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une Utilisation durable des Ressources Sauvages au Sénégal

UDRSS/VALEURS

The Economic Value of Wild Resources in Senegal:

A preliminary evaluation of non-timber forest
products, game, and freshwater fisheries

DISCUSSION DRAFT

Joshua BISHOP¹ and Pedro-Andres GARZON¹
With

Oumou K. LY², Alioune DIENG³, Cheikh Mbacké NDIONE³, Oumar DIOP³, Astou SENE³, M.
NIANG³, Mouhamadou L. MBAYE³, Moustapha DEME⁴, Hamet Diaw DIADHIOU⁴, Djiby
THIAM⁴, Vaque NDIAYE⁴, Moustapha KEBE⁴, Bara GUEYE⁵, Mansour TALL⁵, Fatou NDIAYE⁵,
Mouhammadou F. MBENGUE⁵, Mouhamadou L. SECK⁵, Sokhna D. THIAM⁵, Seynabou DIOUF
NIASSE⁶, Bocar O. SALL⁷, Cheikh LY⁷, D. COULIBALY⁷, I. LY⁷



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¹ International Institute for Environment and Development (IIED).

² World Conservation Union (IUCN), Sénégal Mission.

³ Bureau d'analyse Macro-économique (BAME), Institut Sénégalais de Recherches Agricoles (ISRA).

⁴ Centre de Recherche Océanographique de Dakar-Thiaroye (CRODT), Institut Sénégalais de Recherches Agricoles (ISRA).

⁵ IIED Sahel.

⁶ Institut des Sciences de l'Environnement, U. Cheikh Anta Diop.

⁷ Consultants.

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Summary

The contribution of wild plants and animals to human welfare is widely appreciated but not routinely measured. Reliable and up-to-date information on the economic importance of wild resources is needed to ensure that development policies and investments take account of the full costs and benefits of alternative land uses. This report presents a summary of findings of recent research on the value of non-timber forest products, game, and freshwater fisheries in Senegal, West Africa. The research is based on new data gathered from producers, traders, and consumers of wild plant and animal products.

Preliminary results indicate that non-timber wild plants, game, and freshwater fish are mainly produced for sale in the regions surveyed, with a small proportion destined for home consumption. The economic importance of wild resources varies significantly from one region to another, reflecting differences in natural endowments as well as consumer demand. Wild plants and game appear to be most important to the poorest households, contributing up to 50% of their annual cash income.

Estimates of total economic value added in the production and distribution of non-timber forest products (excluding game) suggest that about half accrues to primary producers, mainly in the form of payments to labour. Intermediaries likewise account for a large share of value added, with retailers generating the smallest portion and thus earning the lowest profits, on a per kilo basis. However, when differences in operating costs and average turnover are taken into account, intermediaries are seen to earn the largest profits from the trade in Non-Timber Forest Products (NTFPs).

The research suggests that a full accounting of the harvest of NTFPs in two major producing regions in Senegal would add *at least* FCFA 1.4 billion per annum (US\$ 2 million) to national income. This figure reflects only the value added at producer level, based on the available data. Given that primary producers typically receive about 50% of the final market value of wild products, we can estimate the annual value added in the entire supply chain at between FCFA 1.6 and 3.1 billion (US\$ 2.3 to 4.3 million), depending on the share of output destined for higher value urban markets. Further extrapolation from the two regions surveyed to the rest of the country, based on alternative assumptions, yields an estimated annual value added ranging from FCFA 3.5 to 11.1 billion, with a median estimate of about 4.5 billion (US\$ 6.3 million). The latter figure is equivalent to about 14% of the recorded value added in the forest sector in the year 2000, which excludes most NTFPs.

These estimates do *not* include the economic value of fuelwood, charcoal and building materials derived from wild plant resources, which are equally significant but largely accounted for in national economic statistics (FCFA 31.6 billion in 2000). Additional value

would need to be included to account for illegal hunting, while value added from sport hunting, wildlife-based tourism and live animal exports is already recorded and generates a further FCFA 1 billion per year.

The economic contribution of freshwater fisheries in two of three major fishing areas surveyed was estimated at FCFA 9.2 billion per year. This represents value added from production through to wholesale markets but excludes value added in retail distribution. Adding home consumption and estimated output in other regions is expected to increase the total (wholesale) value added to between FCFA 10.2 billion and 14 billion (US\$ 14.5 to 19.6 million). This is equivalent to 19-26% of reported value added in the marine fisheries sector in Senegal in 2000 (FCFA 54.7 billion).

Annual value added from all non-timber wild plants, animals and freshwater fisheries in Senegal – currently excluded from the national accounts – is thus conservatively estimated at no less than FCFA 14 billion and possibly as much as 25 billion (US\$ 19 to 35 million per annum).

The results of the research demonstrate the economic significance of wild resources in Senegal. They also underscore the need to ensure the sustainable management of wild plants and animals for the benefit of those who depend upon them. As the government of Senegal pursues its long-term strategy for poverty reduction, it is essential that the full economic contribution of wild resources is taken into account.

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1 Introduction

The amount of income derived from wild resources is not well documented.

Dependency on wild plants and animals is obvious for indigenous communities that do not cultivate crops or raise livestock. More generally, non-timber forest products (NTFPs) and other freely available wild materials are used in most rural communities throughout the developing world, and in some cases in urban areas. Edible wild plants and animals are often important as seasonal supplements when cultivated food is in short supply (e.g. towards the end of the growing season), as dietary supplements all year round, and as emergency supplies during wars and famines.

Wild resources make a significant contribution to rural livelihoods and to the national economies of many countries. However, the magnitude of the income derived from wild resources and particularly NTFPs is not well known, due to a lack of systematic and rigorous data collection at country level (FAO 2000). Typically only resources that are traded in markets are counted, and not even all of these. Home consumption and illicit trade in wild products are often invisible to policy-makers, especially where such products are of greater importance to the poor or to marginalized groups. As a result, the underlying resources may be ignored in official land use planning and in large-scale investment projects.

Several recent studies around the world have estimated the value of forests and other wild lands, in terms of the actual or potential harvest of naturally occurring plants and animals. However, general conclusions are difficult to draw. The evaluation methods used are not always consistent, resulting in estimates that cannot easily be compared. In many cases values are presented without deducting extraction cost, inflating the results. Few studies allow for spatial differences in the availability of NTFPs, or limits to demand, when results from small plots are extrapolated over larger areas.

Despite these difficulties, Pearce and Pearce (2001) attempt to synthesize the results of recent studies, concluding that the value of NTFPs lies in the range of 1-100 USD per hectare, with high values the exception. Kramer, Sharma and Munasinghe (1995) estimated an appropriate level of compensation for rural communities in Madagascar that depend on a forested area destined for strict conservation. The latter authors estimated that 40% of the real income of local communities was derived from wild resources. Cavendish (1999) likewise estimated the value of goods from the wild (i.e. consumption goods, energy sources, output for sale and construction materials) used by rural communities in Zimbabwe, concluding that such goods made up about 37% of real income. Similarly, for three states in India, Bahuguna (2000) found that forest products accounted for 37-76% of the real income of rural communities. Energy inputs (fuelwood and fodder) were most important, representing around 30% of total income. Such studies indicate that wild resources can account for a significant share of household income in some rural areas of the developing world.

In a similar vein, this report contains preliminary estimates of the value of selected wild resources in Senegal. It is based on new surveys conducted between 1998 and 2001 by various researchers under the supervision of IUCN. The research focused on freshwater fisheries, non-timber forest products and game. This report includes:

- a brief description of the VALEURS project;
- an overview of the research objectives and methods;
- a summary and discussion of the major findings to-date;
- preliminary assessment of policy implications; and
- identification of priorities for further research.
- annexes with supplementary tables and a description of the database

The aim of this report is to provide an initial assessment of the production values, costs, and relative economic importance of wild resources in different settings and to different groups in Senegal. It is hoped that the information provided will contribute to future policy-making and investment planning, specifically with respect to potential opportunities and constraints for improving the productivity and sustainability of wild resource use, and their contribution to poverty reduction in Senegal.

