vulnerability through investment in a single resource. For example, forest reserves were identified for the purposes of establishing plantations, and this entailed clearing natural forest and replanting with *Gmelina* as a monoculture. Manual clearing methods proved inefficient. Mechanical land clearing and weeding were planned and adopted. However, the use of mechanical means for land preparation caused removal or compaction of topsoil. Overall, mechanical clearing increased susceptibility to erosion, especially in the first year before canopy closure. Furthermore, clearing of natural forest was unnecessary in some instances because (1) swamps were cleared that eventually became problematic to replant and were abandoned but that, if left, could have served as natural fire break while the vegetation would have supported animal and plant biodiversity; and (2) excessive clearing resulted in the inability to replant at an appropriate rate due to the lack of preparedness, setting the stage for increased soil degradation.

Failure to Consider Financial Sustainability

Long-term financial sustainability of infrastructure projects often has been neglected. Infrastructure falls into disuse or decline, and potential productivity gains are lost. While feeder roads were satisfactorily constructed in most instances, they frequently lacked post-project operations and maintenance arrangements. This absence of arrangements has been attributed to lack of involvement of communities and local government in the roads' design and construction. Poor allocation of

government financial resources has compounded the deterioration of the roads due to lack of maintenance.

Neglect of Environmental Safeguards

While environmental safeguards are in place at project inception, limited follow-up is evident, and environmental externalities typically go unaddressed. For example, spontaneous settlement and unsustainable harvesting often follow in the wake of improved feeder road networks. Much of the lack of follow-up has been associated with persistent weak institutional capacity. In a typical scenario, donor projects have high front-end investments in institutional capacity building, but when the projects are completed, local funds for compliance monitoring are inadequate to ensure that environmental safeguards are upheld.

Absence of Local Management

Perhaps most seriously, recent trends have de-emphasized the need for local management and have undermined traditional social structures. The resultant destruction of social capital has exacerbated open access conditions, contributing to rent dissipation, deeper poverty, and persistent environmental degradation. Undermining traditional tenure systems, when coupled with persistent population growth, has resulted in open access situations in many parts of the natural resource sector: from grazing lands and marginal agricultural lands to water supplies and forest resources. Local incentives to manage the resource properly disappear, and the situation rapidly declines into rent-seeking, excess effort, and eventual rent dissipation. This decline has a three-fold direct impact on poverty. First, the rent dissipation implies that incomes decrease and productivity declines. Second, the increased effort required to harvest the resource at the margin is often at the expense of other potential pursuits, most notably education. Children, women, and other vulnerable groups often become marginalized through this mechanism. Finally, the condition of open access itself leads to environmental degradation through over-harvesting, with its concomitant impacts on surrounding populations.

Summary

Experience from around the world suggests that, in some circumstances, the poor contribute significantly to environmental degradation, while in others, the rich are responsible. Evidence also suggests that as societies get even wealthier, they are able to invest in environmental improvements but they also consume more. Thus, the roles of the poor and the wealthy often context-dependent. What we do know with greater certainty is that poverty itself is often brought about by increased vulnerability and a lack of choices or freedoms to pursue individual needs. Insecurity or uncertainty of tenure, gender-based discrimination, or sudden external shocks all can deepen poverty. The fact that environmental degradation steals away such choices undermines the social and individual resilience that is inherent in the human condition.

3 ENVIRONMENT AND POVERTY CASE STUDY SITES

As noted above, the linkages between poverty and environment are complex and multifaceted. In Nigeria, the implications of environmental degradation on health, reduced productivity of soils, and reduced availability of natural resources are expected to be fairly significant for the poor and for the country's economic development in general.

Introduction to the Case Studies

This study focuses on trying to understand the nature and extent of dependency on natural resources, in particular, by the poorer sections of rural populations. The theme selection criteria include the fact that over 75 percent of the Nigerian population is rural and therefore likely to be dependent on natural resources. We are interested in *understanding to what extent interventions in the natural resource sector can support poverty alleviation and whether enhancing the natural resource base is important for the poor*.

To better understand the micro level implications of natural resources degradation on poverty outcomes, we carried out two village level surveys in two discreet ecosystems between January and March, 2002. The purpose of these surveys was to establish the links between natural resource use and poor households. The questions we wish to answer are:

1. To what extent are the poor dependent on "environmental income" (that is, sources of value derived from natural resources outside the traditionally measured crop/livestock/labor income)?
2. What is the relationship between environmental degradation and poverty? Are the poor the primary agents of environmental degradation?
3. What interventions are best suited to assist the poor in enhancing their natural resource base?

Site Selection and Description

Nigeria's ecosystem can be classified into seven distinct ecological zones: Coastal/Mangrove, Freshwater Swamp, Lowland Forest, and Derived Savanna in the south; and Guinea Savanna, Sudan Savanna, and the Sahel in the north. The areas chosen for the collection of primary data for the study on Poverty and Environment in Nigeria were the *Hadejia-Nguru Wetlands* (HN) in the north; and the *Niger Delta* (ND) area in the south. These two areas were chosen based on the criteria that they (a) represent fragile ecosystems that are globally and locally important, (b) support a significant population, predominantly rural, and (c) support productive and consumptive activities that are dependent on the healthy functioning of the ecosystems. In the following sections, these areas are described in some detail and placed within the context of the Nigerian natural landscape. The socioeconomic characteristics of the areas are described, based in part on the survey data collected for this study and in part on other data sources. The methodology used to carry out the case studies is elaborated, and the results of the study are presented in the final section.

The Hadejia-Jama'are floodplain is formed by the waters of the Hadejia and Jama'are Rivers, which meet to form the Komaduga Yobe river, flowing northeast into Lake Chad. This area receives

approximately 600-700 mm of rainfall per year, over a 3–4 month rainy season, lasting from June to September. Almost 80 percent of the total runoff from the rivers takes place during August and September. The rivers have periods of no flow in the dry season from October to April (Thompson and Hollis 1995). The wetlands are formed by the regular flooding of the rivers during the rainy season when the water spreads among inactive sand dunes (Adams 1993). Low-lying flooded areas known as *fadamas* are thus formed and are valuable for grazing, agriculture, and other domestic uses.

The Hadejia-Nguru Wetlands are an important site for wildlife conservation and wildfowl and support a wide range of economic activities, including wet and dry season agriculture, fishing, fuelwood collection, livestock rearing, and forestry (Hollis and others 1993; Adams and Hollis 1988; Adams 1993; Thomas and others 1993). Eaton and Sarch (1996) note the importance of wildfood resources found within the wetlands and the extensive use of these resources by the wetlands populations. The productive and consumptive activities associated with the wetlands are believed to support a population of over 1.5 million people. However, these wetlands are under

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Box 3.1 Welfare impact of hydrological changes in Hadejia-Nguru Wetlands, Nigeria

In the Hadejia-Jama'are floodplain region in northern Nigeria, more than one-half of the wetlands have already been lost to drought and upstream dams. The Komadugu-Yobe River basin in northern Nigeria supports the water demands of upstream irrigation and water supply projects while maintaining the Hadejia-Nguru floodplain wetlands.

Ecosystem valuation has been used in this area to weigh the costs and benefits of development projects that would divert still more water from the floodplain for irrigated agriculture in upstream areas. The net benefits of such a diversion are estimated at US$29 per ha. In comparison, the floodplain, under the present flooding regime, provides US$167 per ha in benefits to a wider range of local people engaged in farming, fishing, grazing livestock, or gathering fuelwood and other wild products (Barbier and others 1997).

Furthermore, a study of the groundwater recharge function of the wetlands confirms that the wetlands play an important role by maintaining groundwater recharge in the floodplain. Groundwater recharge supports irrigated agricultural production in the floodplain. Irrigated agriculture using water from the shallow groundwater aquifer has a value of 36,308 Naira (US$413) per ha for the study area. A value of at least 2,863 Naira, or US$32.5 per farmer per dry season, or US$62/ha is attributable to the present rate of groundwater recharge (Acharya 2000). In terms of maintaining water supply resources, the value of the recharge function is 1,146,588 Naira or US$13,029 per day for the wetlands. Households on average will have a consumer surplus loss of 86 to 588 Naira per month as a result of a 1-metre drop in groundwater levels, depending on whether they purchase their water or collect it (Acharya and Barbier 2002). Since households that rely entirely on collecting their own water are also typically poorer, the relative welfare impacts on these households are disproportionately large. These results suggest that managed flooding that maintains a certain level of water supply to the wetlands would be a preferred choice to indiscriminate diversion of water to upstream areas.

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threat by reduced flooding due to dam construction and irrigation projects upstream (Acharya 2000). The welfare implications of these hydrological changes, and the apparent costs to society of such investments, are described in box 3.1.

The choice of Hadejia-Nguru Wetlands is justified by four principal considerations:

1. The HN Wetlands are diverse and span across the ecological zones of Guinea Savanna, Sudan Savanna, and the Sahel.
2. The wetlands are deemed of international importance as breeding grounds for migratory birds, thereby having a global value for biodiversity.

3. The wetlands provide a range of natural resources, thereby supporting the livelihoods of the local communities. These livelihoods encompass wet and dry season farming, fishing, fuelwood collection, livestock rearing, gathering of wild-food resources and forestry.

4. Finally, and most important for this study, poverty is high in the area. The per capita income for the area is US$278 but only after accounting for "income" from environmental resources that are collected and consumed by households. Based on conventional income sources (including any revenue from NTFPs that are not marketed), per capita income in the area amounts to approximately US$222 per capita.

The *Niger Delta* also cuts across several ecosystems, namely coastal/mangrove, freshwater swamp forests, lowland rainforests and derived savanna with small areas of intact forest remaining (World Bank 1995). It is a vast floodplain built up by the accumulation of sedimentary deposits washed down by the Niger and Benue Rivers (World Bank 1995). The high rainfall and river discharge during the rainy season, combined with the low, flat terrain and poorly drained soils, cause widespread flooding and erosion. When floodwaters recede, the channels spread out across the Niger Delta swamps, and pools drain poorly. A dynamic equilibrium among flooding, erosion, and sediment deposition is the characteristic of the ND ecosystem (World Bank 1995).

The choice of the Niger Delta area hinges on these facts:

- The area is important for producing oil, which is the dominant source of revenue to Nigeria's economy; yet, despite its vast oil resources, the ND region remains poor, lacking in infrastructure and basic services. In spite of the abundant oil and natural gas reserves in the area, household energy needs still rely on natural resources.

- Pollution from oil drilling and leakages from pipes have adversely affected some parts of the delta. The delta has a high population density, with a current population estimated at 27,642,715 (National Population Commission 2002). In addition, while also a part of the politically defined Niger Delta, Imo State has the highest population density in the country.

- Despite its oil resources, the delta remains underdeveloped and poor. The dominant economic activities in the Niger Delta include fishing, extraction of forest products, and subsistence agriculture. The local population also supplements its diet and income with a wide variety of forest products. Based on the case study survey, per capita incomes in the delta are approximately US$360. Exclusion of "environmental income" from goods that are collected and consumed by the household reduces this per capita income by 35 percent, to US$234.

Thus, these two areas are typical of much of rural Nigeria with a mainly agricultural base. The northern study site is more typical of the north with an agropastoral community. Both areas have poor infrastructure and poor water supply, health services, and electricity provision; and both rely heavily on marketing or trading goods in informal or local markets.

Data Collection

The survey instrument used for collecting primary data is detailed in Appendix A. The aim of this instrument was to collect household level data on income, expenditure, natural resource use, and other socioeconomic characteristics of the household. Questions on health and education were also included to determine the level, quality, and demand for services in these two sectors that have

important implications for productivity and income generation. The survey was conducted in the dry season to (a) find households at home since agricultural work is generally minimal during this period and (b) capture the dependency of households on natural resources during a particularly harsh period. However, the relevance of conducting a similar study in the rainy season should not be underestimated since patterns of resources use and availability are likely to be significantly different during the wet season. *Therefore, to have a panel representation of consumption and expenditure data and to understand more accurately the nature of dependency on natural resources in the study sites, we recommend that the study be continued.*

The survey instrument used for collecting data from respondents in the HN wetlands was translated into the *Hausa* language (a regional language in the north).[5] The translation was done to ensure clarity in administration of the questionnaire. The questionnaire used in the ND was administered in English, with clarifications provided by the enumerators in Pidgin English or the local language as needed. Prior to the data collection, a pilot survey was carried out in both HN and ND areas to test the appropriateness and applicability of the survey instrument and to familiarize the enumerators with it. Following the pilot survey, necessary corrections were incorporated in the final survey instrument.

A multistage, stratified random sampling procedure was employed in the selection of a sample of households used in the field survey. First, the study areas were selected based on the importance of the two ecosystems for the northern and southern portions of Nigeria. This was followed by a stratification of the selected study areas according to ecological zones.

In the Hadejia-Nguru Wetlands, the villages of *Adiani, Ando, Gwayo,* and *Sugum* were selected for detailed data collection. These villages were selected because they cut across the Guinea Savanna, Sudan Savanna, and the Sahel ecological zones and are representative of the wetlands. In addition, the villages are located at varying distances from the wetlands, thereby allowing us to capture the relative impact of being located closer or farther away from the flooded areas.

In the Niger Delta, two villages, *Oloibiri* and *Sampou,* which cut across mangrove/coastal swamp and fresh water swamp were selected. In the densely populated Imo State, which lies in a transition zone between the high forest and the savanna, the villages of *Aronta-Mbutu* and *Amagu-Ihube* were selected for the survey. These villages fall within the lowland forests and the derived savanna zones in northern Imo. Finally, we carried out a random selection of 30 sample households from the selected villages. The random selection was based on the estimated number of households in each village provided by the village head/community leader. For example, in a village with 90 households, we made a random selection of every third household (that is, third, sixth, ninth). In each of the selected villages, 30 households were randomly selected, giving us a total of 240 sample households (120 households in HN and 120 households in the Niger Delta). The sample size is reasonable for the scope of this study although it is important to note that generalizing the results across other types of ecosystems and populations is not recommended. For the two ecosystems chosen for this study, however, the results are likely to be representative given the relative homogeneity in the use and availability of natural resources within each site.

The survey was introduced to the respondents through the local leadership of the respective communities. The support of the local leadership was critical to the willingness of the respondents to participate in the survey, none of whom refused to participate. In all surveyed communities, the

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[5] See Appendix A. Appendix B provides detailed results with summaries thereof in this section.

local leadership gave absolute support and cooperation, thereby contributing to the high degree of participation.

Measurement of Household Income and Expenditure

The procedure used to measure household incomes and expenditures was carried out as follows:

- *Consumption of own-produced food.* The economic value of own-produced food was calculated by using farm gate prices for different types of produced food (mostly grain and vegetables), less the earnings from any food that was sold and not consumed by the household. It is assumed that the level of consumption of own-produced food remains the same during the year.

- *Natural resources collected and consumed by households.* Market rates were used for generating the economic value of goods such as water, fuelwood, and medicinal plants, which were collected and consumed by the households. This is simplified by the fact that there is a market price for nearly all reported products although it may be argued that these market prices are not always reflective of scarcity values of the products but, in some cases, as for water, are more reflective of the cost of delivery.

- *Household incomes.* Household incomes were calculated by multiplying the number of months that each member of the household worked in a particular economic activity, by the average monthly earnings from such activity, and summed up for all the members of the household. Remittances received by the households were added to the household income.[6]

- *Household expenditures.* Household expenditures include expenditures on food, water, agricultural input, education, and health. Household expenditures on natural resources such as water and fuelwood were obtained on a weekly basis, while expenditures on items such as education and agricultural inputs were reported on a yearly basis. In the absence of seasonal data, it is assumed that the household weekly expenditures on food, fuelwood, and water remains the same throughout the 12 months.

Results

This section presents the findings of the empirical case studies on the socioeconomic/demographic characteristics of surveyed households and their natural resource dependency. We begin by presenting the analysis of the demographic variables of the sampled households. The analysis is followed by a discussion of the natural resource use in the areas. Finally, we present an analysis of the contribution of natural-resource-based (environmental) income or consumption to the household's total income or consumption and relate this contribution to poverty levels within the communities.

Demographic Characteristics of Households

The significance of demographics on natural resource dependency hinges on the fact that availability of labor for agricultural production and collection/production of natural resource products such as wild fruit and fuelwood; the amount of produce retained for domestic

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[6] Derived income figures were also used, based on production/collection/revenue derived from natural resources. The derived income figures served as a check to income stated by the respondents.

consumption; and marketable surplus are all, in part, determined by the demographics of the household. The mean household sizes in HN and for ND were found to be 8 and 7 persons respectively. Some studies have found that age has a positive effect on productivity (Kalirajan and Shand 1985, Stefanus and Sexena 1998) since age has a direct bearing on the availability and mobility of agricultural workers, the ease with which improved practices are adopted, and the size of farm area cultivated by the households at any given time.