2 Background and Description of the VALEURS Project

Valuation provides essential information for wild resource management.

The original concept for a project focusing on the economics of sustainable use of wild resources in Senegal was developed by the IUCN (World Conservation Union) Senegal Office, with support from the IUCN Sustainable Use Initiative, IIED and other partners in 1993-94. The project responded to growing interest in the economic significance of the natural environment, together with increasing concern for the sustainability of extractive uses of natural resources. These essentially conservationist aims were coupled with an urgent sense of the need to reduce poverty on a sustainable basis, particularly in rural areas of sub-Saharan Africa, through improved management and more productive and equitable uses of natural resources.

The underlying rationale for the approach adopted in this project was the recognition that decision-making regarding the use of natural resources is largely determined by economic considerations. However, the economic contribution of wild resources is often overlooked, partly due to lack of reliable information on their value. As a result, insufficient attention is paid to wild resources in decisions regarding the use of land and water, infrastructure development and employment creation. Economic valuation is thus a first step in improving the management of wild resources.

2.1 Project Development

The VALEURS project aims to enhance the sustainable use of wild species by rural people in Senegal.

The VALEURS project (*VALorisation des Espèces pour une Utilisation durable des Ressources Sauvages au Sénégal*) aims to enhance the sustainable use of wild species by rural people through appropriate national policies, planning and investment in Senegal. The overall objectives of the project are as follows:

- To assess the dependence of rural populations on wild harvests and the economic value of wild resources relative to other activities and resources in Senegal;
- To demonstrate methods to enhance the sustainability of wild resources for the benefit of rural people in Senegal;
- To identify development policy options for the sustainable management of wild resources to government, donors, non-government organizations, communities and the private sector in Senegal; and
- To communicate the lessons learned in Senegal and other West African countries.

The VALEURS project is coordinated by the Senegal Office of IUCN, which was granted funding by the Netherlands Ministry for Development Cooperation for an initial phase of activities starting in 1998. The first phase of the project (1998-2001) focused on gathering baseline data on the uses and values of selected wild resources. This is expected to be followed by a second phase over a three year period (2002-04) to include policy analysis and advocacy, pilot demonstration programmes in rural areas, development and promotion of permanent monitoring systems for wild resources, additional research on resource values, and communications.

2.2 Phase 1 Activities

Phase 1 of VALEURS sought to assess the economic value of selected wild resource in Senegal.

The primary aim of the first phase of the VALEURS project was to assess the importance of selected wild resources in the household, community and national economy of Senegal. A secondary objective was to strengthen the capacity of local research institutions in the area of wild resources valuation and the economics of biodiversity. To achieve these aims, IUCN established collaborative partnerships with a number of Senegalese and international institutions.

The lead partner for research on wild resource values was the Agricultural Research Institute of Senegal (ISRA), which was selected on the basis of its existing capacity in economics and its network of field offices (“Provincial Research Units”) around the country. Two ISRA units took part in the research: the Bureau for Macroeconomic Analysis (BAME), which focused on terrestrial resources, and the Oceanographic Research Center at Dakar-Thiaroye (CRODT), which undertook the research on continental (freshwater) fisheries. Field surveys by ISRA to collect the data needed for wild resource valuation started in 1999 and continued throughout 2000.

Several other institutions and national agencies were called upon as project partners, including the Center for Ecological Monitoring (CSE), the Directorate of Water and Forests, Hunting and Soil Conservation (DEFCCS), the National Parks Directorate (DPN), among others. They are represented in a Project Implementation Committee (PIC), which also includes specialists in relevant disciplines (i.e. ecology, economics, social sciences, resource management, policy, information management, etc). The VALEURS project also enlisted the services of the Sustainable Use Initiative of IUCN and IIED for training and technical assistance during Phase 1.

2.3 Research Focus

Research by the VALEURS project focused on the value of non-timber forest products, game and freshwater fisheries.

Previous or on-going studies and existing resource monitoring systems in Senegal already pay attention to several important wild products, notably fuelwood, charcoal, timber and marine fisheries. In order to supplement existing information, and enrich understanding of the full value of wild resources, the VALEURS project during its first phase focused on three under-researched areas of wild resource use in Senegal: namely non-timber forest products (including by-products of timber species), game and related by-products, and continental (freshwater) fisheries including major river estuaries (Table 2.1). In each case the research focused on major regions of supply and demand. While the findings of the project thus relate to a relatively narrow group of resources in specific regional contexts, many of the conclusions are likely to be relevant to a broader range of natural resources and regions in Senegal.

Table 2.1 Wild resources considered by the VALEURS project

Wild plants & related products*		Game & other animals	Continental (freshwater) fisheries
Non-timber forest products	Non-timber products from timber species		
Grasses, shrubs, tubers, honey, etc.	Leaves, fruits, nuts, roots, bark, resin, etc.	Reptiles, rodents, birds, warthogs, duikers etc.	Fish, freshwater invertebrates

* Note that the products considered by the study are mainly edible or medicinal and *exclude* fuel, fodder and building materials derived from wild plant materials.

3 Overview of Research Methods

Quantitative surveys focused on major supply regions, wholesale and retail markets, while qualitative discussions with consumers covered a range of end users. Additional information was obtained through key informant interviews and review of secondary literature.

This section outlines the approach adopted by ISRA and other researchers involved in VALEURS, in broad terms. The procedure and methods used by ISRA (BAME and CRODT) to gather information on production and distribution (and in some cases on consumption) are described for each resource complex in turn. This is followed by an overview of the method used by IIED (Sahel office) to gather qualitative information on the determinants of demand for a range of wild resources. Additional details of the methods used are provided in section 4, which discusses the findings of the research.

3.1 Terrestrial Resources

The procedure for terrestrial resources involved two distinct phases (CAF49). Firstly, several regions of the country were selected on the basis of their reputation as major sources of supply of wild products. These included all departments of the eastern and southeastern administrative regions of Tambacounda (Tamba) and Kolda, focusing on Rural Communities⁸ (RCs) located at the periphery of the Niokolo Koba National Park (PNNK). Tamba and Kolda are among the least urbanized regions of Senegal, accounting for about 10% of the national population or 20% of the country's rural population (MEF 2001a). Kolda is one of the poorest regions in Senegal.

Certain RCs in Saint-Louis and Louga Regions were also surveyed. The latter RCs lie within the dry pastoral zone (*Zone Sylvo-Pastorale* or ZSP), in the north of Senegal, where both the composition and density of wild species is markedly different. Another important difference between the ZSP and Tamba and Kolda Regions is the relative importance of livestock in household production strategies and resulting patterns of human migration. Thus in Tambacounda and Kolda most households own no more than a couple of animals, while water and forage are sufficiently abundant all year round so that livestock may be kept near the homestead until slaughtered or sold. In contrast, households in the ZSP possess around ten animals each, on average, including cattle, sheep and other small stock (MEF 2001a). Moreover, low rainfall and a long dry season in the ZSP forces households to drive their animals over large areas in search of water and forage, leading many to adopt a semi-nomadic lifestyle. This in turn implies very different access to both wild resources and market outlets, compared to rural households in the South of Senegal.

Preliminary visits ("participatory diagnostics") were undertaken in the chosen areas to establish which RCs were of interest relative to the wild resources under study and in view of planned sustainable use demonstration project. The aim of these visits was to document the essential features of each region with respect to its population, the types of resources encountered, and the local and national institutions and legislation concerning wild terrestrial resources.

Once the RCs were chosen, the second stage involved detailed questionnaire surveys to determine the socio-economic characteristics of rural households generally and of wild resource producers specifically, as well as the volumes and costs involved, and the economic values generated. The samples in each case were drawn from existing survey data obtained from the Division of Agricultural Statistics (DISA), which had, in 1997, updated the results of the 1988 National Agricultural Census.⁹

The number of households/collectors to be surveyed was calculated in such a way as to ensure that any subsequent extrapolation would be valid within a 95% confidence interval (CAF49). Note however that the survey favoured areas that are relatively rich in wild resources. Moreover, it was not possible to use random sampling in the case of traditional hunting, due to the reluctance of most hunters to participate (see section 4.2). The location and size of the resulting samples are shown in Table 3.1.

⁸ A Rural Community is an administrative division comprising several villages.

⁹ This was a comprehensive survey of rural households in all regions, except for parts of Casamance and Kolda regions where civil unrest and poor security prevented the census from being completed.

Table 3.1 Sample sizes for terrestrial resources (NTFPs and game)

Region	Departments	Rural households	NTFP collectors	Bush meat consumers	Hunters
Tambacounda	Bakel Kédougou Tamba Total	614	93 186 <u>175</u> 454	0 160 <u>48</u> 208	57 (both regions)
Kolda	Kolda Vélingara Total	271	219 <u>47</u> 266	64 <u>0</u> 64	
Zone Sylvo-Pastorale	Various CR Total	321	445	0	0
Total		1,206	1,165	272	57

Source: Based on data in CAF 6525 (pg. 3) and CAF 6541 (pp. 9-10).

In addition to the household (producer) surveys, ISRA/BAME conducted surveys in several markets where wild products are. These included permanent markets in large cities as well as periodic (weekly) markets in selected RCs in Kolda, Tambacounda and the ZSP. Market surveys gathered information from both buyers and sellers, including itinerant traders as well as local retailers. Data was collected on the volume, quality and prices of wild products on display. These visits enabled ISRA/BAME to identify the role of different actors in the supply chain, to evaluate their costs and to estimate value added in the distribution of wild products.¹⁰

3.2 Freshwater (continental) Fisheries

Data on inland and estuary fisheries were collected from representative landing sites in the Senegal River, Sine-Saloum and Casamance estuaries (Table 3.2).¹¹ This was followed by extrapolation of the survey results (CAFs 41, 43 and 44). As in the case of terrestrial resources, the research proceeded in stages:

- Preliminary surveys and review of existing information on the areas targeted;
- Comprehensive surveys of “fishing units” in both the dry and rainy seasons, to control for seasonal effects; followed by
- Daily surveys of catches, fishing effort and prices in selected major landing centres and every fortnight in secondary landing places.

¹⁰ Several urban markets were visited in Dakar and in the regions of Kaolack, Diourbel, Thiès, Kolda and Tambacounda, as well as the agro-ecological Zone Sylvo-Pastorale. For a complete list of the markets visited see Annex A7.

¹¹ Data from the Casamance region has been collected, coded and verified, but is not available and had not been analysed as of the production of this report.

Table 3.2 Continental fisheries: principal and secondary survey sites

Region	Principal sites	Secondary sites
Sine-Saloum	Ndangane Foundiougne Missirah Sokone	Marlody About Bétenty Bambougar
Senegal River	Saint-Louis Richard-Toll Podor	Dakar Bango Nder Guiya
Casamance (preliminary study)	Ziguinchor Kafountine Tendouck Ourong	

Source: CAF44

In addition, more focused surveys and interviews were conducted with key actors in the chain of production, transformation and distribution. Note however that detailed surveys did not extend beyond the point of purchase by wholesalers, hence no data are available for estimating value added in the distribution of freshwater fish products to end use markets. Finally, a preliminary survey of gastropod (mollusc) harvesting was also conducted in the Casamance region.

Most of the landing sites listed in Table 3.2 were monitored for twelve months from November 1999 to October 2000, except for the secondary sites of the Sine-Saloum region, which were monitored between April and December 2000.

3.3 Qualitative Research on Demand for Wild Resources

The surveys carried out by ISRA focus on the harvesting and distribution of wild products, with less attention paid to consumption. In order to obtain additional information on consumer preferences, a qualitative study of the determinants of demand was undertaken by IIED (Sahel office) in mid-2001 (CAF6545). The aim of the latter study was to establish the socio-cultural and socio-economic factors and individual characteristics that shape consumer preferences and that determine popular (shared) perceptions of wild resource uses and values.

To achieve this objective, 16 focus groups were assembled in seven out of ten major regions of the country (Box 3.1). The groups included residents of wild-resource-rich and resource-poor areas, women, men and youth. Additionally, ten interviews were conducted with individuals involved in the trade in wild resources.

Box 3.1 The focus group technique

This is a qualitative research method for investigating social questions, which consists of gathering a representative number of groups, each comprising six to twelve (6-12) socio-economically homogeneous people. The objective is to open a debate following a guide, and thus to collect and analyse the opinions expressed by homogeneous individuals.

Source: Simard, G. 1989. *La méthode des focus group*. Mondia: Laval.

4 Research Findings

This section summarizes the results of the research, focusing on the most robust and salient findings. Where appropriate, comments are provided concerning the reliability of the data, as well as the potential for further analysis using the existing database. Each resource is discussed in turn, starting with non-timber forest products (mainly plants), then game and related animal by-products, and finally continental fisheries. Available data on consumer preferences are included for each resource complex.

4.1 Non-timber Forest Products

As described above, preliminary field visits were undertaken by ISRA/BAME to provide an overview of the management and use of non-timber forest products (NTFPs) in three resource-rich areas: Kolda Region, Tambacounda Region, and the “Sylvo-pastoral zone” (ZSP) of Louga and Saint-Louis Regions (CAF49). This was followed by more detailed surveys in the same regions, including baseline surveys to gather basic socio-economic data on rural households, as well as repeat visits to producers in order to capture seasonal variation in NTFP use.

Thus in Kolda Region, an initial survey of 271 household heads in eleven Rural Communities was followed by repeat surveys of 265 NTFP harvesters in six RCs. In Tambacounda Region, the initial survey covered 614 households while repeat visits concerned 454 NTFP harvesters. The same procedure was used in the ZSP, with baseline data collected first from 321 households, followed by repeat visits to 445 NTFP collectors. In each region, the two survey samples were drawn from the same population. However, they differed in that the latter sample included dependants as well as household heads.¹² The data presented below are mainly drawn from the latter, repeat surveys of NTFP collectors.

4.1.1 Profile of NTFP collectors

There is a gender division of labour and specialisation by age for some NTFPs. However, in most respects NTFP collectors are like the population as a whole.

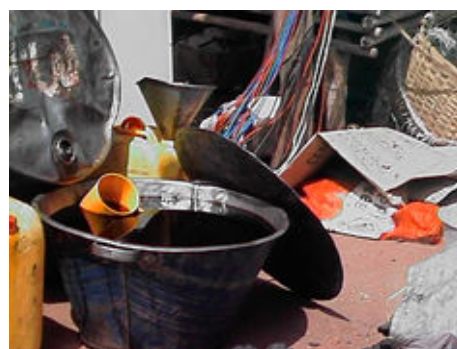
In Kolda Region, NTFP collectors were almost all men (90%) and more than half (55%) were over 40 years old (CAF6539). 72% of collectors were members of the Peulh ethnic group, followed by Ouolof (18%). More than half had attended Quoranic school as children (56%) compared to just 6% having attended primary school and 17% having attended courses as adults in reading and writing (*alphabétisation*).

In Tambacounda Region, 23% of the harvesters interviewed were female and 10% were children. 70 % of those interviewed were over 30 years of age (CAF6521). In terms of ethnic affiliation, the population was 46 % Peulh, followed by Mandingues (29%) and Dialonké (14%). About a quarter (26%) of those interviewed had attended Quoranic school, compared to 12 % attending primary school and another 12% reporting adult training in reading and writing (*alphabétisation*).

¹² Unfortunately, the repeat surveys of NTFP producers did not include certain questions posed in the initial baseline surveys, notably with respect to household income and expenditure. Hence it is not possible to assess the importance of wild resources to households in different income groups.

Finally, collectors in the ZSP reported the lowest levels of education (CAF6535). Thus 60% reported no education at all, although 20% had attended adult literacy courses. Agriculture is the main activity (43%) in the ZSP, followed by animal husbandry (39%). The Peulh are again the majority ethnic group (75%), followed by the Ouolof.