The mean age for the households in HN was 18 years and in the Niger Delta 24 years, while 35 percent of household members in the Hadejia-Nguru Wetlands and 29 percent in the Niger Delta are married. There seems to be a dominance of young persons in the study areas. This may have implications for household labor for agricultural activities and could result in increased dependence on gathered products as food or income supplements. High youth unemployment in Nigeria is also a factor in increasing civil strife and unrest in both urban and rural areas.

Education

Many studies have revealed that the level of education (years of schooling) helps rural households use production information efficiently and, to that extent, educated households are better producers (Phillips 1994, Wang and others 1996, and Yang 1997). The educational level of households as revealed by table 2 indicates that only 20 percent of the households in Hadejia-Nguru had completed at least primary education. By contrast, in the Niger Delta, 58 percent of the households have completed at least primary education. The low educational levels in Hadejia-Nguru may account for the predominance of farming as the primary occupation. The difference in the level of human capital available to households in the two study sites should have implications for household welfare levels.

Educational status and household income also showed a strong correlation of 0.733, at a significance level of 0.05 for households in the Niger Delta. The implication is that educated members of the households earn relatively higher incomes than those members that were not educated.

Table 2. Educational level of household members

Educational level	Hadejia-Nguru (% of household members)	Niger Delta (% of household) members
	1.9	6.4
Post-secondary	5.4	17.1
Secondary completed	6.5	19.7
Secondary uncompleted	6.0	15.1
Primary completed primary	21.2	24.6
Uncompleted adult Education	2.4	0.4
Nursery	2.9	3.4
Koranic only	15.5	-
Never attended school	41.1	13.2

Health Status and Access to Health Facilities by Household

The proportion of household members who were sick during the month prior to the survey is presented in table 3. The table reveals that approximately a third of the household population were ill in the previous 4 weeks. The survey relied on self-diagnosis by respondents (see complete results in Table B6, Appendix B).

There was a significant negative correlation coefficient of –0.149 between household's that went to school and household members who were ill in the previous 4 weeks (health status). The correlation coefficient between education and health status for Hadejia-Nguru was –0.55 but was not statistically significant. The implication of the negative correlation is that illnesses among household members decrease when such members have been to school. It is expected that *a priori*, educated households may be more inclined to wash their hands before eating and boil water obtained from ponds/river before drinking. Consequently, such households are likely to be less prone to suffer from many illnesses. 30 (HN) to 40 per cent (ND) of those who reported sickness over the last 4 weeks suggested that they had malaria or fever during this period.

The survey on health facilities shows that sick persons in Hadejia-Nguru commonly visit private clinics/patent medicine stores. In the Niger Delta, most sick people resort to self-medication. Most households do not have access to government hospitals/clinics. The access to health facilities is strongly influenced by their proximity to urban centers, and by the quality of the road that connects the community to the nearest urban center. This is particularly so in remote rural areas where poverty prevails. Consequently, many households resort to the use of locally based systems (such as traditional healers, self-medication).

Table 3. Health status of household members in previous four weeks

Health status response	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Yes	270	28.2	248	29.6
No	689	71.8	589	70.4
Total	959	100.0	837	100.0

Natural Resource Dependency

We expect that rural households in our study sites depend on natural resources to complement or supplement their earnings from farming activities. There is a tendency toward income diversification through dependency on natural resources, such as extraction of fuelwood and other forest products, which supplements income earned from farming. Our survey shows that approximately 15 percent of individuals and 43 percent of households in Hadejia-Nguru, and 13 percent of individuals and 43 percent of households in the Niger Delta, consider farming as their predominant occupation. The second most important occupation in Hadejia-Nguru, 28 percent of households, is fishing, while 13 percent of households in the Niger Delta identify trading as their second most important occupation. Detailed employment categories for individuals are presented in Appendix A. The employment status of household members is presented in table 4. Of the working population, over 71 percent in the Hadejia-Nguru Wetlands are self-employed while over 67 percent are self-employed in the Niger Delta.

Table 4. Employment status of household members

Employment status	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Paid employee	25	2.6	42	5.0
Employer	16	1.7	10	1.2
Self-employed	294	30.7	172	20.3
Unpaid family worker	77	8.0	43	5.1
No employment status[a]	547	57.0	579	68.4
Total	959	100.0	846	100.0

a. Predominantly children, women, and old people were identified by respondents as being in this category, although they may well be involved in some household and economic activities as unpaid family workers.

Natural Resources and Their Uses

The significance of natural resources for rural households consumption and production have been well documented in the literature (Falconer and Arnold 1991, Lampietti and Dixon 1994, and Townson 1994). In the study areas, households depend on a wide range of natural resources. These include a wide variety of food stuff such as edible fruits, vegetables, and oils; a large number of uses for wood, including fuelwood for domestic energy; implements such as the hoe; other tree uses such as livestock fodder and browse; the use of grass for thatch, mats, and baskets; soil for block-making and pottery, and medicinal plants. The types of natural resources, their significance, and their uses by households in the study area are presented in table 5.

Table 5. Use of resources by households in the study areas

Resources	Hadejia-Nguru	Niger Delta
Land	Arable farming, *fadama* farming, recession farming, brick-clay, potash, sand, pottery, grazing, soil, medicinal plants	Farming, soil, medicinal plants
Water	Drinking, livestock, block/brickmaking, fish, irrigation	Drinking, sand, gravel, fishing, periwinkles, other seafood
Forest	Fuelwood, doum palm, wild fruits, bushmeat, grasses, fodder, herbs, poles, crafts, medicinal plants	Fuelwood, palm fruits, wild vegetables, bushmeat, snails, canes/poles, timber, crafts, herbs, roots, medicinal plants

While quantitative data is often lacking, there is significant information on the resource use patterns in these areas. In the Hadejia-Nguru Wetlands, for example, Eaton and Sarch (1997) estimate that over 250,000 head of cattle may be reared, supporting a cattle trade with an annual turnover of over Naira 400 million (1995 prices, N80=US$1). Based on a case study of two villages within the wetlands, Eaton and Sarch (1997) also find that in addition to fish and fuelwood, a number of other resources are used by wetlands populations to provide food, building materials and income. Doum palm, potash, fuelwood, and foods from wild fruits and leaves were studied in greater detail. They find that many of these wildfood sources are critically important for a number of disadvantaged groups, in terms of both income generation and food supplements. Medicinal plants, although not reported to any great extent in the current survey, may also be more important than we currently are able to ascertain.

Land is considered to be the most important resource for approximately 58 percent and 64 percent of households in Hadejia-Nguru and the Niger Delta respectively. This fact is not surprising since farming is the primary economic activity of these households. In traditional agriculture, land is the most important factor of production since low levels of technology and other related problems of land tenure do not provide sufficient incentives for land improvement investments (Amaza 2000).

In the study areas, farming is not capital intensive. Farmers use the hoe and cutlass as the basic tools to carry out crop production. None of the households owns tractors or other machinery needed for full farm mechanization. In Hadejia-Nguru, 36 percent of the farmers use animal traction to plough their farms. Nondurable agricultural inputs used in crop production include seeds, fertilizers, and farm labor. Household shares of expenditures on these agricultural inputs are 5.5 percent in Hadejia-Nguru and 2.6 percent in the Niger Delta.

Sources of Water Used by Households

Hand-dug/tubewells are the primary source of water for households in Hadejia-Nguru during both dry and wet seasons. Approximately, 93 percent of households depend on wells for domestic water use. Households spend on average 2 hours daily fetching water for domestic use. Water vendors, who fetch water from wells and deliver to households, charge 2–5 Naira per 36 liters of water. In contrast, in the Niger Delta, 79 percent of the households depend mainly on rainwater during the rainy season, and 33 percent of the households obtain water for domestic use primarily from rivers during the dry season.

The difference in the main source of water reported by households in the two study areas may be explained by differences in environmental conditions. A short rainy season and a prolonged dry season characterize the Hadejia-Nguru environment while the Niger Delta is characterized by a relatively long rainy season and a relatively short dry season. Thus, households in the Niger Delta collect rainwater during the rainy season for their domestic water supply. Some of the households even conserve rainwater in small ponds for use during the dry season, when there is serious water scarcity.

Potable water supply is a problem in all the surveyed communities. Thus, water from sources such as wells, ponds/streams, and rivers constitute health risks/hazards for the households. Access to safe drinking water is a crucial factor affecting the health status of the surveyed households, and this is reflected in the prevalence of diseases such as diarrhea and stomach pains (table 6). Safe drinking water is available to only a very small fraction of the population, approximately 8 percent and 23 percent of the households rely on tap water in Hadejia-Nguru and Niger Delta respectively.

Sources of Fuel for Domestic Use

Fuelwood is the primary source of domestic energy for over 90 percent of the households in both Hadejia-Nguru and the Niger Delta. The demands for fuelwood are for cooking and heating.

Some economic factors that influence households' demand for fuelwood include price and availability of substitutes. The demand for fuelwood is influenced by its price relative to the price of substitute fuels, such as, kerosene, cooking gas, and electricity. Household income levels determine the type of fuel to be used in cooking. Most households cannot afford the initial high cost of stoves, cookers, and cylinders that are required for fuel substitutes such as kerosene and cooking gas. As a result, reliance on fuelwood therefore continues to be very high. This is true as well for urban areas, where fuelwood continues to be the cheaper alternative to gas and kerosene.[7] Fuelwood's relatively low price encourages its use compared to other fuel substitutes.

In the Niger Delta ecosystems, fuelwood is either collected or purchased at relatively low prices and may be the main driving factor in determining demand. However, in the Hadejia-Nguru ecosystems, demand for fuelwood is extremely high largely due to the lack of substitutes. This demand is being met by fuelwood collection predominantly from degraded woods and green trees. The prices for fuelwood are therefore relatively high in the region, typically ranging from N10–N20 per bundle. The mean household expenditure on fuelwood in Hadejia-Nguru was N136 per week, with very little variation among households. Many households collect fuelwood and may supplement purchased fuelwood with own-collected fuelwood. Substitute fuels such as kerosene and cooking gas are not available. The Niger Delta areas appear to rely more on collected (as opposed to purchased) fuelwood. Consequently, while there is an opportunity cost of time spent in collecting the wood, household expenditures are somewhat lower at approximately N83 per week.

The dependency of households on fuelwood for domestic use has adverse socioeconomic and environmental impacts. First, in ecosystems in which fuelwood supplies do not meet the demand, as in Hadejia-Nguru, trees are cut down indiscriminately. This practice leads to deforestation and

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[7] Common uses of fuelwood in urban centers include its use in cooking (usually as a supplement to other fuels) and in bakeries which can use up to 140 cubic feet of wood per week. The impact of increasing urban demand for fuelwood on forest reserves in rural areas is a matter of some concern but has not been studied in adequate detail. The wood-fuel sector is also a significant employer and there is tremendous potential and danger associated with increasing demand across rural and urban areas.

facilitates desertification. Desertification in turn has multiple effects on the environment. It tends to promote soil erosion, which leads to a reduction of soil nutrients available for the crop uptake. Desertification also reduces water conservation leading to reduction of water availability and evapotranspiration rate in crops (FORMECU 1994). Overall, the stability of the environment is compromised and the potential for food production impaired as a result of environmental degradation.

Fuelwood dependency also has important implications for labor allocation and household welfare. The rural poor must either find low-cost fuelwood or do without. In the Hadejia-Nguru, increasing distances over which fuelwood must be transported have caused prices to rise in recent years while those who collect fuelwood must walk ever farther in search of new supplies. The task of gathering fuelwood is predominately done by women. This traditional gender responsibility affects family life, because it reduces time available for other activities such as taking care of children, tending crops, preparing food, and carrying out other economic and/or domestic activities.

Household Expenditures and Incomes

One of the objectives of this study was to investigate the degree to which poor, rural households are dependent on natural resources. Per capita expenditures have been used as a measure of welfare in most studies on poverty in Nigeria (World Bank 1996, FOS 1999). In this study, we use total income and expenditure as the measure of household welfare. While consumption is the preferred measure of income (Deaton 1980), we expect that the difference between household income and consumption is relatively small since there is high dependence on own-collected and own-produced goods. Own-produced and own-collected products together comprise 28 percent to 42 percent of household income in the Hadejia-Nguru Wetlands and Niger Delta respectively.

The distribution of aggregate expenditure by households in Hadejia-Nguru and the Niger Delta are presented in tables 6 and 7 respectively. In both study sites, food accounted for a substantial proportion (over 50 percent) of total household expenditure. Not surprisingly, the proportion of household expenditure on education in the Niger Delta is relatively high compared to Hadejia-Nguru. Estimates of household expenditure on environmental resources show that in Hadejia-Nguru Wetlands, households spend a significant proportion of their disposable income on the purchase of fuelwood and water. It was earlier observed that fuelwood was the dominant source of energy used for domestic uses in both Hadejia-Nguru and the Niger Delta. The relatively lower proportion of expenditure on fuelwood in the Niger Delta may be explained by differences in prices since, in the Niger Delta, due to relatively higher density of forest cover, households obtain their fuelwood at little or no cost. In addition, the increased use of kerosene among households in the Niger Delta, to some extent, substitutes for fuelwood. This substitution effect, which might have been influenced by nonprice factors, such as the convenience of using kerosene and its availability, accounts for the higher proportion of household expenditure on kerosene (more than three times the proportion spent on fuelwood) in the Niger Delta.

The mean household income among households in Hadejia-Nguru is approximately N250,782 (approx. $1,931), while in the Niger Delta, households earn on average N286,808 (approx. $2,208) per annum (tables 8 and 9). A range of factors influence the somewhat higher household incomes in the Niger Delta, including educational status of the households, which in turn improves the ability of households to use production resources efficiently.

Table 6. Aggregate expenditure by households in Hadejia-Nguru

Category of expenditure	Total expenditure (Naira)	% share of total
Food	9906908	52.03
Education	47632	0.25
Health	864345	4.54
Agricultural inputs	1042695	5.48
Animal traction	277200	1.46
Hired labor	855617	4.49
Veterinary	64300	0.34
Clothes	1205920	6.33
Remittances	993960	5.22
Debts	528910	2.78
Others	5454	0.03
Nonenvironmental Resources Expenditure	15792941	82.95
Fish	909220	4.78
Water	831454	4.37
Fuelwood	927940	4.87
Grazing resources	511160	2.68
Building material	44010	0.23
Wildfood	8646	0.05
Medicinal plants	7114	0.04
Bushmeat	1620	0.01
Others	5769	0.03
Environmental Resources Expenditure	3246933	17.05
Total Expenditure	19039894	100.00
Mean Household Expenditure per Annum	158665.78	

Closer proximity to more urban centers also helps in marketing of goods at higher prices. A wide range of natural resources are also available to households and, while degradation of these resources is proceeding at a rapid rate, there is relatively good availability of resources for the current population.

Expenditure patterns also vary across the two sites. Higher average expenditures of N223,864 in the Niger Delta compare with N158,666 in the Hadejia-Nguru Wetlands. These values suggest an expenditure: income ratio of 78 percent and 63 percent for the Niger Delta and the Hadejia-Nguru Wetlands respectively[8]. In some areas, the level of saving is severely skewed with poorer households exhibiting high rates of dis-saving. For example, in the Niger Delta, the poorest

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[8] Without including environmental income, this ratio would be 112% and 120% respectively.

households have an expenditure: income ratio of 2.7. In the Hadejia-Nguru Wetlands, however, the poorest quintile also has relatively high rates of saving (13%). While this result is surprising for developing countries, it is clearly a reflection of the fact that we have tried to capture all forms of consumption when measuring income. This, together with our findings that household expenditure on natural resources such as fuelwood and water is significant, further suggest that poor households may have the ability to boost their savings rates with increased availability of natural resources that meet household consumption needs.

Table 7. Aggregate expenditure by types for households in Niger Delta

Category of expenditure	Total expenditure (Naira)	% share of total
Food	13922564	51.83
Education	2815239	10.48
Health	807888	3.01
Agricultural inputs	703975	2.62
Transport	208020	0.77
Kerosene	638966	2.38
Clothes	1938700	7.22
Remittances	396950	1.48
Debts	357900	1.33
Others	789201	2.94
Nonenvironmental Resources Expenditure	22579403	84.05
Fish	1924520	7.16
Water	642885	2.39
Fuelwood	205020	0.76
NTFPs	700700	2.61
Bushmeat	308100	1.15
Others	503000	1.87
Environmental Resources Expenditure	4284225	15.95
Total Expenditure	26863628	100.00
Mean Hh Expenditure per Annum	223863.57	

Table 8. Aggregate income by source for households in Hadejia-Nguru

Source of income	Income (Naira)	% of total
Crop income	7962700	26.46
Trading income	4518900	15.02
Semi-skilled labor income	3844080	12.77
Skilled labor income	2686488	8.93
Prepared food vendor	1688640	5.61
Livestock income	594238	1.97
Unskilled labor income	122400	0.41
Remittances	120000	0.40
Total Cash Income (exclude env. income)	21537446	71.57
Consumption of own-produced food	2397486	7.97
Fishing income	2941200	9.77
NTPFs cash income	959850	3.19
Consumption of own fuelwood	197080	0.65
Consumption of own water	274014	0.91
Consumption of own wildfoods	915720	3.04
Livestock graze of environmental resources	798720	2.65
Consumption of collected medicinal plants	54080	0.18
Use of env. goods for housing	18200	0.06
Total Environmental Income	6158864	20.47
Total Income	30093796	100.00
Mean Env. Income Per Household	51323.87	
Mean Total Income per Hh	250781.63	

Table 9. Aggregate income by source for households in Niger Delta

Source of income	Income (Naira)	% of total
Crop income	9333776	27.12
Semiskilled labor income	5687280	16.52
Trading income	2222400	6.46
Skilled labor income	1082040	3.14
Unskilled labor income	584400	1.70
Livestock income	662605	1.93
Remittances	82500	0.24
Miscellaneous income	361506	1.05
Total cash income (exclude env. income)	20016507	58.16
Consumption of own-produced food	2228824	6.48
Bushmeat income	4360720	12.67
NTFPs cash income	3910400	11.36
Fishing income	2503800	7.27
Wildfoods income	577200	1.68
Sand/gravel/stones	369000	1.07
Consumption of own fuelwood	348972	1.01
Consumption of collected water	28600	0.08
Consumption of collected medicinal plants	36504	0.11
Use of env. goods for housing	36400	0.11
Total Environmental Income	12171596	35.37
Total Income	34416927	100.00
Mean Env. Income per Hh	101429.97	
Mean Total Income per Hh	286807.73	

Household Sources of Environmental Income and Contribution to Total Income

In both Hadejia-Nguru and the Niger Delta, income from crop production comprises the dominant source of cash income to households. This phenomenon can be explained by the growing demand for food, especially within the urban population, the main buyers of marketed agricultural products. Such income can be enhanced by improved marketing of goods to more central markets and is an important policy consideration for poverty reduction strategies for the regions.

Among the nonagricultural, natural-resource-based sources of income, fishing is the most important activity for both Hadejia-Nguru and the Niger Delta. There is also a growing market demand for fish as a result of rapid population growth, particularly among the urban population and improved management of this sector, including marketing linkages, could have positive impacts on household income. Mathes (1990) and Thomas and others (1993) note that the Hadejia-Nguru Wetlands have long been recognized as an important center of fish production in the region. Fishing is undertaken mainly during the flooded season although some villages and individuals fish throughout the year. Thomas and others (1993) estimated that the annual fish production from the wetlands may vary between 1,620 and 8,100 metric tons, which may well be an underestimate. Barbier and others (1993) estimate a market value of Naira 480 million based on an estimated annual catch of over 6,000 metric tons of fish. Again, marketing, storage and processing are critical elements of enhancing income generating opportunities.

In the Niger Delta, NTFPs collected from common property resources contribute approximately 32 percent of the environmental income and approximately 11 percent of the total income. Such NTFPs are mainly palm wine, palm oil, and other forest products. One thing that characterizes these NTFPs, which generate significant income, is that they are mostly edible food products obtained from natural resources. The existence of informal and local market outlets provides incentive to the rural communities to participate in their collection and marketing.

Diversity of Income Sources

Income diversification by households is seen as a key survival strategy in areas in which exposure to risk, such as climatic variability, is high. Households may choose to diversify income sources at the risk of lower average incomes, or households with diversified incomes may have lower income variability over time. Our samples show that households in both sites derive some percentage of their income from a variety of sources (tables 10 and 11). However, poorer households are more dependent on a single source of income whereas richer households have a more even spread across various income sources. Among the poorest households, 42 percent (Niger Delta) to 58 percent (Hadejia-Nguru) of the households derived their income from only a single source while 71 percent (Niger Delta) to 75 percent (Hadejia-Nguru) were dependent on two or less sources of income. More diversified households appear to have less variability in income, thereby allowing higher rates of savings over time.

Table 10. Household income dispersion analysis in Hadejia-Nguru

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
100% total income (*Naira*)	1541753	2905369	4392840	7961408	13292425	30093796
% of households with:						
1 Income source	58	17	21	21	29	
2 Income sources	17	25	42	42	38	
3 Income sources	13	42	33	25	13	
4 Income sources	4	13	4	13	13	
5 Income sources	8	4	0	0	8	
6 Income sources	0	0	0	4	4	
Total	100	100	100	100	100	

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
80% total income (*Naira*)	1233402	2324295	3514272	6369126	10633940	24075036
% of households with:						
1 Income source	58	21	21	21	29	
2 Income sources	29	71	75	67	46	
3 Income sources	13	8	4	8	17	
4 Income sources	0	0	0	4	8	
5 Income sources	0	0	0	0		
6 Income sources	0	0	0	0		
Total	100	100	100	100	100	

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
50% total income (*Naira*)	770877	1452685	2196420	3980704	6646213	15046898
% of households with:						
1 Income source	79	54	38	21	33	
2 Income sources	21	46	63	79	63	
3 Income sources	0	0	0	0	4	
4 Income sources	0	0	0	0	0	
5 Income sources	0	0	0	0	0	
6 Income sources	0	0	0	0	0	
Total	100	100	100	100	100	

Table 11. Household income dispersion analysis in the Niger Delta

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
100 % total income (Naira)	472652	1754500	3175676	6471800	22542299	34416927
% of households with:						
1 income source	42	8	17	17	25	
2 income sources	29	46	46	29	17	
3 income sources	21	25	21	29	25	
4 income sources	8	21	17	25	21	
5 income sources	0	0	0	0	12.5	
Total	100	100	100	100	100	

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
80 % Total Income (Naira)	378122	1257680	2686462	5177440	18168780	27668484
% of households with:						
1 income source	38	8	17	17	25	
2 income sources	38	54	50	58	29	
3 income sources	21	38	33	25	46	
4 income sources	4	0	0	0	0	
5 income sources	0	0	0	0	0	
Total	100	100	100	100	100	

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
50 % Total income (Naira)	266326	877250	1587839	3235900	11355488	17322803
% of households with:						
1 income source	58	67	67	75	50	
2 income sources	38	33	33	25	50	
3 income sources	4	0	0	0	0	
4 income sources	0	0	0	0	0	
5 income sources	0	0	0	0	0	
Total	100	100	100	100	100	

Summary

Findings 1: Natural Resource Dependence of the Poor

The results show that, although mean incomes are above the national average, *rural households are strongly dependent on environmental resources.* In aggregate, between 20 percent (Hadejia-Nguru) and 35 percent (Niger Delta) of household income comes from environmental resources. The poorest half of the sample obtain 39 percent (Hadejia-Nguru) to 60 percent (Niger Delta) of their income from such sources, confirming the frequently cited result that environmental degradation will have a greater impact on the poor than on the rich. If crop income is classified as environmental income, dependencies are even higher: 55 percent (Hadejia-Nguru) and 69 percent (Niger Delta). Environmental income then would constitute 100 percent of the income for the lowest two quintiles at Hadejia-Nguru, and for the lowest 3 quintiles for the Niger Delta.

Findings 2: Poverty as Vulnerability

Poverty is best understood in the context of vulnerability to income shocks, which we measure through considering the *diversity of income sources*. An income dispersion and concentration analysis was undertaken to show the number of sources of income that contributed to 100 percent, 80 percent, and 50 percent of the incomes in each income quintile. While many households had up to five or more income sources, the patterns of concentration clearly showed that the poorest households generally had fewer options and that a large portion of their incomes was dependent on only a single source. For example, among the poorest households, 42 percent (Niger Delta) to 58 percent (Hadejia-Nguru) of the households derived their income from only a single source, and 71 percent (Niger Delta) to 75 percent (Hadejia-Nguru) were dependent on one or two sources.

Findings 3: Saving and Dis-saving

Another measure of vulnerability is associated with income variability and the ability to generate surpluses. Many studies confirm that the poor are, in fact, able and willing to invest in environmental assets if they have such surpluses. In our sample, the variability in incomes at times places the poorest households in a situation of extreme dis-saving. In the Niger Delta, for example, expenditures over the survey period were 270 percent of incomes for the poorest quintile. For the entire sample set of 240 households, the aggregate expenditure:income ratio is 71 percent, indicating that a net generation of wealth is occurring in these areas (78 percent in the Niger Delta and 63 percent in Hadejia-Nguru.) This phenomenon suggests that, if incentive and credit structures were working properly, substantial savings would be available locally for re-investment. Such investment has occurred elsewhere in the country. For example, many communities have invested locally in boreholes to improve water supply. The fact that a significant proportion of this income is in-kind and dependent on the availability of natural resources, suggests that income variability is a critical factor in enabling wealth accumulation by these households. The dis-saving occurring among the poorer households further suggests that credit schemes aimed at assisting these households are particularly required to reduce income disparity and reduce the vulnerability of these households.

Findings 4: Role of the Relatively Wealthy

While we have not investigated the sustainability of resource use patterns in the study sites, our results clearly show that the poor consume fewer environmental resources than do the rich. In Hadejia-Nguru, the richest quintile was responsible for 65 percent of expenditures on environmental goods and services (water, fuelwood), while the poorest 2 quintiles (40 percent of the households) were responsible for only 4 percent of such expenditures. Similarly, for the richest quintile, consumption of environmental goods and income derived from these resources is 59% of total income derived from environmental resources across all households. The poorest two quintiles consume 6 percent of these resources. In the Niger Delta, corresponding expenditure figures for the richest quintile is 74% while the lowest two quintiles spend less on 2% on environmental resources. Consumption figures for Niger Delta show a similar disparity with over 50% of environmental income accruing to the richest quintile and less than 4% to the lowest two. The mechanisms for this consumption occur through two different routes, one of which may partially alleviate poverty. In some cases, consumption of environmental goods and services by the wealthy has a direct impact

on the resource; this has immediate negative consequences on the poor. In other instances, this consumption may also generate income to the poor (for example, resale of natural products), in which case it may still have negative environmental impacts, but it also has some direct positive benefits in terms of income generation. The offsetting impact of this income generation, however, is relatively small since wealthier households also collect and consume resources. Our survey suggests that such incomes to the poorest quintile are at most 3 percent of the total expenditures in the sample.

4 POLICY RECOMMENDATIONS

Previous sections affirmed that conditions are likely to differ from site to site or sector to sector. In light of this, one cannot jump straight to policy recommendations in the absence of empirical information that describes local conditions. Nevertheless, there are some general lessons that can provide some guidance as to how appropriate policies might be designed.

General Lessons in Policy Design

These policy lessons and "best practice" policy options – based on work conducted by the EC/UNDP (Ambler and others 1999a, b.) – provide a menu of alternatives that might be considered in conjunction with local conditions (box 4.1). In addition, some important underlying principles often are seen as part of such interventions. We present these here as additional factors that may be considered in the design of future programs and research.

Self-sufficiency

Fostering and promoting self-sufficiency is an appropriate objective of any policy initiative that seeks to improve environmental quality and reduce poverty. The objective has merit on a number of accounts. First, it reduces vulnerability through promoting (usually) a diverse set of opportunities. Second, it provides local incentive for sustainable management. Finally, it reduces the role of external factors; in Nigeria, this implies that there are fewer burdens on state coffers and that there is a greater potential to extend programs to a broader range of people. Self-sufficiency need not be targeted to environmental resources. In some instances, alternatives (for example, farmed food crops or wage labor) will take pressures away from environmental resources. As previous sections note, however, such substitutability must not be taken for granted and must be verified empirically before it is built into policy assumptions.

Precautionary Principle

The precautionary principle states that irreversible actions should be avoided; it is a keystone of sustainable development policy. It is also appropriate when dealing with fragile environmental resources or vulnerable populations such as the rural poor. Policies that follow this principle are more likely to protect environmental assets while reducing vulnerability of the poor.

Community Driven Development

Community Driven Development (CDD) treats poor people and their institutions as assets and partners in the development process. This approach gives control of decisions and resources to community groups who often work in partnership with demand-responsive support organizations and service providers including elected local governments, the private sector, NGOs, and central government agencies. Programs that use this approach would have more ability to build local management capacity, identify needs for services, increase opportunities for economic growth and improve local governance of resources.

Box 4.1 Policy options and best practice policies

Although "win-win" policies may be elusive, a large amount of work can be done to support appropriate policy choices within any given context. The EC/UNDP framework provides detailed explanations of these potential practices and interventions. Those of greatest relevance within a developing country setting such as Nigeria are summarized below.

Empirical research. The most significant barrier to policy initiatives is to determine whether poverty alleviation and the reduction of environmental pressures are actually complementary goals or substitutes in any given sector or at any given site. Empirical work that establishes the trade-offs and linkages must be conducted at the household level and must be part of an ongoing monitoring program that tracks time-series information and feeds this information back into local decisionmaking and management structures.

Conceptual and operational shifts. Best practice policies must acknowledge that the poor are willing and capable partners in managing environmental assets. Their technical knowledge should not be underestimated, nor should their willingness to provide their own (scarce) financial resources to such efforts. Operational shifts in terms of implementing projects and actions can and must be transferred to those who are affected by the policies.

Access to assets. Policies should protect and expand the asset base of the poor. This can be done directly in the form of environmental assets. If it is done indirectly through other assets, the substitutability/complementarity of these assets with the environmental assets must be established to ensure that environmental assets are not unduly threatened. For example, cases of potentially perverse and destructive complementarities are becoming more abundant as development agencies are becoming more experienced with alternative income-generating schemes near sensitive areas. The higher income from these schemes often facilitates purchase of equipment that in turn leads to destructive practices (for example, purchase of chain-saws).

Asset improvement. Even where access is secure, assets often are underused or not sustainably managed. The EC/UNDP framework prescribes a role for co-management and co-investment in such circumstances. Such co-management should be permitted to emerge from existing local management and decisionmaking structures rather than introducing a threat or replacement to such structures.

Appropriate infrastructure and technology. While the poor do have substantial technological expertise in traditional systems, such expertise can be upgraded with the potentially desirable effects of improving productivity and sustainability of resource use. Again, this may create unintended negative impacts on environmental resources if higher incomes encourage other types of unsustainable activities not directly related to the introduction of such technologies.

Employment and compensation for the poor. Where high levels of poverty are contributing to unsustainable resource use, labor-intensive employment and compensation programs for the poor may be appropriate measures. These measures are better still if the projects are directly related to improving environmental assets.

Market and Planning Reforms. Many policy interventions involve removal of existing structures that are inadvertently biased toward the poor. For example, the removal of subsidies to the nonpoor will provide the government with greater financial resources to target the poor. In addition, the use of community-based ecosystem planning encourages local participation in management processes that may reduce the vulnerability of the poor while providing opportunities for ecosystem-based management.

Conclusions and Recommendations Arising from This Study

While the principles noted above are useful for policy planning in general, empirical research such as provided by this study can identify specific actions to address poverty and environmental degradation. We explain our conclusions and recommendations based on the findings of this study in the context of ongoing programs and strategies relevant to Nigeria's economic and environmental objectives.

The "environmental goal" of the Millennium Development Goals (MDGs), the World Bank's Environmental Strategy (WBES), and the Africa Region's Environmental Strategy (ARES) all highlight the linkages between poverty and the environment. The MDG of achieving environmental sustainability by 2015 emphasizes the integration of the principles of sustainable development into country policies and programs and reversing the loss of environmental resources.[9] yes The indicators to measure progress are specified by the MDG to include the proportion of land area covered by forest, the land area protected to maintain biological diversity, GDP per unit of energy use (as proxy for energy efficiency), and carbon dioxide emissions (per capita).

The WBES assesses the environment through a "poverty lens" and targets three pillars for focusing environmental management on alleviating poverty with lasting results. These pillars are

1. Improving environmental health

2. Ensuring sustainable livelihoods

3. Reducing vulnerability to natural disasters. Maintaining global ecosystems and life support systems is recognized as fundamental to each of these objectives. Integrating environment into development and poverty reduction strategies and programs; putting in place the policy, institutional, and social conditions to promote environmentally sustainable and equitable private sector-led development; and linking local and global environmental objectives are all key elements of the WBES.

In line with the above frameworks, the ARES aims to assist its clients to

1. Make the transition to sustainable economic development, through improving environmental and natural resource management

2. Empower communities and individuals to make sustainable livings based on the natural resource endowments of the region and to take responsibility for managing them

3. Reduce the burden of diseases and poor health by improving the quality of the environment in which people live

4. Reduce the vulnerability of people and economies of the region to natural disasters and severe climatic events

5. Manage and conserve the unique biological diversity of the region, for themselves, their future generations and the world

6. Establish an enabling environment and build the capacity to achieve these objectives and maintain them over the long term.