At first glance, no major differences are apparent between NTFP collectors and the general population in each region (CAF6529, 6537 and 6539). Nevertheless, there is some evidence of a gender division of labour for different products and also some specialisation by age (see Tables 4.3 and 4.4 below). Similarly, in the ZSP, men are more likely to engage in the production of *gomme arabique* while women are more likely to report gathering fruits such as *jujube*. Specialisation at different stages of production is also apparent, as seen by the example of palm oil in Kolda, where men gather the fruits and women process them into oil. This kind of division of labour is also observed when products are commercialised. Honey is generally sold by men, whereas *Mbepp* and palm oil tend to be sold by women.



Palm Oil

NTFP production costs, transformation and conservation.

NTFPs are mainly gathered on foot, within a single day and using simple tools. Cost-effective techniques for more efficient NTFP extraction and conservation are needed as well as improved resource management systems.

About half of those interviewed (46%) in Kolda Region reported harvesting NTFPs *after* the end of the agricultural season, at which point the activity becomes their main occupation (CAF6539). There is thus some evidence of competition for labour resources between NTFPs and agriculture. Note however that for a majority of products, maturation and harvest takes place during the dry season, between December and June (two exceptions are *leung* and *toll*).

The costs of gathering NTFPs appear to be determined by the quantity that can be comfortably collected and carried home on one's head during the course of a single return trip. 72% of those interviewed reach gathering places by foot, indicating that NTFPs are relatively accessible (bearing in mind that few rural households in Senegal possess a motor vehicle). On average, gatherers reported spending two hours per trip to collect NTFPs and no more than half a day for 65% of them.¹³

Note however that trips can have multiple aims and outputs. For example, several different NTFPs may be collected while on the way to or from agricultural fields, or while grazing livestock. This makes it difficult to measure the time required for NTFP collection, and thus the true labour cost. Nevertheless, as a rough approximation, we

¹³ These estimates were not verified and may be understatements. Specialist NTFP collectors may spend considerably more time than the average.

assume an opportunity cost of labour of around FCFA 1000 for an 8 hour working day in rural areas, and an average headload weighing 25 kg. On this basis we estimate the mean labour cost at 10 FCFA/kg for raw material.¹⁴ If the average trip in fact lasts a full day (and assuming single-purpose trips), and if collectors are assumed to earn at least the opportunity cost of their time from the sale of raw material, we would obtain a labour cost of around 40 FCFA/kg (using the same average headload as before). These cost estimates are comparable to the range of NTFP prices reported for wild fruits, but well below some other products (see Tables 4.3 and 4.4 below). It must be stressed however that these estimates are very tentative. Moreover, they exclude the costs of any tools required as well as processing and marketing costs.

Production techniques vary according to the product but are generally rudimentary. Many of the instruments used to gather NTFPs are made by collectors themselves, while knives, machetes, axes and bamboo sticks are bought in local markets. 25% of all collected material was ultimately processed and the rest was either consumed at home or sold in its raw state. No information was collected on processing costs or labour inputs, but it is notable that no modern techniques of conservation are used. Hence the recommendation of ISRA researchers that more efficient methods for the extraction and conservation of NTFPs should be promoted together with improved management systems, using cost-effective and appropriate technologies.

4.1.2 The sustainability of NTFP harvesting

Local producers and traders report increasing scarcity of some species, but additional data is needed to assess the sustainability of plant harvests.

The lack of biological data on stocks or yields prevents any direct assessment of the sustainability of wild plant harvests, based on this study. On the other hand, some hints are given by the perceived evolution of stocks by local populations. Many expressed concern regarding the apparent decline of *Saba senegalensis*, *Adansonia digitata*, *Parkia biglobosa* and of *Tamarindus indica*.



Artificial Bee Hives

Traditional honey gathering from wild bee hives appears to be particularly destructive (CAF65415). Conventional methods typically involve the destruction of bee colonies and sometimes also the ignition of uncontrolled bushfires, resulting in unintended damage to surrounding flora and fauna.¹⁵

Interviews with NTFP traders revealed further hints of increasing resource scarcity (CAF6545). For example, one trader of medicinal plants interviewed by researchers reported that the time required for his

¹⁴ FCFA 125 per hour x 2 hours ÷ 25 kg = 10.

¹⁵ Several recent initiatives such the *Projet de Relance de l'Agriculture* (PRAP) and the *Programme de Gestion Durable et Participative des Energies Traditionnelles et de Substitution* (PRODGEDE) include activities designed to reduce these impacts (CAF65415).

suppliers to fulfil each order had increased from 2-3 days up to several weeks, due to the need to travel further to secure raw materials. Similarly, a lady involved in the wholesale trade in *Mbepp* gum in Touba complained that at least 15 days are now required to assemble a shipment, compared to five days 10 years ago.

No one factor was singled out as the over-riding cause of resource scarcity in all regions. However, 73% of respondents in Tambacounda felt that road improvements had increased pressure on wild resources, due to easier access (CAF6521). Bush fires, drought and the resulting poor regeneration of wild plants were other frequently mentioned causes of wild resource scarcity.¹⁶ In general, over-exploitation did not figure high on the list of causal factors mentioned, while villagers were divided in their assessment of the impact of population growth.

Local management of NTFPs

There is little evidence of local management or regulation of NTFP harvesting.

Little evidence of local management or regulation of NTFP harvesting was observed. In many cases traditional extraction rights that had been recognized in the past were considered obsolete and insufficient to prevent conflicts over wild resources. In fact, some conflicts were reported in communities exploiting valuable tree resins (*Mbepp* and *Arabique* gums) in the ZSP (CAF6535). It is not clear whether a relationship exists between the strength of traditional rights and the frequency of wild resource-related conflicts, although the data may permit such analysis. In any event, most respondents (~85%) expressed a preference for local management of wild resources, through their village councils, rather than rely on state agencies. This is consistent with the general policy of decentralisation adopted by the national government, although progress to date has been slow (CAF65414).

An important exception to the general lack of local resource management concerns the extraction of *Mbepp* gum (or resin), one of the most important NTFPs in Senegal. In some areas, this practice is governed under an informal system of temporary but exclusive rights to extract resin from particular trees. At the beginning of the resin-tapping period, during the dry season, trees are marked in one way or another by potential extractors as a means of claiming exclusive rights during that period. Such marks are acknowledged and respected by other resin tappers. However, because the use rights created in this way are strictly temporary there remains a risk of over-exploitation, as suggested by the use of rudimentary extraction techniques that often damage the trees being tapped.

State regulation of NTFP harvesting

Official statistics on production and trade in NTFPs do not include harvesting for home consumption, which is largely unregulated and unreported. Illegal sales are likewise uncertain but may be significant.

¹⁶ Hence the suggestion from ISRA that increased efforts should be devoted to fighting bush fires, including the creation or strengthening of local fire control committees.

Rural households are free to harvest most NTFPs (excluding game) in small amounts for domestic consumption, provided they use methods approved by the state. The harvest of NTFPs for commercial purposes, on the other hand, requires a permit issued in advance by the state forestry agency and is subject to payment of specified fees according to the type of product and the quantity harvested (Table 4.1). Permit fees are a significant proportion of market value, in most cases, suggesting that there may be strong motives for some producers to engage in illegal (unpermitted) trade.

Table 4.1 Permit fees for non-timber forest products

Product	Fee in FCFA/Kg
<i>Mbepp</i> gum (Sterculia Gum)	100 (until 1999)
<i>Gomme Arabique</i> (Arabic Gum)	50
Other gum	25
<i>Pain de Singe</i> (fruit of <i>Adansonia digitata</i>)	25
<i>Jujube</i> (fruit of <i>Zyzuphus Mauritania</i>)	25
<i>Madd</i> (fruit of <i>Saba senegalensis</i>)	25
Palm nuts	15
Palm oil	50/litre
Palm wine	80/litre
Ronier palm	75/regime
<i>Beurre de Karité</i> (Shea butter)	50/litre
Other fruits and nuts	25
Miscellaneous leaves	25
Misc. bark and roots	30
Other miscellaneous	80/litre or kg

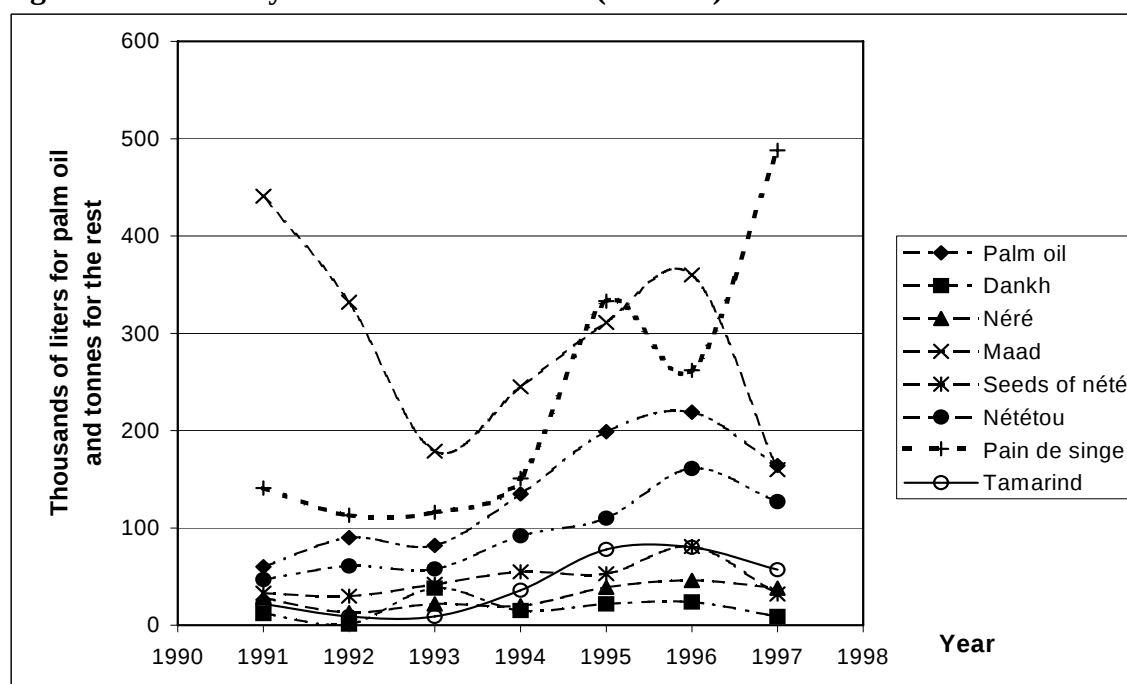
Source: various.

Data from the state forest service suggest that commercial sales of NTFPs have been increasing in recent years, although this may also reflect better enforcement of permit regulations (Figure 4.1). These data include imports but exclude illegal sales of plant products, as well as own-consumption by producers.

The dramatic rise in reported sales from 1994 could reflect a 50% devaluation of the CFA Franc in January of that year. In other words, demand for and supply of wild products may have increased in response to higher prices of imported or industrial substitutes following the devaluation. The greatest increases are for Baobab (*Pain de singe*), Palm oil, *Maad*, *Nététou* (both edible fruits), and Tamarind. Sales of *Dankh*, *Néré* and *Nété* seeds, on the other hand, changed little over the same period. Note also that sales of all products except Baobab appear to have fallen off in 1997. The latter downturn may reflect a gradual erosion of the price advantage of wild products, due to domestic price and wage inflation. This is however pure speculation, and more recent data would be needed to assess whether the downturn was permanent or temporary, and likewise whether Baobab sales continued their upward trend.

Recorded sales of many NTFPs rose dramatically during the late 1990s, with the fastest growth for Baobab fruit (Pain de singe). The 50% devaluation of the CFA Franc in 1994 may be one cause, resulting in increased competitiveness of wild products in the market place, compared to imports and industrial substitutes.

Figure 4.1 Officially recorded NTFP trade (1991-97)



Source: Adapted from Table16 in CAF6539, IREF/Kolda, 1997, p18.

4.1.3 Commercialisation of NTFPs

A significant share of NTFP production in the areas surveyed is destined for the market, with home consumption playing a secondary role in most cases.



Root Sticks: example of NTFP

The survey data suggest that NTFP collection is primarily a commercial enterprise, with home consumption playing a minor role. Data for Kolda and Tamba regions (CAF6544) indicate that for most wild products, over 75% of production is sold (see Tables 4.3 and 4.4 below). Likewise in the ZSP, the survey data suggest that a similar proportion of NTFP production is destined for sale (taking all products together).

In general home consumption is likely to be under-reported, particularly for products gathered opportunistically or by women and children. The share of NTFP production consumed at home may also be more important in resource poor regions, where

traders are less likely to come calling. Nevertheless, it is clear that NTFP production for the market is a significant activity in the regions studied, and an important source of income for rural households.

Honey and Nété are two products more likely to be consumed at home, accounting for 36% and 25% of production, respectively, in both Kolda and Tamba regions.¹⁷ In contrast, while *Soon* is hardly consumed at all by producers in Tambacounda, most of this edible fruit is consumed by producers in Kolda. A similar pattern is apparent in the case of *Tool*. Karité (Shea butter) was reported in Tambacounda Region only, and fully 47% of production was destined for home consumption. No clear relation was observed between the own-consumption rate and other variables (e.g. price, volume of production or who gathers the product). Further analysis of the survey data may reveal more insights, although additional field research is probably required to obtain a thorough understanding of the NTFP production strategies of different households.

The NTFP supply chain

The NTFP supply chain involves many different intermediaries. Primary producers (rural households) typically earn about half of total value added.

In the chain of supply from producer to final consumer of NTFPs, up to six different actors can be identified (CAF6532). Primary producers (1) who harvest and process NTFPs reside mainly in rural areas and exploit wild resources both for their own needs and for sale. Some products may be sold direct to consumers on the roadside, but more often rural people sell to local traders (2). The latter assemble the output from several producers for onward sale to itinerant merchants known as “*Bana bana*” (3). These in turn bring urban goods to weekly rural markets and likewise supply urban markets with wild products. It is normally the *Bana bana* who secure a licence to trade NTFPs from the forestry service, due to the fact that they transport products along controlled roads.

When they reach the larger towns, the *Bana bana* often rely on urban intermediaries or “*Coxeurs*” (4) who control information on demand, supply and prices. It is through these *Coxeurs* that the *Bana banas* are put in touch with NTFP wholesalers (5). The latter in turn distribute wild products to urban retailers (6) for sale to end users.¹⁸ The complete supply chain is illustrated in Figure 4.2.

To illustrate the distribution of volume and value added along the supply chain, data on quantities and prices may be used to simulate a composite wild product that is traded in average markets by typical agents.¹⁹ For the South of the country, the main destination markets are Dakar, Kaolack and Thiès. Assuming total marketed output of 3,500 kg for 10 harvesters from this region, the distribution of product would be as follows: 2,000 kg to Dakar, 800 kg to Kaolack, and 700 kg to Thiès. The implication is that the population of Dakar – which accounts for about 25% of the total population

¹⁷ The high rate of own-consumption of wild honey is confirmed in a parallel report (CAF65415).

¹⁸ Some wholesalers also engage in retail trade in NTFPs.

¹⁹ Based on information provided by 100 collectors in Tamba and Kolda Regions, 25 *Bana-banas*, 10 wholesalers from Dakar, Kaolack, Thiès, and 30 retailers.

of Senegal – consumes a disproportionate share (50-60%) of all NTFPs sold, possibly reflecting higher average incomes in the capital.