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[9] <http://sima/mdg/NewFrame/goal-7.htm>.

The findings of this study reaffirm the need to tackle the poverty-environment linkages through a variety of mechanisms. Two of these mechanisms are relatively conventional and are the mainstay of some current programs:

1. *Programs that target environmental safeguards for resources on which the poor rely*

2. *Programs that place greater reliance on decentralized management.*

Both of these are intended to reinforce the positive feedbacks that exist between the poor and natural resources. As the study shows, dependency on natural resources among the rural poor is high. As noted earlier in box 3.1, investments that undermine the resource base of the rural poor can also result in high social costs and inefficient use of capital. Furthermore, the lack of any evidence of environmental management plans at the village or community level suggests a need for greater community management of natural resources. Such plans would improve resource management based on the use patterns of communities, which can also take greater responsibility for the maintenance of these resources.

Increased evidence of conflicts over the use of natural resources further suggests that social unrest is being fuelled by economic hardship and scarcity of natural resources. Government schemes and externally funded programs have, often unwittingly, increased inequality in resource use. As a result, community relationships have become strained. Such tensions create tremendous constraints to sustainable resource use and will need to be addressed.

The empirical work also points to two other dimensions that are not frequently addressed by natural resource policies:

1. *Diversification of income sources for the poor to improve their resilience and decrease their vulnerability to environmental degradation*

2. *Programs targeted to the wealthiest households that reduce their negative impacts on the environment, and improve access to resources for poorer households.*

Income diversification is an import aspect of poverty alleviation, and environmental resources can play an important role in providing a greater diversity of options to all users. To do so, however, it will be critical to evaluate marketing opportunities and the sustainability of markets. For instance, under the agricultural expansion programs in the north, the lack of market outlets is clear in the numerous road-side vegetable sellers visible along highways. Villages farther away from roads often do not have even this option. Diversification of income from sources other than natural resources will also be required to reduce both poverty and pressure on natural resources.

Furthermore, wealthier households, which are the most significant stress on environmental goods and services, can be targeted through a number of mechanisms ranging from being induced to substitute away from "environmental goods" to reinvesting some of their substantial savings in environmentally beneficial asset improvement. Removing inappropriate agricultural price supports and perverse subsidies that result in inefficient resource use is a critical step in creating incentives and management systems that motivate households to make investments in maintaining natural capital and using resources more efficiently. Simultaneously, improving access and opportunities for the poor to reduce resource capture by the wealthier households is required.

Finally, the results of the empirical work and the review of natural resource programs suggest that a more complete understanding of resource use patterns and poverty-environment linkages is critical for informed policy development. It is of interest that the survey in the Hadejia-Nguru Wetlands

revealed that conflicts and hydrological variation (siltation, too much water, too little water) were seen as the major constraints to natural resource management. In contrast, the population surveyed in the Niger Delta noted that population pressure, deforestation, and oil pollution were the major factors in the delta (tables C28 and C29, Appendix B).

Therefore, this study strongly recommends that the *Poverty Reduction Strategy (PRSP) for Nigeria should reflect the nature of the fundamental linkage between natural resources and rural poverty.* This study provides preliminary information on the nature of this linkage in the case study sites, and its results may be generalized to some extent in those areas. However, given the variation in economic and ecological conditions across the country, to improve current understanding of these issues, we recommend that similar studies be carried out in each of Nigeria's six geopolitical zones In addition, this study is restricted to evaluating resource use patterns during the dry season as a basis of its empirical data. A longer term study that can capture seasonal trends will provide valuable information to the formulation of policies aimed at attacking rural poverty. In addition, the role of women, in particular the dependency of female-headed households on natural resources, needs to be investigated further since the present study was unable to do justice to this important issue. In-country capacity for carrying out such studies exists. The challenge is to develop the sensitivity and broad-based constituencies to ensure that the results of such studies are incorporated into development planning.

Implications for Policies and Projects

Based on a quick assessment of the proposed lending program for Nigeria, the *Local Empowerment and Environmental Management Program (LEEMP)* appears to be the best example of a program that aims to place greater reliance on decentralized management while putting in place environmental safeguards to protect the resources on which the poor rely. The program aims to help communities make the transition to sustainable economic development, through improving environmental and natural resource management It also aims to empower communities to make a sustainable living based on the natural resource endowments and to take responsibility of managing them. The program aims to link local and global objectives through its protected area and biodiversity management component. Sixty percent of the funds under this program aim to support direct investments at the community level for natural resource management, multisectoral public infrastructure establishment, and/or rehabilitation microprojects. These microprojects will be identified and implemented by communities through a guided participatory process applying microwatershed planning principles and in compliance with environmental and social safeguards. The project will also build capacity at the state and local levels to screen these microprojects for potential environmental issues and to monitor the implementation of mitigation activities. In addition, the project has attracted grant funding from the Global Environment Facility (GEF) to support the management and conservation of biological-diversity and ecosystems in selected areas.

A second proposed project that could satisfy the above goals is *Nigeria Fadama II,* which seeks to contribute to increased agropastoral and food chain supply productivity and competitiveness through improved technology, better access to inputs, product markets, and associated services. The project aims to create off-farm income and rural employment, significantly improve the income-earning capacity of poor farmers, and contribute to poverty reduction in rural areas. This project should also aim to put in place appropriate incentives, including environmental and social

safeguards, to protect the resources on which the poor rely, and will continue to rely, as they rise out of poverty over the long term.

For example, the project could (a) raise awareness of the need for environmental safeguards to preserve resources on which the poor rely; (b) raise awareness and strengthen capacity at the state and local levels to monitor and ensure compliance with existing regulations on environmental safeguards, for example, the regulation that no cultivation should take place within 50 meters of the bank of a water body; (c) identify incentives that promote investment in the natural resource base on which the poor rely, for example, afforestation of river banks in return for goods or services provided by the project; and (d) identify incentives that discourage noncompliance with the law, for example, fines, forfeiture of equipment or services provided by the project. The project could also identify environmental and social "hot spots" that may need a different package of interventions–to maximize the opportunities offered by the natural resource base and invest in preservation as well as exploitation. The GEF funding earmarked for this project could support these types of interventions, for example, by harnessing some of the recreational use values associated with large bodies of water while optimizing social welfare across user groups through benefit-sharing agreements.

The project could reinforce the positive feedback that exists between the poor and natural resources by empowering the local levels to manage the resources on which they depend. User groups often are willing to agree on an integrated resource use plan that would allow equitable use of the resource base. Participatory Rural Appraisal (PRA) processes can facilitate the development of such plans. Such planning processes would also assist in resolving conflicts that are bound to arise in situations in which the incentives provided by a program may inadvertently impact negatively on the livelihoods of another user group.

A third proposed project that could address some of the issues identified in this study is the proposed *Niger Delta Development Project*, which is in a very early stage of processing and is focused on institutional development. The delta is prone to conflicts arising from resource degradation (especially nonoil resources on which the poor are most dependent, lack of adequate benefit sharing from resource exploitation (especially oil), and inadequate income-generation opportunities for local populations. The findings of the present study suggest that rural populations in the delta are highly dependent on environmental resources, both in terms of consumption and expenditure. The study finds that rural households derive at least 35 percent of their income from environmental resources. The Niger Delta's population is approximately 70 percent rural, and any attempts by the project and by the Niger Delta Development Corporation to improve conditions in this area therefore will benefit by addressing the environmental dependency of the rural populations in this area and the nature of their income sources. To address poverty in this area, improving marketing linkages for NTFPs, improving service delivery for health and water, and addressing the high level of dis-savings for the poorest populations will be needed. The relatively high demand for education in the region (as suggested by its share in household expenditure) is a another factor that such programs should build on and encourage. As mentioned above, mechanisms to promote environmental safeguards for resources on which the poor rely and community empowerment or decentralized management of natural resources should be mainstreamed into any program that targets natural resources management. At the same time, training and awareness raising to strengthen institutional capacity at the community level will be needed to ensure that communities take responsibility for the sustainable use of their resources. These elements of community empowerment are identified in the proposed project; therefore, this study can help identify some of the specific points of entry with regard to environmental resources.

Finally, the study proposes additional investigations into the poverty–environment relationship, for example, Poverty and Environmental Health and the Impact of Environmental Degradation on Agricultural Productivity, in addition to continued evaluation of the research on Natural Resources Dependence of the Poor. The current study could complement the findings of other ongoing investigations in the country such as Conflict Assessment, which will study access to natural resources as a source of conflict; and Social Risk Assessment, which also could consider the risks associated with the high dependence of the poor on natural resource use as a source of income. Additional studies, such as investigating the linkages between environmental health and the poor, will be relevant to the evolving programs in Nigeria, in particular, to improve the quality of life of the urban poor. Examples of projects that could benefit from a sound understanding of these linkages are the Lagos Metropolitan Development Project, the Lagos Water Sector Restructuring Project, and the Community-based Urban Development Project. These projects aim to rehabilitate urban infrastructure and improve the quality of services for the urban poor by increasing access to basic services and by facilitating partnerships among the poor, local government authorities (LGAs), and state governments for decisionmaking related to on-site public expenditures. Unravelling the linkages among environmental degradation, health, and productivity could ensure that these programs target the poor more effectively and sustainably.

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APPENDIX A. SURVEY INSTRUMENT

Summary

The study used mainly primary data. The main instrument for data collection was a structured questionnaire administered to households by trained local enumerators under the supervision of the local consultant. The survey was introduced to respondents through the local leadership of the respective communities, all of whom gave absolute cooperation and support.

The survey instrument was translated into *Hausa*, a regional language in the north, which was used for collecting data from respondents in the Hadejia-Nguru Wetlands. The translation was done to ensure clarity in the administration of the questionnaire. Translation of the survey was not required for the Niger Delta. Prior to the data collection, a pilot survey was carried out in both Hadejia-Nguru and Niger Delta areas to test the appropriateness and applicability of, and to familiarize the enumerators with, the survey instrument. Following the pilot surveys, necessary corrections were incorporated in the final survey instrument used in the two sites. Minor variations to the attached questionnaire were incorporated to allow for differences in resources found in the two ecosystems. For example, doum palm is used in the north while other types of palm, such as Nypa and oil palm, are found in the south.

The main features of the questionnaire covered information on

- Demographic characteristics
- Education
- Health
- Employment
- Use of natural resources (water, fuel)
- Household consumption
- Household income and sources of income.

Sensitive questions, such as illegal use of bush meat, were avoided during the surveys. No interviews were discarded.

Survey Implementation and Quality Control

Survey Implementation

Multistage random sampling procedure was employed in the selection of a sample of households used in the field survey. First, the study areas were selected to take into account the diverse ecosystems, natural resources endowments, and high incidence of poverty. This process was followed by a stratification of the selected study areas according to ecological zones.

In the Hadejia-Nguru Wetlands, four villages were selected: *Adiani, Garin Ando, Gwayo,* and *Sugum.*

In the Niger Delta, two villages, which cut across Mangrove/coastal swamp and fresh water swamp, were selected. The selected villages are *Sampou and Oloibiri.* Oloibiri is the community in which oil expiration first started in 1968. In Imo State, which lies in a transition zone between the lowland rain forest and high forest, two villages, *Aronta-Mbutu* and *Amagu-Ihube,* which lie in the lowland forests and the derived savanna in northern Imo, were chosen for the data collection.

Finally, 30 sample households were randomly selected from the selected villages. The random selection was based on the estimated number of households in each village provided by the village head/community leader. For example, in a village with 90 households, there was a random selection of every third household (that is, third, sixth, ninth). In each of the selected villages, 30 households were randomly selected, yielding a total of 240 sample households (120 households in Hadejia-Nguru and 120 households in the Niger Delta).

Quality Control

The consultant carried out supervisory visits during the data collection period to ensure that appropriate data were being generated. In addition, a repeat survey was carried out two weeks after the first survey. The purpose of the repeat survey was to verify the data collection and household recall to ensure quality control. The repeat survey was generally consistent with the initial survey. However, in a few cases, variation was observed with respect to household consumption of goods (items purchased, collected, and produced in the last week). In such cases, the average value of the surveys was used in the analysis.

Survey

The survey instrument follows.

HOUSEHOLD NATURAL RESOURCE USE SURVEY

SECTION A. INTRODUCTION
(spoken by the enumerator to the respondent)

My name is _____. I am working with _____, and we are carrying out a survey to understand the use and demand for natural resources in this area. We are interested in understanding the importance of natural resources for your household, and we would like to ask you a few questions about your use of these resources. Your answers will help us understand the needs of this area. There are no right or wrong answers to these questions. The interview will take approximately one hour.

Will you allow us to interview you?
Yes   Ï
No   Ï

If the respondent answers no, thank him/her and stop the interview.
If the respondent answers yes, the enumerator should continue to section A.

Enumerator: Please record:

1a.   Respondent's name   _____
1b.   Household number _____
2.   Village name   _____
3.   How many people are listening to the interview (do not count yourself and the respondent)? ___
4.   Time of the interview _____
5.   Date of the interview _____

A2. Enumerator: Starting with the respondent, ask for the following information about each member of the household. This will include anyone who is living in the household (including wives and children) and anyone who is temporarily away but is remitting money or goods to the households, for example, children who are living in a city but are sending money home.

ID	Name	HH relationship	Sex	Age/years	Ethnic group	Marital status
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Name: write name. **Household relationship:** household head (1); spouse (2); child (3); son/daughter in law (4); grandchild (5); parent (6); parents in law (7); siblings (8); others (specify) (9). **Sex:** male (1); female (2). **Age:** years. **Marital status:** married (1); widowed (2); divorced (3); separated (4); never married (5).

SECTION B. EDUCATION

Enumerator: Use the same ID numbers from section A.

ID	Has [ ] ever attended school? Yes=1 No=2	Is [ ] currently attending school? Yes=1 No=2	What was the highest level of school attended (see key below)?	How many years of schooling has [ ] completed?	Has [ ] had any vocational training? Yes=1 No=2	Did [ ] have to pay to attend school? Yes=1 No=2	How much in the last one year did you pay for [ ] to attend school?
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

School levels code : Post-secondary (1); Secondary completed (2); Secondary uncompleted (3); Primary completed (4); Primary uncompleted (5); Adult education (6); Koranic only (7).

SECTION C. HEALTH

ID	In the past 4 weeks, has [ ] been ill? Yes=1 No=2	In the past 4 weeks, did [ ] suffer from one of the following (see below for code)?	For how many days in the past 4 weeks did [ ] suffer from this?	For how many days in the past 4 weeks was [ ] unable to carry out his/her normal duties due to the illness?	Did [ ] visit health facility for the illness? Yes =1 No =2	What kind of health facility did [ ] visit? How accessible is it?	In the past 4 weeks, how much did [ ] spend on treatment and medicines?
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Illness code: Headache/dizziness (1); Cough/cold (2); Vomiting/stomach pains (3); Respiratory problems (4); Fever (5); Diarrhea (6); Injury (7); Malaria (8); Meningitis (9); Other (10). **Health facility code**: Government, District or state hospital (1); Private clinic (2); Traditional/village medicine practitioner (3); Self medication (4); Other (5). Accessibility code: Less than 500m (A); 500m – 1,000m (B); 1,000 – 2,000m (C); 2,000m – 4,000m (D); more than 5,000m (E).