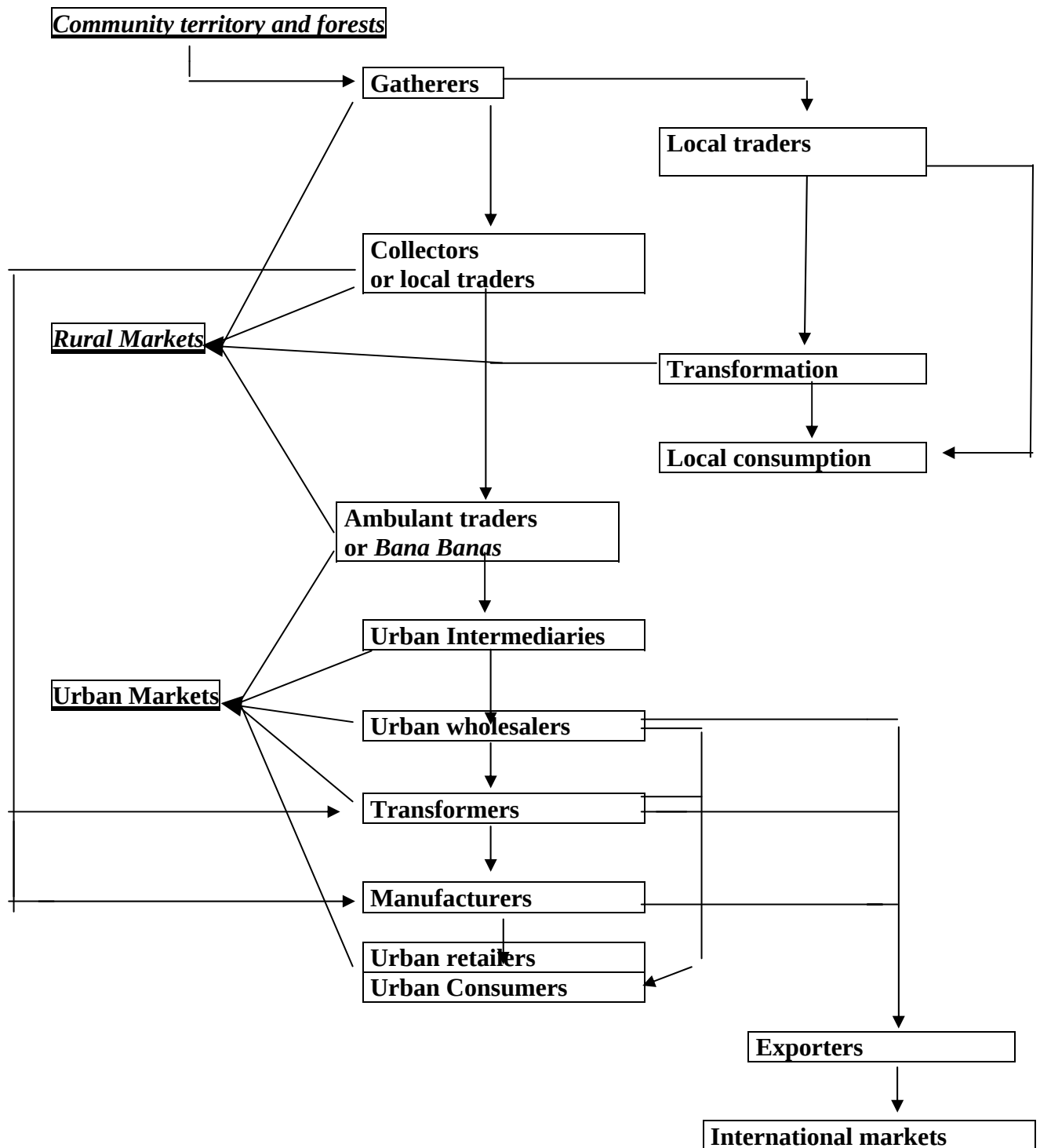
Based on this simulation we can develop an economic profile of agents involved in the NTFP supply chain (Tables 4.2a, 4.2b and 4.2c). In terms of the average volume sold, primary producers (rural households) have similar annual turnover to vendors working at the retail end of the supply chain. On the other hand, *Bana-banas* handle the largest volume of NTFPs in their trips back and forth between rural and urban areas, and they likewise report the highest total sales. In all of the regions surveyed, rural producers appear to generate between 45% and 55% of the value added per kilo of product. Value added per kg is generally lower and more variable for intermediaries and retailers working in different markets, according to the survey data (Table 4.2c).

B



Borassus Aethiopum

Figure 4.2 The supply chain for NTFPs (from CAF6532)



**Table 4.2a Annual value added along the supply chain (for a composite NTFP)
Southern Senegal-Dakar Axis**

Agents along the chain	Sales volume (kg/yr)	Sales revenue (FCFA/yr)	Value added		
			(FCFA/yr)	(FCFA/kg)	(%/kg)
Rural household	667	172,890	166,915	251	55
<i>Bana-bana</i>	18,000	5,850,000	540,000	30	6
Wholesaler	6,000	2,850,000	879,000	147	32
Retailer	1,200	630,000	37,500	31	7
Total value added				459	100
Retail price (Dakar)				525	

Source: Recalculated table from CAF6532.

**Table 4.2b Annual value added along the supply chain (for a composite NTFP)
Zone Sylvio-Pastorale - Dakar Axis**

Agents along the chain	Sales volume (kg/yr)	Sales revenue (FCFA/yr)	Value added		
			(FCFA/yr)	(FCFA/kg)	(%/kg)
Rural household	502	183,052	183,035	357	45
<i>Bana-bana</i>	7,530	5,418,000	2,358,750	313	40
Wholesaler	3,765	3,012,000	318,000	84	11
Retailer	753	666,405	24,600	24	4
Total value added				787	100
Retail price (Dakar)				885	

Source: Recalculated table from CAF6532.

Table 4.2c Shares of added values per agent, per region and weighted averages

Agents along the chain	South-Dakar	ZSP-Dakar	ZSP-Touba	South-Kaolack	South-Thiès	Weighted Average
Rural household	55	45	49.3	53.4	51.2	52.2
<i>Bana-bana</i>	6	40	27.5	3.0	1.6	12.0
Wholesaler	32	11	14.5	27.6	31.5	26.2
Retailer	7	4	8.6	16.0	15.7	9.6

Source: Recalculated table from CAF6532. For details of other supply chains from rural areas (South and ZSP) to provincial towns (Kaolack, Thiès and Touba) see Annex 1, Table A.8.

Note: Averages are weighted by volume and the assumed importance of each region. See section 4.1.5.

Another VALEURS study found that 28% of the final market value of honey accrues to producers, 25% goes to wholesalers and 47% to retailers.²⁰ Note also that for some high value products, such as *Mbepp* and *Arabique* gum, the distribution chain may be shorter and more closely controlled by major industrial buyers. The latter often pre-finance the collection of raw material, operating through the *Bana banas* and local traders (Box 4.1).

²⁰ These figures are for produced as well as wild honey (CAF65415).

Box 4.1 Wild plant exports: The case of Mbepp gum (*Sterculia setigera*)

In 1998, 347 tons of *Mbepp* gum were exported by three firms to France and the United Kingdom. The following year exports reached 409 tons. Until 1999, the gum was taxed at a rate of 100 FCFA per kilo. In the same year exports of *Mbepp* gum generated FCFA 286 million in payments to rural producers and FCFA 48 million in tax revenues. The leading exporter is the *Société d'Etude et d'Exploitation de Végétaux à Usage Pharmaceutique* (SETEXPHARM), which also sells 29 other plant products to the pharmaceutical and chemical industry. Other major exporters include the *Société de Commercialisation de la Gomme* (SOCOGOM) and the private firm *Fouad Rihayoueri* in Tambacounda Region.

Source: CAF6520.

4.1.4 Determinants of demand for NTFPs

Low-income households are less able to afford modern treatments, and are thus more reliant on traditional, plant-based remedies. For richer households, wild plant medicines may be used as a complement to modern treatments, or as a treatment of “last resort” when the latter has failed.