SECTION D1. EMPLOYMENT (page 1 of 2)

ID	1. What was the primary and secondary occupation [ ] had in the past 12 months? **Primary = most important in terms of income generation and/or time spent on doing this work. Secondary = second most important in terms of income and/or time spent.**		What was [ ] 's employment status in this occupation? **Paid employee =1 Employer = 2 Self-employed = 3 Unpaid family worker = 4 Other (specify) = 5**	How many weeks did [ ] work in this occupation during the past 12 months? (number of weeks)	How many days/hours per week on average did [ ] work in this occupation?				What was [ ]'s average monthly/daily wage/salary earnings from this occupation?		How much extra did [ ] receive during the past 12 months in this occupation as remuneration in kind, as tips, commissions, as bonus?		
		Description of economic activity			Average number of		Average				As remuneration in kind (noncash items, estimated as average N per month)	As tips, commissions (average per month)	As bonus (annual total)
					Days per week	Hours per week	Monthly salary/ earnings	Daily wage rate					
1	Primary												
	Secondary												
2	Primary												
	Secondary												
3	Primary												
	Secondary												
4	Primary												
	Secondary												
5	Primary												
	Secondary												
6	Primary												

	Secondary										

ID	What was the primary and secondary occupation [ ] had in the past 12 months? **Primary = most important in terms of income generation and/or time spent on doing this work. Secondary = second most important in terms of income and/or time spent.**		What was [ ] 's employment status in this occupation? **Paid employee =1 Employer = 2 Self employed = 3 Unpaid family worker = 4 Other (specify) = 5**	How many weeks did [ ] work in this occupation during the past 12 months? (number of weeks)	How many days/hours per week on average did [ ] work in this occupation?		What was [ ]'s average monthly/daily wage/salary earnings from this occupation?		How much extra did [ ] receive during the past 12 months in this occupation as remuneration in kind, as tips, commissions, as bonus?		
		Description of economic activity			Average number of		Average		As remuneration in kind (non cash items, estimated as average N per month)	As tips, commissions (average per month)	As bonus (annual total)
					Days per week	Hours per week	Monthly salary/ earnings	Daily wage rate			
7	Primary										
	Secondary										
8	Primary										
	Secondary										
9	Primary										
	Secondary										
10	Primary										
	Secondary										

SECTION D2. SELF-EMPLOYMENT (page 1 of 2)

ID	What were the average number of days worked per week in other self-employment activities (farming, livestock, fisheries, cooking, fuelwood collection, hunting, construction, trading stall). List the 2 main economic activities.		What was [ ] 's average daily/monthly wage/earnings from all these other activities during the past 12 months?
	Description of economic activity	Average number of days per week	Average monthly earnings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

HOUSEHOLD-LEVEL INFORMATION

SECTION E. USE OF NATURAL RESOURCES

E0. This survey is interested in understanding how important natural resources are to you and your household. What are the most important natural resources your household uses? List in order of importance : most important (1); second most important (2) third most important (3).

Land   ( )
Water   ( )
Forest   ( )
Medicinal plants   ( )
Sand   ( )
Other (specify) _____ ( )

E1.   What are the sources of water your household uses?

	Rainy Season	Dry Season
Well/tubewell	☐	☐
River	☐	☐
Ponds	☐	☐
Rain water	☐	☐
Other (specify) _____	☐	☐

E2.   Which is the main source of fuel for each of the following activities. If you use two or more kinds of fuel to carry out the task, please tell me which is the first most important source of fuel and the second most source of fuel for that task.

Primary source................1
Secondary source..............2

	Cooking	Lighting	Heating	Other uses
Fuelwood				
Sawdust				
Thatch, grass				
Charcoal				
Kerosene				
Bottled gas				
Electricity				
Other				

E3.   I would now like to ask you how much you rely on natural resources such as water, grass, fuelwood; where you obtain them, and how much you earn from them.

	Item purchased last week for household consumption		Amount collected/ produced last week (quantity and units)	Average time spent producing/ collecting this item in the last week (hours)	What is the source of the item collected/ produced? Swamp/ponds = 1 Forest = 2 Farm = 3 Plantations = 4 Other (specify)=5	Did you sell or consume the item you collected /produced? Sell = 1 Consume = 2 Both = 3	Amount sold last week from collect ed/produc ed item (quantity)	Earnings from amount sold last week (Naira)
	Quantity and units	Price paid per unit						
Cereals								
Fresh vegetables								
Tubers (cassava, yam)								
Water								
Fish, seafood								
Meat, poultry, eggs								
Dairy products (milk, yogurt)								
Timber/cane								
NTFPs: palm wine, leaves								
Fuelwood								

	Item purchased last week for household consumption		Amount collected/ produced last week (quantity and units)	Average time spent producing/ collecting this item in the last week (hours)	What is the source of the item collected/ produced? Swamp/ponds = 1 **Forest = 2** **Farm = 3** **Plantations = 4** **Other (specify)=5**	Did you sell or consume the item you collected /produced? **Sell = 1** **Consume = 2** **Both = 3**	Amount sold last week from collect ed/produc ed item (quantity)	Earnings from amount sold last week (Naira)
	Quantity and units	Price paid per unit						
Grazing resources								
Building material (e.g.,. palm)								
Medicinal plants								
Gathered food (berries, leaves)								
Bush meat/snail								
Oil palm								
Tobacco, kola nuts, tea								
Other (specify)								

E4.   How many farm plots do you own? (**Enumerator: if the respondent has fish ponds instead, or in addition to farm plots, please list below**)

Plot (pond) number	Distance from residence	Type of crop (fish) produced	Quantity of crop (fish) produced in the last 12 months (in local measure units)	Plot (pond) size (ha)
1.				
2.				
3.				
4.				
5				
6.				

E5.   Do you have livestock?
      yes   Ĭ (go to E6)
      no   Ĩ

E6.   How many?

	Number of animals presently owned?	How many did you own last year?	How many have you sold this year?	How much did you sell the animals for (total Naira)	Do you sell or consume the products from these livestock (meat, milk) Sell = 1 Consume = 2 Both = 3	Amount of product sold last week from item (quantity)	Earnings from amount sold last week (Naira)
Goats							
Poultry							
Others (specify)							

SECTION F. INCOME

F1.   Have you asked for a loan from the local government or a bank in the last 12 months? (circle one)

Yes   No

F2.   Was this loan granted? (circle one)

Yes   No

F3.   What are the main sources of income for your household?

Sources	How important are the following for your household income? (Main source = 1; secondary source = 2; tertiary source = 3)	In the past 3 years has the status of these activities changed?	Why these changes? 1=soil degradation/ erosion 2=pollution 3=low income from activity 4=other (specify)	How much did the household receive from these sources in the last 12 months? E.g., for farming, last harvest season, and for how long?	How much did the household receive from these sources in the last week?
Farming					
Fishing					
Fish farm					
Laborer (specify e.g., farm, construction)					
Trading					
Animal husbandry					
Fuelwood					
Woodlot trees (specify species)					
Bush meat					
Cottage industry (e.g., furniture)					
Medicinal plants					
Sand/gravel					
Remittances/gifts					
Loans					
Other (explain)					

F4. What is the household's **total** income per month (Naira)?

500-1000	Ĩ
1000-1500	Ĩ
1500-2000	Ĩ
2000-4000	Ĩ
4000-6000	Ĩ
6000 and more	Ĩ

F 5. What is the household's seasonal income?

Income (Naira)	Dec – Mar	April – Nov
500-1000		
1000-1500		
1500-2000		
2000-4000		
4000-6000		
6000 & more		

F6. Expenditures

Item	Amount you spent on this item in the last 12 months (total)?
Soup ingredients (e.g., salt, maggi)	
Agricultural inputs (e.g., fertilizer, seeds, fishing gear)	
Clothing	
Kerosene, coal, other	
Transport (farm produce marketing)	

Remittances/gifts	
Debts	
Other (e.g., toiletries)	

F7. Do you own any of the following items?

Item	No.	Are you the sole owner of this item or do you share ownership with someone? Sole owner = 1; Share = 2	How many years ago did you acquire this item?	Did you purchase this item or did you receive it as a gift? Purchase = 1; Gift = 2
House				
Bicycle				
Motor cycle				
Car				
Canoe/Boat				
Shop				
Radio				
Plantation or woodlot trees (specify species)				
Fishing rights/fish ponds				
Other (specify)				

SECTION G. STATUS OF NATURAL RESOURCES

What are your perceptions of the status of natural resource availability and management (e.g., land, water, forests)?

SECTION H. CLOSING

H1. How difficult did you find this survey? (circle)

Very difficult   Difficult   Not too difficult   Very simple

H2. To improve our understanding of your needs and requirements, we would like to revisit you in 2 weeks time to repeat some of these questions. Will you agree to meet with us again in 2 weeks?

     Yes_____No

Enumerator: Please thank the respondent for his/her time and conclude the interview.

Total time taken for the interview: _____

Enumerator: After you have completed the interview, please note the following:

How reliable do you think the responses were in this survey? (circle one)   Reliable   Not reliable
Make any other relevant notes on the back page.

APPENDIX B. DETAILED DESCRIPTIVE SURVEY RESULTS

Table B1. Population/size of sample

Hadejia-Nguru	Frequency	%
Gwayo	241	25.1
Sugum	211	22.0
Adiani	227	23.7
G. Ando	280	29.2
Total	959	100.0

Niger Delta	Frequency	%
Samporu	210	24.8
Oloibiri	195	23.0
Aronta-Mbutu	236	27.9
Amagu-Ihube	205	24.2
Total	846	100.0

Table B2. Age distribution of household members

	Number	Minimum	Maximum	Mean	Standard deviation
Hadejia-Nguru	958	1.00	90.00	18.43	16.99
Niger Delta	846	0.5	85.00	24.37	17.84

Table B3. Marital status of household members

Marital status	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Married	339	35.3	246	29.1
Widow	31	3.2	25	3.0
Divorced	6	.6	2	.2
Separated	2	.2	6	.7
Never married	581	60.6	567	67.0
Total	959	100.0	846	100.0

Table B4. Educational level of household members

Educational level	Niger Delta		Hadejia-Nguru	
	Frequency	%	Frequency	%
Post-secondary	54	6.4	18	1.9
Secondary completed	145	17.1	52	5.4
Secondary uncompleted	167	19.7	62	6.5
Primary completed	128	15.1	58	6.0
Primary uncompleted	208	24.6	203	21.2
Adult education	3	.4	23	2.4
Nursery	29	3.4	149	15.5
Never attended school	112	13.2	394	41.1
Total	846	100.0	959	100.0

Table B5. Health status of household members in the previous four weeks

Health status response	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Yes	270	28.2	248	29.6
No	689	71.8	589	70.4
Total	959	100.0	837	100.0

Table B6. Type of illness suffered by household members

Category of illness	Hadejia-Nguru Frequency	%	Niger Delta Frequency	%
Headache/dizziness	20	2.1	24	2.8
Cough/cold	61	6.4	12	1.4
Vomiting/stomach pains	14	1.5	26	3.1
Respiratory problems	12	1.3	18	2.1
Fever	46	4.8	25	3.0
Diarrhea	8	0.8	4	0.5
Injury	10	1.0	7	0.8
Malaria	44	4.6	74	8.7
Meningitis	3	0.3	5	0.6
Other	75	7.8	51	6.0
Was not ill	666	69.4	600	70.9
Total	959	100	846	100.0

Table B7. Households' access to health facilities

Category of illness	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Government hospital	96	10.0	58	6.9
Private clinic	120	12.5	50	5.9
Traditional practitioner	50	5.2	34	4.0
Self-medication	3	.3	85	10.0
Did not visit health facility	690	71.9	608	71.9
Other	0	0	11	1.3
Total	959	100.0	837	100.0

Table B8. Primary economic activities of household members

Primary economic activity	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Farming	148	15.4	118	13.9
Fishing	58	6.0	9	1.1
Trading	47	4.9	49	5.8
Natural resources products	1	0.1	10	0.1
Prepared food seller	50	5.2	4	0.6
Livestock/animal husbandry	2	0.2	0	0
Crafts	50	5.2	0	0
Unskilled worker	1	0.1	18	2.1
Semiskilled worker	22	1.9	33	3.9
Skilled worker	18	2.3	15	1.8
Agroprocessing	9	0.9	0	0
Others	5	0.5	12	13.2
None/nonapplicable[a]	548	57.2	578	68.3
Total	959	100.0	846	100.0

a. Household members who were unavailable for participation or not involved in primary economic actives, that is, children and young adults (mainly students). The dominance of this category of members in the population contributes to the huge rate of "nonapplicable" entries.

Table B9. Secondary economic activities of household members

Secondary economic activity	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Farming	65	6.8	159	18.8
Fishing	73	7.6	24	2.3
Trading	29	3.0	22	22.4
Natural resources products	2	0.2	8	0.9
Prepared food seller	2	0.2	4	0.5
Livestock/animal husbandry	4	0.4	0	0
Crafts	19	2.0	4	0.5
Unskilled worker	2	0.2	9	1.1
Semiskilled worker	9	0.9	19	2.2
Skilled worker	2	0.2	1	0.1
Agroprocessing	6	0.6	0	0
Others	6	0.6	4	0.5
None/nonapplicable	740	77.2	595	70.3
Total	959	100.0	846	100.0

Table B10. Employment status of household members

Employment status	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Paid employee	25	2.6	42	5.0
Employer	16	1.7	10	1.2
Self-employed	294	30.7	172	20.3
Unpaid family worker	77	8.0	43	5.1
No employment status	547	57.0	579	68.4
Total	959	100.0	846	100.0

Table B11. Types of natural resources and their major uses

Major types of resources	Hadejia-Nguru	Niger Delta
Land	Arable farming, fadama farming, recession farming, brick-clay; potash, sand, pottery, grazing, laterite for brick-blocks, building	Farming; laterite for brick-blocks, building, roads
Water	Drinking, livestock, block-making, fish, irrigation	Drinking, fishing, periwinkles, sand, seafood, livestock
Forest	Fuelwood, doum palm, wild fruits, bushmeat, grass, fodder grazing, herbs, poles, crafts	Fuelwood, palm fruits, wild vegetables, bushmeat, snail, cane, poles, timber, crafts
Medicinal plants	Herbs, roots, leaves used to treat illness	Herbs, roots, leaves used to treat illness
Sand/ gravel	Building, repair works	Building, repair works

Table B12. Primary importance of natural resources to households

Category of resource (most important)	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Land	69	57.5	73	60.8
Water	48	40.0	35	29.2
Forest	3	2.5	7	5.8
Medicinal plants	0	0	2	1.7
Sand/gravel	0	0	3	2.5
Other	0	0	0	0
Total	120	100.00	120	100.0

Table B13. Secondary importance of natural resources to households

Category of resource (second most important)	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Land	46	38.3	34	28.3
Water	68	56.7	70	58.3
Forest	6	5.0	12	10.0
Medicinal plants	0	0	3	2.5
Sand/gravel	0	0	1	0.8
Other	0	0	0	0
Total	120	100.0	120	100.0

Table B14. Tertiary importance of natural resources to households

Category of resource (third most important)	Hadejia-Nguru		Niger Delta	
	Frequency	%	Frequency	%
Land	5	4.2	8	6.7
Water	3	2.5	18	15.0
Forest	110	91.7	77	64.2
Medicinal plants	1	0.8	7	5.8
Sand/gravel	0	0	10	8.3
Other	1	0.8	0	0
Total	120	100.0	120	100.0

Table B15. Sources of water used by households

Source of water	Hadejia-Nguru				Niger Delta			
	Rainy season		Dry season		Rainy season		Dry season	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Well/ tubewell	112	93.3	111	92.5	2	1.7	26	21.7
Rivers	0	0	0	0	10	8.3	55	45.8
Ponds	0	0	0	0	2	1.7	114	11.7
Rain Water	0	0	0	0	103	85.8	1	0.8
Tap	8	6.7	9	7.5	0	0	0	0
Other	0	0	0	100	3	2.5	24	20.0
Total	120	120	120	100	120	100	120	100

Table B16. Primary sources of domestic fuel used by households

Primary source of fuel	Hadejia-Nguru			Niger Delta		
	% of households using fuel for:			% of households using fuel for:		
	Cooking	Lighting	Heating	Cooking	Lighting	Heating
Fuelwood	96.7	2.5	90.8	85.8	0	90.8
Charcoal	0	0	6.7	0	0	5.0
Kerosene	1.7	97.5	0.8	12.5	95.8	3.3
Grass	0.8	0	0	0	0	0
Sawdust	0	0	0	1.7	0	0
Electricity	0	0	0	0	0.8	0
Bottled gas	0	0	0	0	0.8	0
Candle	0	0	0	0	0	0
Other	0.8	0	1.7	0	2.5	0.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table B17. Secondary sources of domestic fuel used by households

Primary source of fuel	Hadejia-Nguru			Niger Delta		
	% of households using fuel for:			% of households using fuel for:		
	Cooking	Lighting	Heating	Cooking	Lighting	Heating
Fuelwood	63.3	2.5	80.0	46.7	0	48.3
Charcoal	0	0	9.2	0	0	40.0
Kerosene	7.5	59.2	0	53.3	55.0	5.8
Sawdust				0	0	0.8
Grass	23.3	0	5.0	0	1.7	0
Dung	0	0	1.7	0	0	0
Electricity	0	0	0	0	38.3	3.3
Bottled gas				0	0	0
Candle	0	0	0	0	0	0
Torchlight	0	35.8	0	0	0	0
Other	5.8	2.5	4.1	0	5.0	1.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table B18. Aggregate expenditure by households in Hadejia-Nguru

Category of expenditure	Total expenditure (Naira)	% share of total
Food	9906908	52.03
Education	47632	0.25
Health	864345	4.54
Agricultural inputs	1042695	5.48
Animal traction	277200	1.46
Hired labor	855617	4.49
Veterinary	64300	0.34
Clothes	1205920	6.33
Remittances	993960	5.22
Debts	528910	2.78
Others	5454	0.03
Nonenvironmental resources expenditure	15792941	82.95
Fish	909220	4.78
Water	831454	4.37
Fuelwood	927940	4.87
Grazing resources	511160	2.68
Building material	44010	0.23
Wildfood	8646	0.05
Medicinal Plants	7114	0.04
Bushmeat	1620	0.01
Others	5769	0.03
Environmental Resources Expenditure	3246933	17.05
Total Expenditure	19039894	100.00
Mean Household Expenditure per Annum	158665.78	