Research on consumer preferences for NTFPs was carried out by IIED-Sahel using qualitative methods rather than quantitative surveys (CAF6545). Focus groups and key-informant interviews were conducted with representative groups of NTFP traders and consumers in both urban and rural settings. The researchers dealt with the use of wild plants for food and for medicinal purposes separately, but their findings are presented here as a whole, mirroring the section on production.

Wild plants are mainly used for their nutritional and medicinal purposes. In regard to pharmacopoeia, urban populations appear to recognize a broader range of uses of wild plants, possibly reflecting cross-cultural exchange. Rural residents on the other hand tended to list fewer plants and uses, and these are more site-specific. Palm oil and honey are common to all cultural and ethnic backgrounds.

Income is thought to be a major determinant of demand for wild products, especially for medicinal uses. Low-income households are less able to afford modern treatments, and are thus more reliant on traditional, plant-based remedies. Self-medication with wild plant products is common, suggesting that most suppliers are not traditional healers. For better-off households, wild plant medicines may be used as a complement to modern treatments, or as a treatment of “last resort” when the latter has failed.



Sign of a traditional healer

Household income also affects the demand for other NTFPs. Thus while most people consume honey, wealthier household may use it as spreadable sweet or in cosmetics, as well as a basic sweetener. On the other hand, certain by-products of honey such as wax and royal jelly are not widely appreciated (CAF65415). Researchers also noted higher demand for palm oil in the South of Senegal, where prices for this product are generally lower.

Age is another determining factor in demand for NTFPs. Older consumers frequently rely on wild products to treat common afflictions such as diabetes, haemorrhoids and hypertension, which can require constant and expensive treatment if based on modern drugs. On the other hand, some young men reported the use of wild products to treat sexually transmitted diseases, noting the advantage of confidentiality compared to modern treatment. However, in general the young exhibit little knowledge of wild medicinal plants.

Some consumers stated that wild products were less expensive or more efficient than modern substitutes. Thus while palm oil is slightly more expensive than industrial vegetable oil, smaller amounts are required for most preparations. Traditional soaps based on wild products are also considered very accessible. Others noted increasing consumption of native fruits, including many wild products, in response to rising prices for imported fruits, sweets and juices.

There was little evidence of immediate concern for wild resource scarcity among consumers. Rural communities continue to enjoy good access to wild plants, although some expressed concern about future supplies. Urban consumers tend to focus more narrowly on the price and quality of wild products. Their perceptions of resource scarcity are based on changes in prices only.

4.1.5 Conclusion: The economic value of NTFPs

Total value added from the harvest of non-timber, non-fuel forest products in Senegal is estimated at between FCFA 3.5 and 11 billion, with a median estimate of FCFA 4.5 billion or 14% of the reported output of the forest sector in 2000.

Data on the production of NTFPs obtained from a sub-set of the harvesters surveyed may be used to estimate the aggregate volume and “farm-gate” value of production for the Tamba and Kolda regions (CAF6544).²¹ The extrapolation assumes that the survey sample is representative, and reflects the relative population of each Rural Community within its department and region. The value of NTFPs gathered in the regions of Tambacounda and Kolda is thus estimated at FCFA 789 million and 606 million, respectively, including own-consumption, or about FCFA 1.4 billion overall (US\$1.95 million).²² Given the relatively limited use of modern (purchased) inputs in NTFP production, virtually all of the above sum may be considered value added to the

²¹ Data from 58% of the sample for Tambacounda and 42% of the sample for Kolda were used to generate an estimate of the total economic value of NTFPs in these regions.

²² USD 1= FCFA 715

economy.²³ Note however that these estimates exclude the additional value added in marketing and distribution of NTFPs to end users (see below and Figure 4.3).

Important regional differences can be highlighted. Thus Tambacounda is notable for production of *Mbepp*, *Karité* and *Pain de singe*, while Kolda is a greater producer of honey, palm oil, *Nété* and Tamarind. Details are provided in Tables 4.3 and 4.4. No estimates are available for the ZSP, although similar data was collected there and it may be possible to use the same extrapolation procedure.

While Tamba and Kolda regions (and the ZSP) are known to be major sources of supply, it is clear that NTFP harvesting takes place in other regions of the country also. In an effort to estimate the total contribution of NTFPs to the national economy, including value added in distribution, several alternative extrapolations were carried out. The resulting estimates are based on different assumptions about the relation between officially recorded (taxed) and unrecorded production of NTFPs, as well as different assumptions about the share of output destined for urban markets and thus the amount of value added in distribution (Figure 4.3).

Reading Figure 4.3 from the left side, we first report the estimated “farm gate” value of all NTFPs produced for sale or consumed directly by producers in Kolda and Tamba, as above. This figure is already an extrapolation but is considered relatively reliable, assuming that the survey data are accurate, the sample is representative, and the procedure used to extrapolate from the sample to the region is correct.

The next set of three values, reported in the middle of Figure 4.3, show low, medium and high estimates of the farm gate value of NTFPs for Senegal as a whole. The first step in deriving these values is to estimate NTFP output in the ZSP, where complete survey data is lacking but we do have official statistics on NTFP production in 1994. The low estimate is based on the assumption that the ratio between officially reported (taxed) output of NTFPs and actual output in the ZSP is identical to that observed in Tamba. In this region the volume of output calculated using the survey data is about 43% more than the volume reported by the Forest Service.²⁴ The high estimate for the ZSP is based on the ratio observed in Kolda, where estimated output equals 126% of the reported (taxed) volume, while the middle estimate is an average of the two.

The values reported in the middle of Figure 4.3 likewise include an estimate for the Zinguinchor region (FCFA 405 million). In this case we simply use the calculated value for Kolda, assuming a similar resource endowment and pattern of demand, but with a downward adjustment for the smaller population in Zinguinchor. In effect, we assume that NTFP output in this resource-rich area is determined mainly by demand, proxied by population. Finally, the middle values in Figure 4.3 also include a crude estimate of NTFP value for the rest of the country, based on the simple assumption that output in resource-poor regions equals half the value in Kolda, Tamba, the ZSP and Zinguinchor. On this basis we obtain a low estimate of the annual farm-gate value

²³ Note that some of this value may represent liquidation of natural capital, if current rates of extraction exceed the sustainable harvest (however defined).

²⁴ We would expect the total volume of production to exceed officially reported volume due to home consumption, which is not taxed, as well as illegal (unpermitted) production for sale. However, it is not clear why the discrepancy between the survey data and official figures are so dramatically different in Kolda and Tamba regions.

of NTFP production for Senegal as a whole of FCFA 3.1 billion, a middle estimate of 3.3 billion, and a high estimate of about 6 billion (US\$4.3 to \$8.4 million per annum).

The right hand side of Figure 4.3 shows an even wider range of estimates, in this case including the additional value added in the distribution of NTFPs to end use markets. Recall from the discussion above that primary producers generally receive 45-55% of the final market value of NTFPs, while intermediaries and retailers add significant value (and earn large profits) by supplying NTFPs to consumers. The highest values are recorded in large urban markets, where consumer purchasing power is greatest.

The values reported on the right side of Figure 4.3 are based on three assumptions about the share of *marketed* output of NTFPs (excluding home consumption) that is ultimately destined for higher value urban markets: 100%, 45% and 20%. In effect, the lower estimate assumes that 80% of NTFPs sold in rural markets are ultimately consumed by other rural residents, while the higher estimate assumes that rural producers meet all of their needs through own-consumption and thus all sales are destined for urban markets.²⁵

On this basis we obtain estimates of the annual value added from the production and distribution of NTFPs in Senegal ranging from FCFA 3.5 billion to 11.1 billion, with a median of 4.5 billion (US\$ 6.3 million). To put these numbers in context we may compare them to value added in the forest sector as conventionally defined and reported by government. For 2000 the official estimate was FCFA 31.6 billion, mainly comprising value added from the production and distribution of timber, fuel wood and charcoal derived from unmanaged natural forests (MEF 2001b).



Medicinal Plants

²⁵ For this extrapolation we use the weighted average value added accruing to primary producers for all regions and all end use markets, i.e. 52.5% as reported in Table 4.2c. Note that the middle estimate (45%) corresponds to the proportion of the national population residing in urban areas of Senegal.