Table B19. Aggregate income by source for households in Hadejia-Nguru

Source of income	Income (Naira)	% of total
Crop income	7962700	26.46
Trading income	4518900	15.02
Semi-skilled labor income	3844080	12.77
Skilled labor income	2686488	8.93
Prepared food vendor	1688640	5.61
Livestock income	594238	1.97
Unskilled labor income	122400	0.41
Remittances	120000	0.40
Total cash income (Exclude env. Income)	21537446	71.57
Consumption of own-produced food	2397486	7.97
Fishing income	2941200	9.77
NTFPs cash income	959850	3.19
Consumption of own fuelwood	197080	0.65
Consumption of own water	274014	0.91
Consumption of own wildfoods	915720	3.04
Livestock graze of environmental resources	798720	2.65
Consumption of collected medicinal plants	54080	0.18
Use of env. goods for housing	18200	0.06
Total Environmental Income	6158864	20.47
Total Income	30093796	100.00
Mean Env. Income per Household	51323.87	
Mean Total Income per Household	250781.63	

Table B20. Aggregate expenditure by types for households in Niger Delta

Category of expenditure	Total expenditure (Naira)	% share of total
Food	13922564	51.83
Education	2815239	10.48
Health	807888	3.01
Agricultural inputs	703975	2.62
Transport	208020	0.77
Kerosene	638966	2.38
Clothes	1938700	7.22
Remittances	396950	1.48
Debts	357900	1.33
Others	789201	2.94
Nonenvironmental Resources Expenditure	22579403	84.05
Fish	1924520	7.16
Water	642885	2.39
Fuelwood	205020	0.76
NTFPs	700700	2.61
Bushmeat	308100	1.15
Others	503000	1.87
Environmental Resources Expenditure	4284225	15.95
Total Expenditure	26863628	100.00
Mean Hh Expenditure per Annum	223863.57	

Table B21. Aggregate income by source for households in Niger Delta

Source of income	Income (Naira)	% of Total
Crop income	9333776	27.12
Semiskilled labor income	5687280	16.52
Trading income	2222400	6.46
Skilled labor income	1082040	3.14
Unskilled labor income	584400	1.70
Livestock income	662605	1.93
Remittances	82500	0.24
Miscellaneous income	361506	1.05
Total Cash Income (exclude env. Income)	20016507	58.16
Consumption of own-produced food	2228824	6.48
Bushmeat income	4360720	12.67
NTFPs cash income	3910400	11.36
Fishing income	2503800	7.27
Wildfoods income	577200	1.68
Sand/gravel/stones	369000	1.07
Consumption of own fuelwood	348972	1.01
Consumption of collected water	28600	0.08
Consumption of collected Medicinal plants	36504	0.11
Use of env. goods for housing	36400	0.11
Total Environmental Income	12171596	35.37
Total Income	34416927	100.00
Mean Env. Income per Household	101429.97	
Mean Total Income per Household	286807.73	

Table B22. Distributional analysis by quintiles of aggregate household expenditure in Hadejia-Nguru (*Naira/yr*)

Expenditure type	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
Food	445950	902990	1320528	2247610	4989830	9906908
Education	0	0	0	375	47257	47632
Health	1650	63355	97645	131285	570410	864345
Agricultural inputs	0	1715	41500	138400	861080	1042695
Animal traction	0	0	0	31400	245800	277200
Hired labor	0	11247	72170	183200	589000	855617
Veterinary	0	0	0	380	63920	64300
Clothes	3090	79830	181500	297000	644500	1205920
Remittances	0	1460	17500	88000	887000	993960
Debts	0	0	690	56920	471300	528910
Others	0	0	0	0	5454	5454
Nonenvironmental Resources Expenses						15792941
Fish	0	18460	99320	188500	602940	909220
Water	0	66040	138034	190580	436800	831454
Fuelwood	0	49920	142480	226980	508560	927940
Grazing resources	0	0	0	28340	482820	511160
Building material	0	0	0	0	44010	44010
Wildfood	0	0	0	1096	7550	8646
Medicinal plants	0	0	0	699	6415	7114
Bushmeat	0	0	0	0	1620	1620
Others	0	0	0	314	5455	5769
Environmental Resources Expenditure						3246933
Total Household Expenditure	1338703	2016045	3175804	5219156	7290186	19039894

Table B23. Distributional analysis by quintiles of aggregate household expenditure in the Niger Delta (*Naira/yr*)

Expenditure type	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
Food	974336	1462988	2218750	2996608	6269882	13922564
Education	0	66870	216000	574669	1957700	2815239
Health	1200	19975	76040	142658	568015	807888
Agricultural inputs	0	2405	37370	115500	548700	703975
Transport	0	0	0	15300	192720	208020
Kerosene	65930	237200	139400	82320	114116	638966
Clothes	15800	124900	272000	414000	1112000	1938700
Remittances	0	0	2600	53650	340700	396950
Debts	0	0	0	20500	337400	357900
Others	12100	47680	85260	159260	484901	789201
Nonenvironmental Resources Expenses						22579403
Fish	0	71760	303160	551200	998400	1924520
Water	0	0	35	75530	567320	642885
Fuelwood	0	0	0	140	204880	205020
NTFPs	0	0	3900	91780	605020	700700
Bushmeat	0	0	0	0	308100	308100
Others	0	0	0	0	503000	503000
Env. Resources Expenditure						4284225
Total Household Expenditure	1280356	2504683	3697549	5229684	14149356	26863628

**Table B24. Distributional analysis of household income by sources of income
In Hadejia-Nguru**

Source of income	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
(a) Cash Income Sources						
Trading income	0	0	0	200000	4318900	4518900
Semiskilled labor income	0	0	0	0	3844080	3844080
Skilled labor income	0	0	0	0	2686488	2686488
Prepared food vendor	0	0	0	276720	1411920	1688640
Livestock income	0	0	2871	35610	555757	594238
Unskilled labor income	0	0	0	0	122400	122400
Remittances	0	0	0	0	120000	120000
Consumption of own-produced food	64521	86325	178206	240017	1828417	2397486
(b) Environmental Income Sources						
Crop income	638452	99700	1175500	1317500	4731548	7962700
Fishing income	113462	127900	791538	428766.7	1479533	2941200
NTFPs Cash Income	7682	68245	130297	371996	381630	959850
Consumption of own fuelwood	0	0	6284	7800	182996	197080
Consumption of own water	7240	19826	64582	89654	92712	274014
Consumption of own wildfoods	8652	19632	20584	21320	845532	915720
Livestock graze of environmental resources	0	0	214895	22880	560945	798720
Consumption of collected medicinal plants	0	0	0	0	54080	54080
Use of env. goods for housing	0	0	0	0	18200	18200
Total Household Income	1541753	2905369	4392840	7961408	13292425	30093796

Table B25. Household income dispersion analysis in Hadejia-Nguru

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
100% Total Income (Naira)	1541753	2905369	4392840	7961408	13292425	30093796
% of households with:						
1 Income source	58	17	21	21	29	
2 Income sources	17	25	42	42	38	
3 Income sources	13	42	33	25	13	
4 Income sources	4	13	4	13	13	
5 Income sources	8	4	0	0	8	
6 Income sources	0	0	0	4	4	
Total	100	100	100	100	100	

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
80% Total Income (Naira)	1233402	2324295	3514272	6369126	10633940	24075036
% of households with:						
1 Income source	58	21	21	21	29	
2 Income sources	29	71	75	67	46	
3 Income sources	13	8	4	8	17	
4 Income sources	0	0	0	4	8	
5 Income sources	0	0	0	0		
6 Income sources	0	0	0	0		
Total	100	100	100	100	100	

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
50% Total Income (Naira)	770877	1452685	2196420	3980704	6646213	15046898
% of households with:						
1 Income source	79	54	38	21	33	
2 Income sources	21	46	63	79	63	
3 Income sources	0	0	0	0	4	
4 Income sources	0	0	0	0	0	
5 Income sources	0	0	0	0	0	
6 Income sources	0	0	0	0	0	
Total	100	100	100	100	100	

Table B26. Household income distributional analysis by sources of income in Niger Delta *(Naira)*

Sources of Income	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
(a) Cash Income Sources						
Semiskilled labor income	0	0	0	268800	5418480	5687280
Trading income	0	0	0	166120	2056280	2222400
Skilled labor income	0	0	0	0	1082040	1082040
Unskilled labor income	0	0	0	0	584400	584400
Livestock income	0	0	0	0	662605	662605
Remittances	0	0	0	0	82500	82500
Miscellaneous income	0	0	0	0	361506	361506
Consumption of own-produced food	86524	98452	118256	429480	1496112	2228824
(b) Environmental Income Sources						
Crop income	84629	126842	283520	1909200	6929585	9333776
Bushmeat income	54122	98426	864127	1989584	1354461	4360720
NTFPs Cash Income	31263	62452	432628	792056	2592001	3910400
Fishing income	12685	32148	573919	864287	1020761	2503800
Wildfoods income	0	0	0	0	577200	577200
Sand/gravel/stones	0	0	0	0	369000	369000
Consumption of own fuelwood	8216	21283	22600	64480	232393	348972
Consumption of own collected water	0	0	0	0	28600	28600
Consumption of collected medicinal plants	0	0	0	0	36504	36504
Use of env. goods for housing	0	0	0	0	36400	36400
Total Income	472652	1754500	3175676	6471800	22710975	34416927

Table B27. Household income dispersion analysis in Niger Delta

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
100% Total Income (Naira)	472652	1754500	3175676	6471800	22542299	34416927
% of households with:						
1 income source	42	8	17	17	25	
2 income sources	29	46	46	29	17	
3 income sources	21	25	21	29	25	
4 income sources	8	21	17	25	21	
5 income sources	0	0	0	0	12.5	
Total	100	100	100	100	100	

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
80% Total Income (Naira)	378122	1257680	2686462	5177440	18168780	27668484
% of households with						
1 income source	38	8	17	17	25	
2 income sources	38	54	50	58	29	
3 income sources	21	38	33	25	46	
4 income sources	4	0	0	0	0	
5 income sources	0	0	0	0	0	
Total	100	100	100	100	100	

	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Total
50% Total Income (Naira)	266326	877250	1587839	3235900	11355488	17322803
% of households with						
1 income source	58	67	67	75	50	
2 income sources	38	33	33	25	50	
3 income sources	4	0	0	0	0	
4 income sources	0	0	0	0	0	
5 income sources	0	0	0	0	0	
Total	100	100	100	100	100	

Table B28. Most Important constraint to natural resource management perceived by households in Hadejia-Nguru

Category of constraint	Frequency	%
Farmer/herder conflict	19	15.8
Scarcity of drinking water	4	3.3
Siltation/low flood water	25	20.8
Lack of electricity .	2	1.7
Deforestation	5	4.2
Lack of access road	10	8.3
Loss of soil fertility	3	2.5
Farm destruction	3	2.5
Lack of flood water	8	6.7
Pests	16	13.3
Too much water	13	10.8
Lack of river water	2	1.7
Other	10	8.3
Total	120	100.0

Table B29. Most important constraint to natural resource management perceived by households in Niger Delta

Category of constraint	Frequency	%
Over-exploitation of resources due to population pressure	42	35.0
Deforestation	41	34.2
Pollution from oil	25	20.8
Flooding	1	.8
None	9	7.5
Soil erosion/loss of fertility	2	1.7
Total	120	100.0

**Selected Comments from Survey Participants on Constraints
to Natural Resource Management**

Hadejia-Nguru:

- "The major problem that affects natural resources availability in the area is associated with resource-use conflict between farmers and livestock herders."

- "Felling down of trees, destruction of farm lands by livestock, and low flood water constitute the dominant factors that affect natural resources availability in the area."

- "We experience declining natural resources availability as result of low flood water due to siltation and resource-use conflicts between farmers and livestock herders."

- "Farm destruction by herders, damage of crops by pests, and scarcity of flood waster affects the availability of fish."

- "Lack of flood water in some years, farm destruction by herders, loss of soil fertility, and crop infestation from pests."

Niger-Delta:

- "There are abundant forest resources which the community is dependent upon. But this is declining due to water pollution through oil exploration activities."

- "Incessant oil spill affects crop productivity, rapid deforestation, and water pollution."

- "Frequent oil spills lead to poor yields of agricultural products and water pollution. There is the problem of serious deforestation."

- " There is abundant, but unexploited natural resources. Establishing a craft industry in the area would assist in the better use of the cane rope, which presently is not used maximally."

- "There is loss in soil fertility due to poor nutrients as a result of erosion and deforestation."

- "Natural resources are becoming less available due to population pressure and poor management."

- "There has been a great change in the forest cover. Thick bushes have disappeared. The degradation is due to over-exploitation of forest resources and farming activities."

APPENDIX C. MAPS

MAP SECTION

Status of Agricultural Practices in Nigeria

1976/78

1993/95

LEGEND:

State Boundaries
Agriculture

Extensive (grazing, minor row crops) Small Holder Rainfed Agriculture
Extensive Small Holder Rainfed Agriculture with Denuded Areas
Floodplain Agriculture
Intensive (row crops, minor grazing) Small Holder Rainfed Agriculture
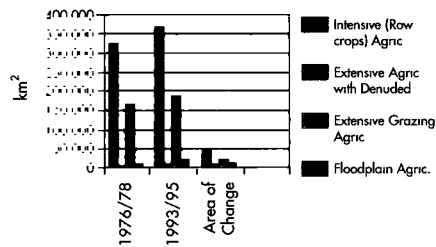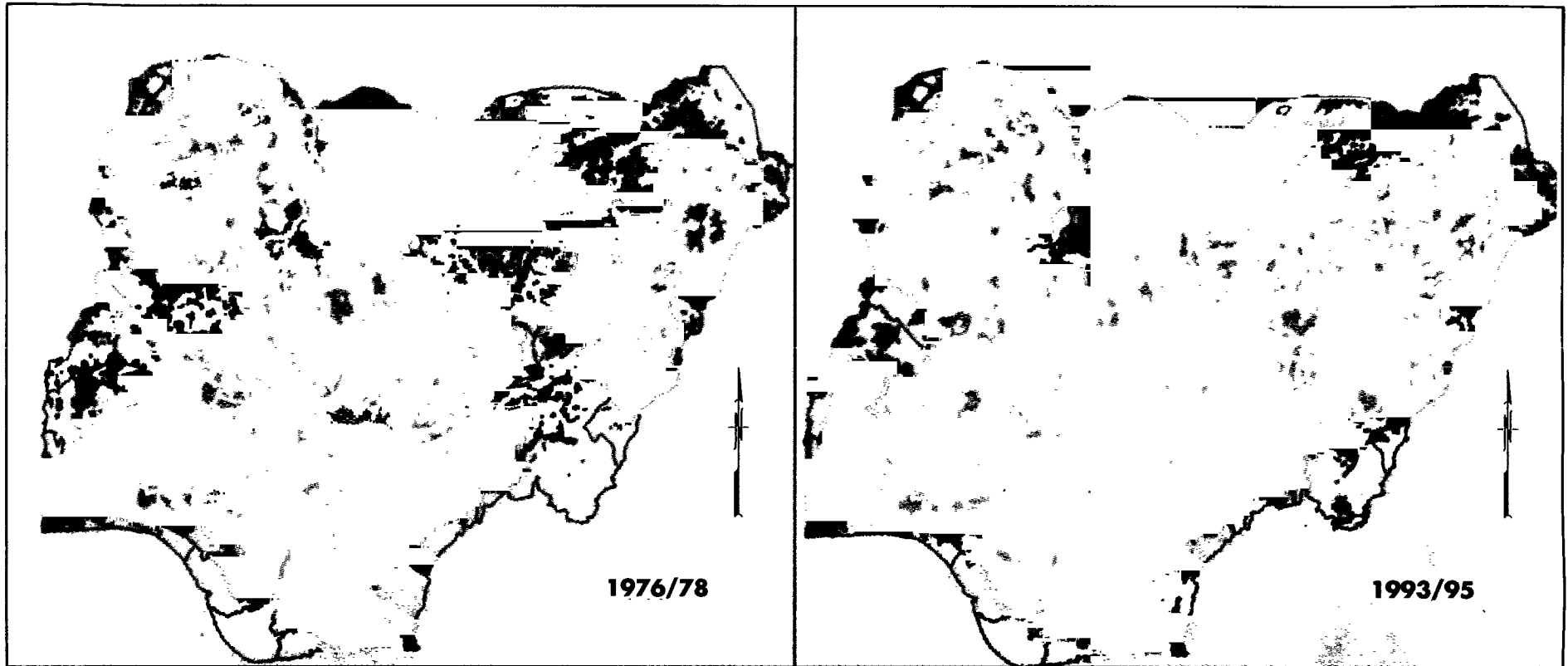
Vegetation and Landuse	1976/78 km²	1993/95 km²	Area of Change km²	%
Intensive (Row crops) Agric.	322,794	365,491	42,697	4.7
Extensive Agric. with Denuded	3,518	9,206	5,688	0.8
Extensive Grazing Agric.	166,328	187,238	20,910	2.3
Floodplain Agruculture	9,451	20,918	11,467	1.3

Intensive (Row crops) Agric

Extensive Agric with Denuded

Extensive Grazing Agric

Floodplain Agric.

0 100 200 300 400 500

KILOMETERS

Forest Cover Changes in Nigeria

1976/78
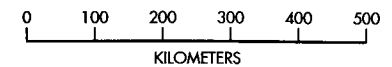
1993/95

FOREST COVER CHANGES

- Undisturbed
- Disturbed
- Riperian
- Montane

	1976/78	1993/95	Area Change km^2
Undistrubed	29,951	365,491	-13,837
Disturbed	14,573	9,206	4,417
Riparian	7,402	187,238	-2,148
Montane	6,762	20,918	-3
Total	54,688	43,127	-11,571

LEGEND:

☐ State Boundaries

Forest Cover

■ Disturbed Forest
■ Montane Forest
■ Riparian Forest
■ Undisturbed Forest

0   100   200   300   400   500

KILOMETERS
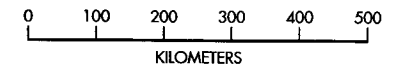
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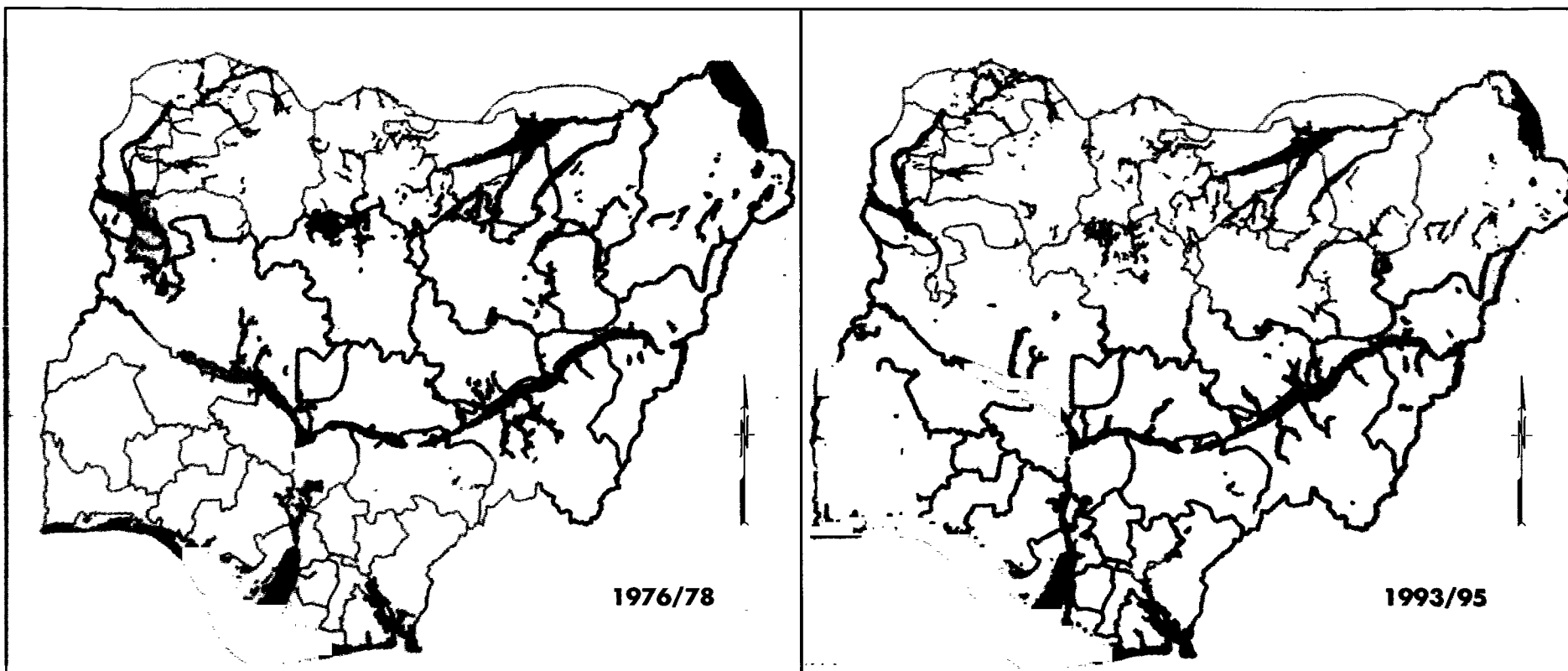
1976/78

1993/95

CHANGES IN WETLANDS AND
LOWLAND AGRICULTURAL LANDUSE

- Floodplain Agriculture
- Mangrove Forest
- Forested Freshwater Swamp
- Saltmarsh/Tidal flat
- Graminold/Sedge/f/water marsh
- Shrub/Sedge
- Total
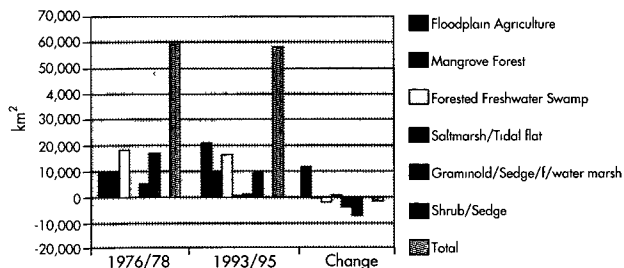
	1976/78 km²	1993/95 km²	Area of Change km²
Flood Plain Agriculture	9,461	20,467	11,467
Mangrove Forest	9,994	9,977	-17
Forested Freshwater Swamp	18,316	16,499	-1,817
Saltmarsh/Tidal Flat	4	546	541
Graminold/Sedge F/water marsh	4,882	781	-4,011
Shrub/Sedge/	16,899	9,248	-7,651
Total	59,546	58,058	-1,488

LEGEND:
State Boundaries
Wetlands
- Floodplain Agriculture
- Forested Freshwater Swamp
- Graminold/Sedge Freshwater Marsh
- Mangrove Forest
- Saltmarsh/Tidal Flat
- Shrub/Sedge/Graminold Freshwater Marsh/Swamp
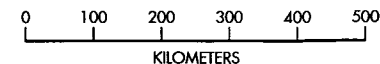
0   100   200   300   400   500

KILOMETERS

IBRD 32140

Status of Vegetation Cover
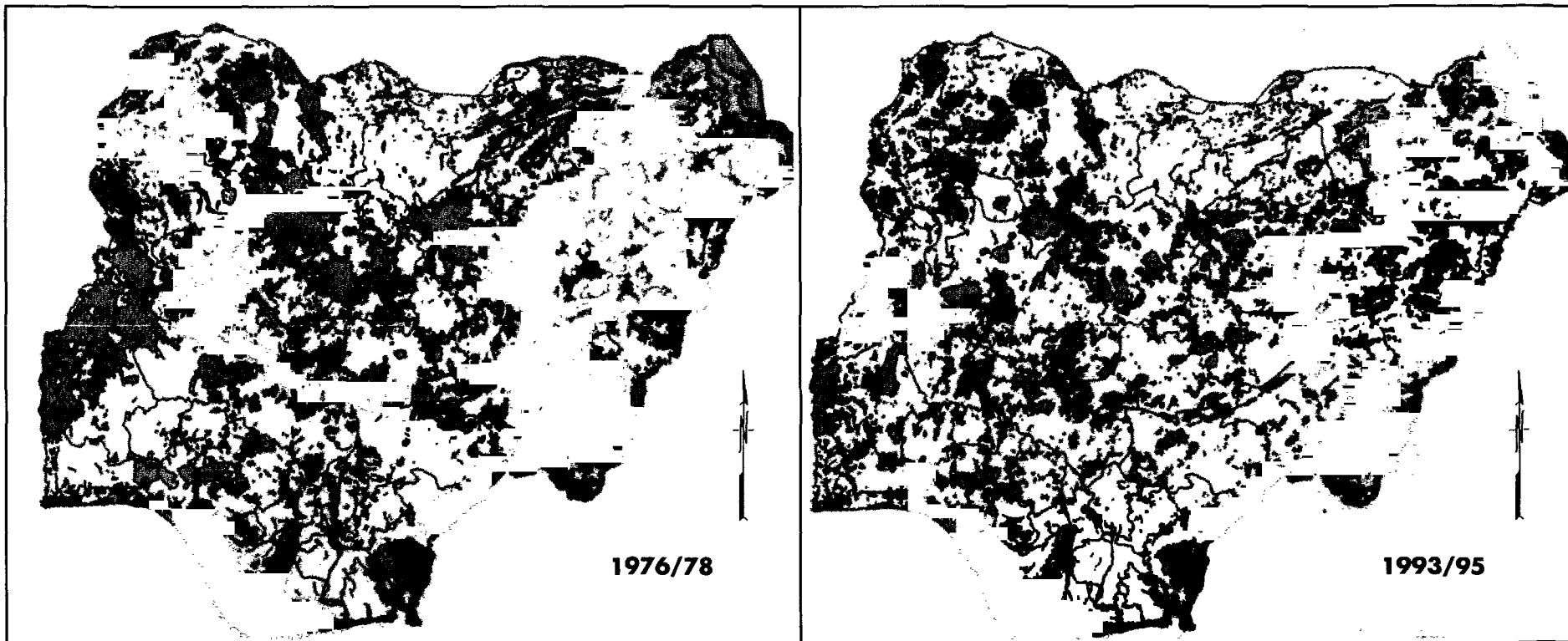
1976/78

1993/95

VEGETATION COVER CHANGED
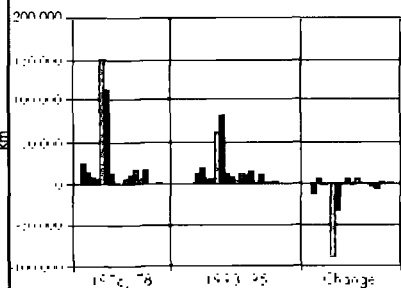
- Undisturbed Forest
- Distrubed
- Riparian
- Montane Forest
- Guinea Savanna
- Sudan Savanna
- Sahel Savanna
- Grassland
- Montane Grassland
- Discontinuous Grassland
- Mangrove Forest
- Forest Freshwater Swamp
- Graminold/Sedge
- Shrub/Sedge Freshwater Marsh
- Teak/Gmelina Plantation
- Agriculture Tree Crop Plantation
- Forest Plantation

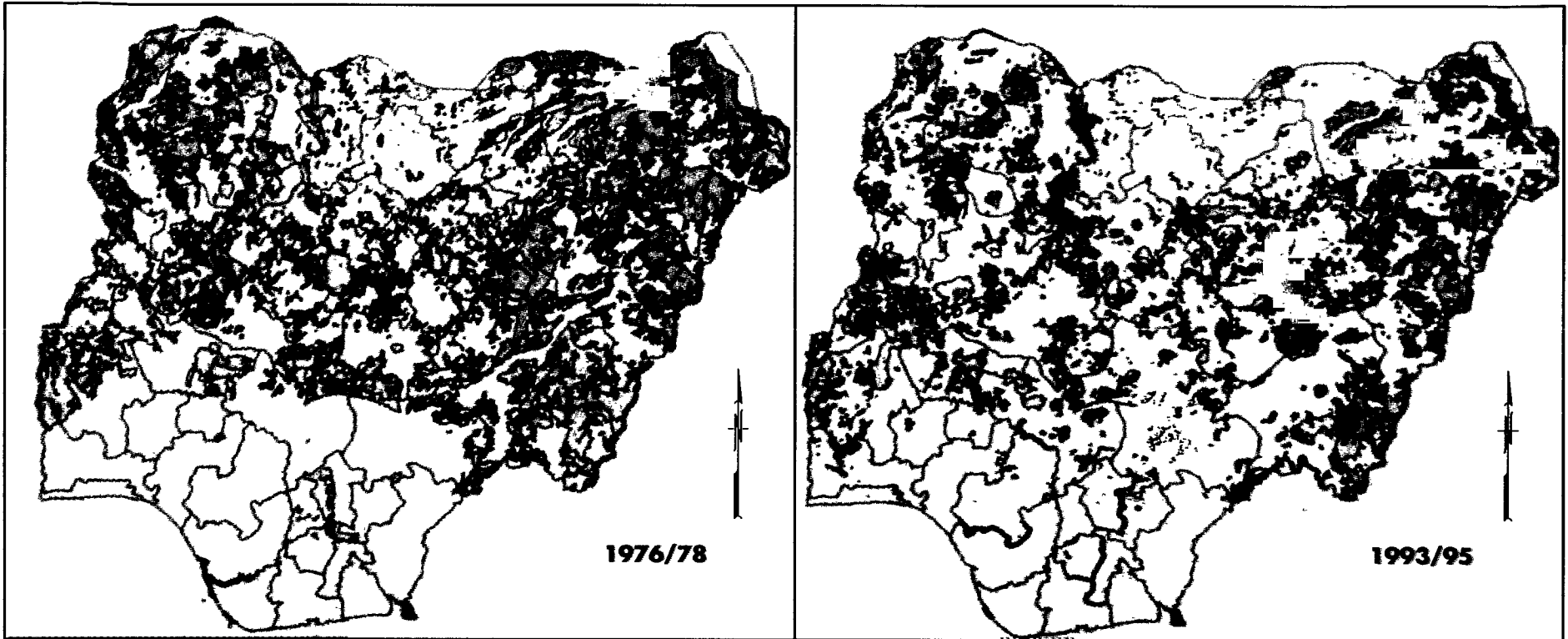|	1976/78 km²	1993/95 km²	Area of Change km²
Undisturbed Forest	25,981	12,144	-13,837
Distrubed	14,573	18,990	4,417
Riparian	7,402	5,264	-2,138
Montane Forest	6,782	6,779	-3
Guinea Savanna	151,290	61,383	-89,907
Sudan Savanna	113,660	81,494	-32,166
Sahel Savanna	12,549	11,983	-566
Grassland	1,034	7,000	5,966
Montane Grassland	1,739	3,112	1,373
Discontinuous Grassland	6,137	11,248	5,111
Mangrove Forest	9,994	9,977	-17
Forest Freshwater Swamp	16,316	14,899	-1,417
Graminold/Sedge	4,882	871	-4,011
Shrub/Sedge Freshwater Marsh	16,799	9,238	-7,561
Teak/Gmelina Plantation	628	1,154	526
Agriculture Tree Crop Plantation	630	1,541	911
Forest Plantation	997	1,573	576
Total	391,393	258,650	-132,743

LEGEND:

State Boundaries

Vegetation
- Discontinuous grassland dominated by grasses and bare surfaces
- Disturbed Forest
- Dominantly grasses with discontinuous shrubs and scattered trees
- Dominantly shrubs and dense grasses with a minor tree compoment
- Dominantly trees/woodland/shrubs with a subdominant grass component
- Forest Plantation
- Forested Freshwater Swamp
- Graminold/Sedge Freshwater Marsh
- Grassland
- Mangrove Forest
- Montane Forest
- Montane Grassland
- Riparian Forest
- Shrub/Sedge/Graminold Freshwater Marsh/Swamp
- Teak/Gmelina Plantation
- Undisturbed Forest
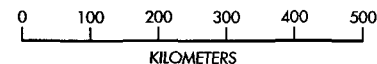
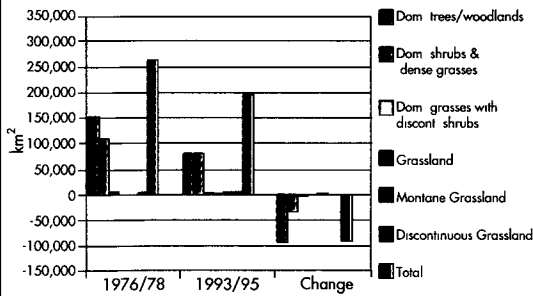0   100   200   300   400   500

KILOMETERS

IBRD 32141

Status of Savanna Vegetation

1976/78

1993/95

SAVANNA CHANGES

350,000
300,000
250,000
200,000
150,000
km² 100,000
50,000
0
-50,000
-100,000
-150,000

1976/78 1993/95 Change

■ Dom trees/woodlands
■ Dom shrubs & dense grasses
□ Dom grasses with discont shrubs
■ Grassland
■ Montane Grassland
■ Discontinuous Grassland
▨ Total

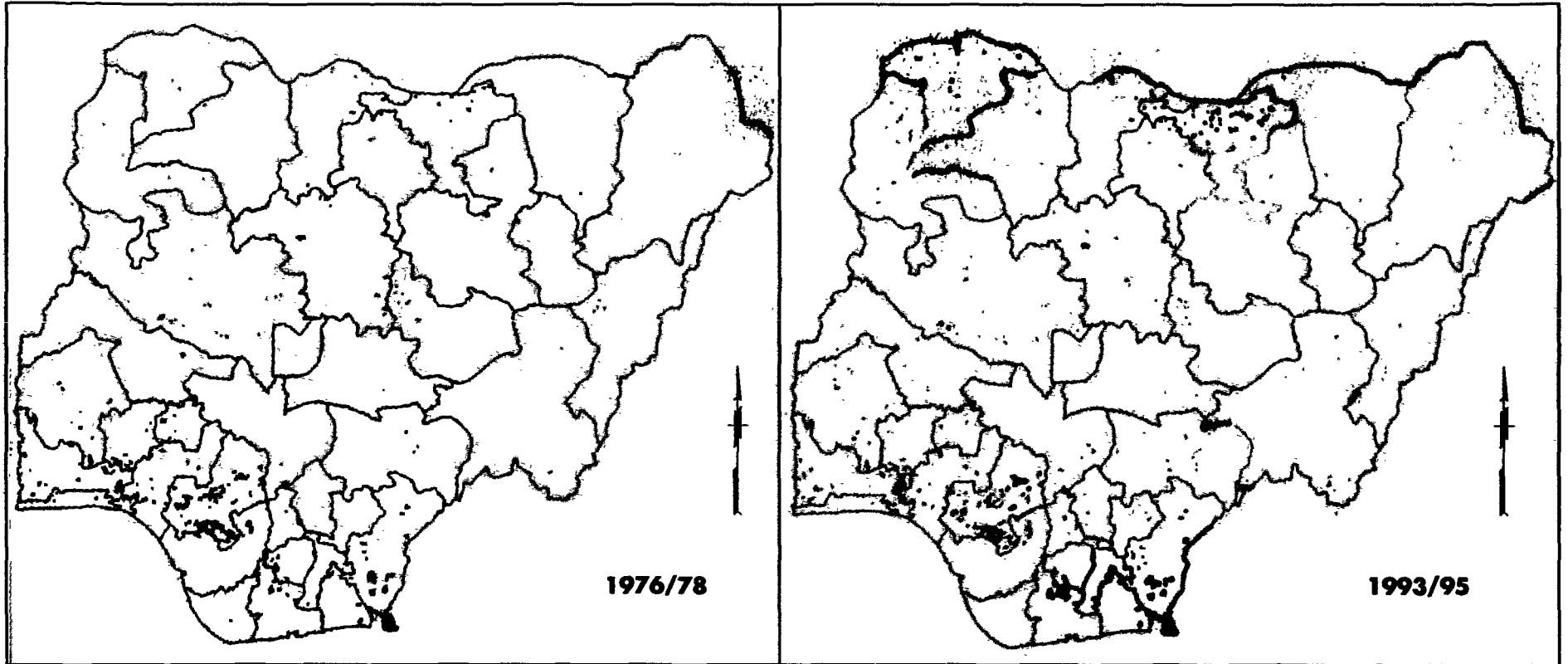|	1976/78 km²	%	1993/95 km²	%	Area of Change km²	%
Dom trees/woodlands	151,293	16.6	81,386	9	-89,907	-7.5
Dom. shrubs & dense grasses	113,660	12.5	81,694	9	-32,186	-3.5
Dom. grasses with discont. shrubs	12,649	1.4	11,983	1.3	-566	-0.1
Grassland	1,034	0.1	7,989	0.9	6,955	-.6
Montane Grassland	1,739	0.2	3,112	0.3	1,373	0.1
Discontinuous Grassland	6,137	07	11,246	1.2	5,111	0.5
Total	266,632	31 5	197,412	21.7	-89,220	-9.8

LEGEND:

☐ State Boundaries

Savanna

■ Discontinuous grassland dominated by grasses and bare surfaces
■ Dominantly grasses with discontinuous shrubs and scattered trees
■ Dominantly shrubs and dense grasses with a minor tree component
▨ Dominantly trees/woodlands/shrubs with a subdominant grass component Grassland
■ Montane grassland

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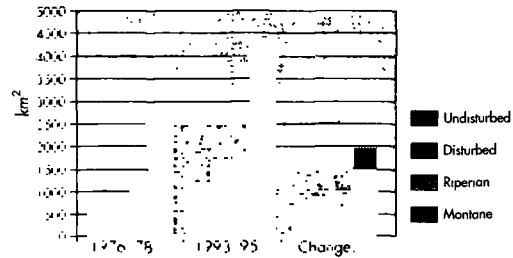
0 100 200 300 400 500

KILOMETERS
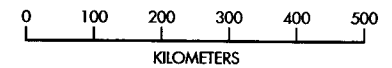
Status of Plantations in Nigeria

1976/78

1993/95

PLANTATIONS ESTABLISHMENT

- Undisturbed
- Disturbed
- Riperian
- Montane

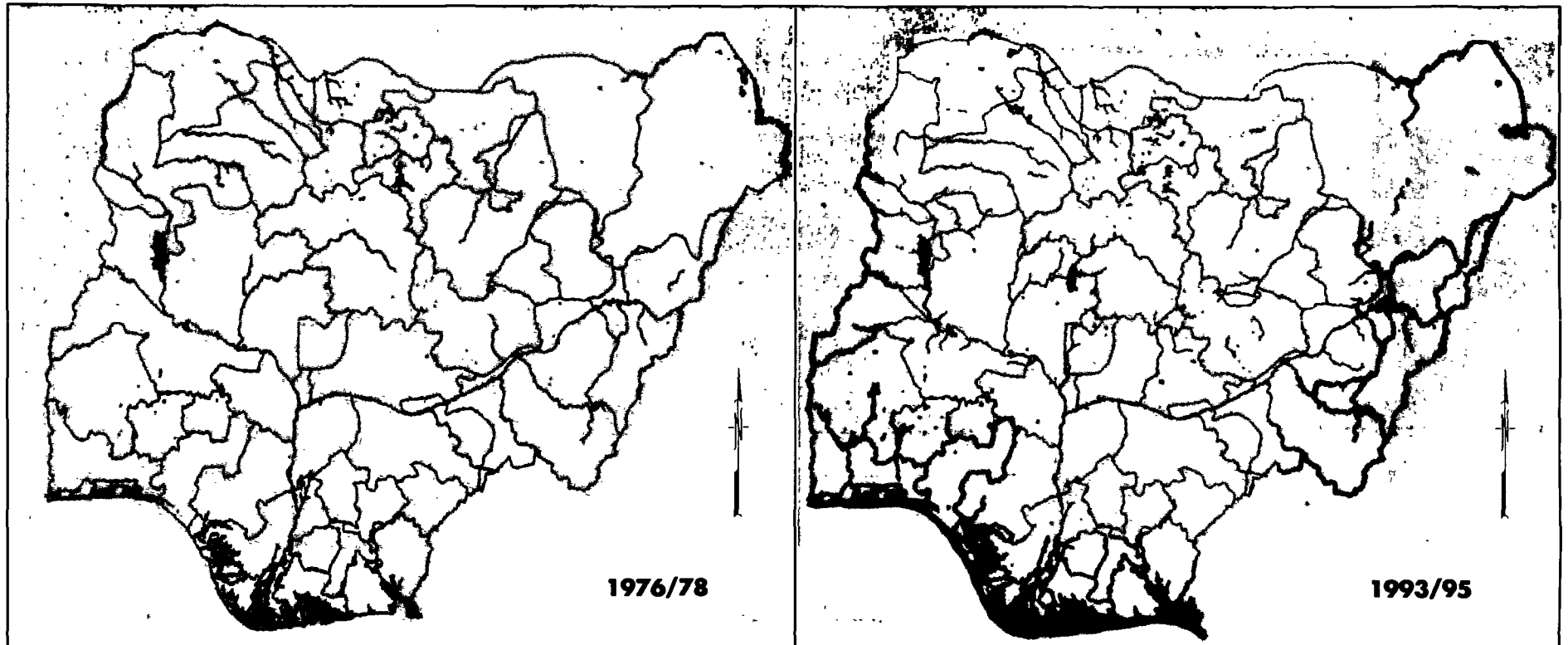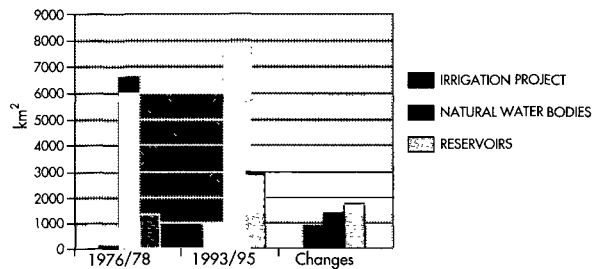|	1976/78 km²	%	1993/95 km²	%	Area of Change km²	%
Teak/Gmelina	628	0.1	1156	0.1	528	
Agric. Tree Crop Plantation	830	0.1	1,641	0.2	811	0.1
Forest Plantation	997	0.1	1,573	0.2	576	0.1
Total	2,455	0.3	4,370	0.5	1,915	0.1

LEGEND:

☐ State Boundaries

Plantations
- Agricultural Tree Crop Plantation
- Forest Plantation
- Teak/Gmelina Plantation
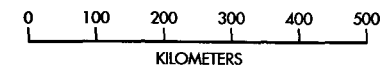
OCTOBER 2002

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KILOMETERS

IBRD 32143

Status of Waterbodies and Irrigation Projects

1976/78

1993/95

CHANGES IN WATER BODIES AND IRRIGATION PROJECTS

- ■ IRRIGATION PROJECT
- ■ NATURAL WATER BODIES
- ▨ RESERVOIRS

	1976/78		1993/95		Area of Change	
	km²	%	km²	%	km²	%
Irrigation Project	147	0.1	988	0 1	841	
Natural water bodies	6,591	0 7	7,851	0.9	1,280	0 2
Reservoir	1,327	0.2	2,888	0 3	1,561	0 1
Total	7,918	0 9	10,739	1 2	1,821	0 3

LEGEND:
▢ State Boundaries
Waterbodies 93.shp
■ Irrigation Project
■ Natural Waterbodies. Ocean, River, Lake
■ Reservoir
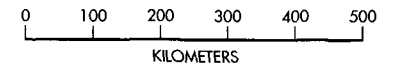
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KILOMETERS

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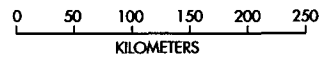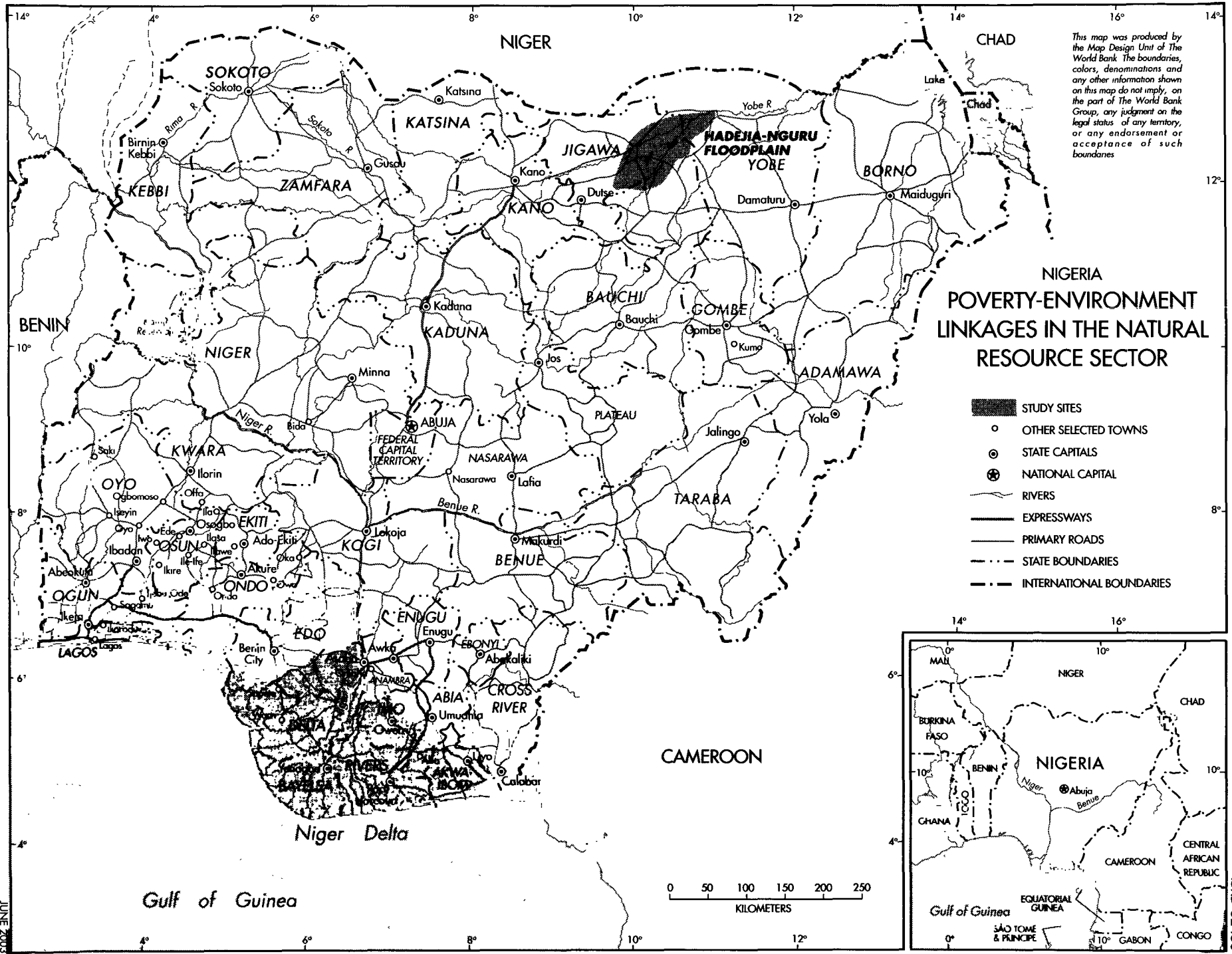
NIGER

CHAD

Lake
Chad

SOKOTO
Sokoto

Katsina

Yobe R

KATSINA

JIGAWA

HADEJIA-NGURU
FLOODPLAIN
YOBE

BORNO

Birnin
Kebbi

Gusau

Kano

Dutse

Damaturu

Maiduguri

KEBBI

ZAMFARA

KANO

BENIN

NIGER

Kaduna

BAUCHI

Bauchi

GOMBE

Gombe

Kumo

Minna

KADUNA

Jos

ADAMAWA

PLATEAU

ABUJA
FEDERAL
CAPITAL
TERRITORY

Yola

Jalingo

Bida

Saki

KWARA

Ilorin

Offa

Ila

NASARAWA

Nasarawa   Lafia

TARABA

OYO
Ogbomoso
Iseyin
Oyo   Ede   Osogbo   EKITI
Iwo   OSUN   Ilasa   Ado-Ekiti
Ibadan   Ile-Ife   Iluwe   Oka
Abeokuta   Ikire   Akure
 ONDO
OGUN   Ijebu Ode   Ore

Benue R.

Lokoja

KOGI

Makurdi

BENUE

Ikeja   Sagamu
LAGOS   Lagos

EDO

Benin
City

ENUGU
Enugu
Awka
ANAMBRA
ABIA
Umuahia

EBONYI
Abakaliki

CROSS
RIVER

CAMEROON

Owerri

RIVERS
BAYELSA   AKWA
IBOM   Uyo
Calabar

Niger Delta

Gulf of Guinea

NIGERIA

POVERTY-ENVIRONMENT
LINKAGES IN THE NATURAL
RESOURCE SECTOR

STUDY SITES
○   OTHER SELECTED TOWNS
◉   STATE CAPITALS
⊛   NATIONAL CAPITAL
RIVERS
EXPRESSWAYS
PRIMARY ROADS
STATE BOUNDARIES
INTERNATIONAL BOUNDARIES

0   50   100   150   200   250
KILOMETERS

MALI   NIGER   CHAD

BURKINA
FASO

BENIN   NIGERIA

GHANA   Abuja

Niger
Benue

CENTRAL
AFRICAN
REPUBLIC

CAMEROON

Gulf of Guinea   EQUATORIAL
GUINEA

SÃO TOMÉ
& PRÍNCIPE   GABON   CONGO