Estimated “forest-gate” value of NTFPs sold or consumed by all producers in Kolda and Tambacounda, based on the survey data (see text).

Estimated forest-gate value of NTFPs for Senegal as a whole, including sales and own-consumption, based on alternative assumptions about the ratio of total production volume to recorded (taxed) output (see text).

Estimated total value added including distribution to end users, based on alternative assumptions about the share destined for high value urban markets (see text).

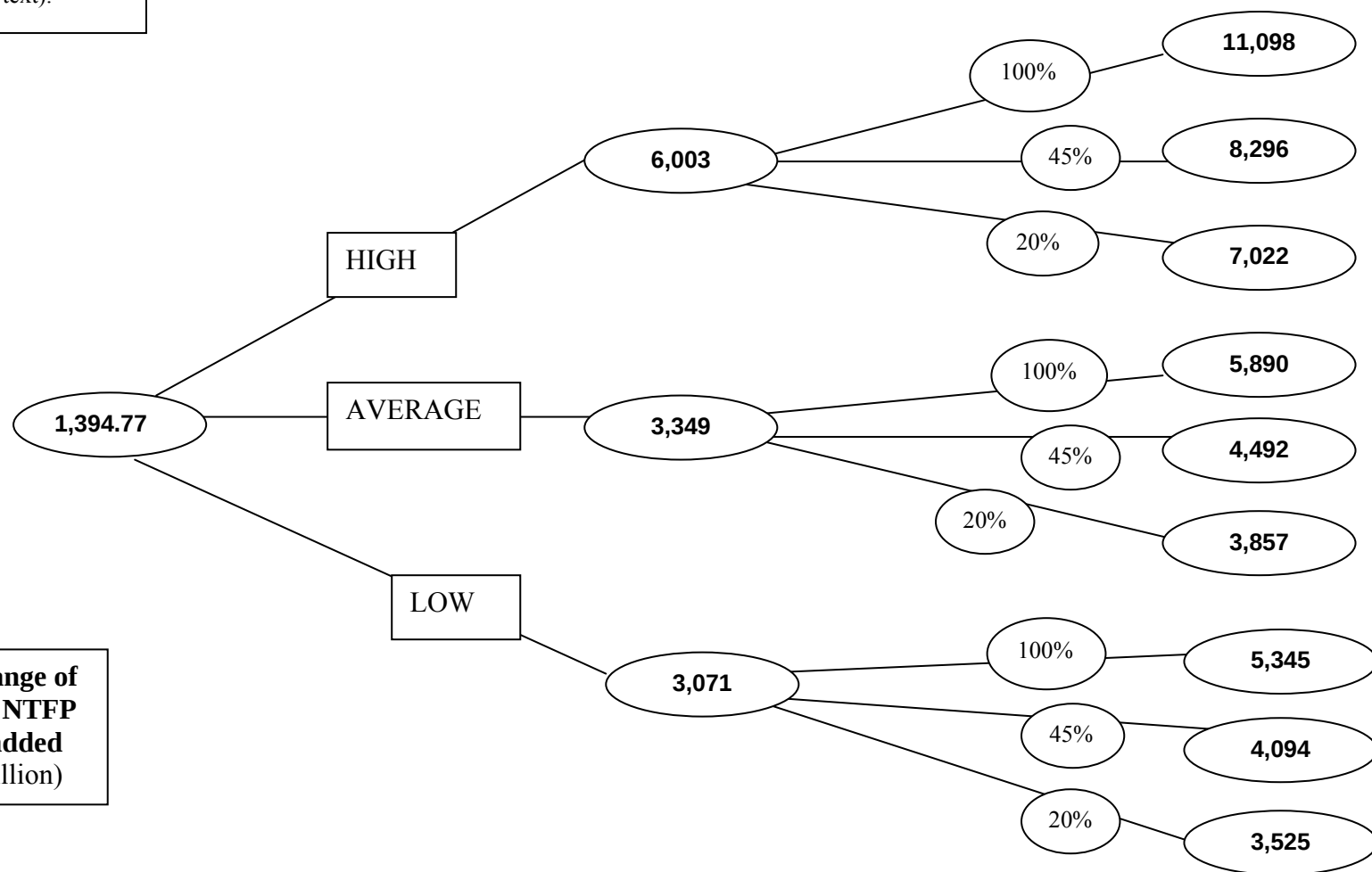


Figure 4.3 Range of estimates for NTFP total value added (in FCFA million)

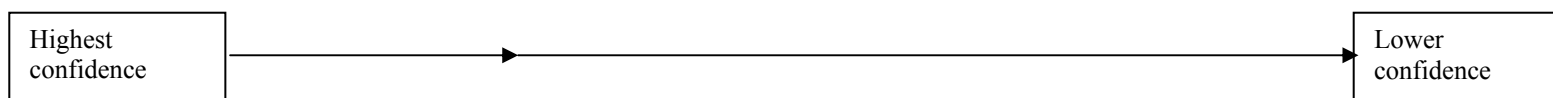


Table 4.3. Harvests, sales and values at producer level of NTFPs in Kolda Region (2000)¹

Product	Harvester/s ²	Extrapolated production (kg)	Own-consumption (share of output used at home)	Average Price (FCFA/kg)	Estimated total value of sales (FCFA)	Estimated value including own-consumption (FCFA)
Huile de palme		314,587	0.10	710	201,020,880	223,356,770
Honey and derivatives	F, M	367,723	0.36	585	137,675,655	215,117,955
Pain de singe	M, F(t)	365,400	0.16	135	41,436,360	49,329,000
Tamarin	F	187,200	0.10	215	36,223,200	40,248,000
Nete	M, F(t)	194,388	0.25	145	21,139,695	28,186,260
Madd	F, M	402,367	0.20	65	20,923,110	26,153,855
Dankh		42,012	0.09	96	3,670,080	4,033,152
Igname	F, M	17,208	0.31	234	2,778,750	4,026,672
Mbepp		6,254	0.25	600	2,814,600	3,752,400
Solom		32,311	0.25	60	1,453,980	1,938,660
Taba		94,108	0.10	20	1,693,940	1,882,160
Gomme arabique		720	0.14	520	322,400	374,400
Tool		13,734	0.49	25	295,275	343,350
Soon		2,958	0.91	55	148,060	162,690
Leung		1,511	0.16	60	75,720	90,660
Dimb ³		247,859	1.00	27	0	6,692,193
TOTAL					471,671,705	605,688,177
Total value of own-consumption		134,016,472 (22%)				

Notes: 1/ Reported volumes exclude imports from Guinea and Guinea Bissau.

2/ Age and sex of harvester: F=female, M=male and C=child. (t) refers to involvement in processing.

3/ No price reported, hence estimated conservatively at 50% of the mean (unweighted) price per kg for *Madd*, *Dankh*, *Solom*, *Taba*, *Tool*, *Soon* and *Leung*.

Table 4.4. Harvests, sales and values at producer level of NTFPs in Tambacounda Region (2000)

Product	Harvester/s	Estimated production (Kg)	Own-consumption (share of output used at home)	Average Price (FCFA/kg)	Estimated total value of sales (FCFA)	Estimated value including own-consumption (FCFA)
Mbepp	F, M, C	1,017,500	0.03	575	567,955,409	585,062,500
Pain de singe		531,160	0.16	121	54,090,421	64,270,360
Honey and derivatives		67,113	0.36	713	30,674,083	47,851,569
Karite		54,206	0.47	843	24,117,153	45,695,658
Gomme arabique		19,091	0.00	555	10,595,505	10,595,505
Tamarin		38,500	0.10	214	7,439,097	8,239,000
Dankh	F, C	118,152	0.09	62	6,700,506	7,325,424
Madd	F, C	120,350	0.24	55	5,060,000	6,619,250
Igname		35,008	0.31	150	3,629,862	5,251,200
Nete		33,126	0.25	134	3,343,575	4,438,884
Taba		94,108	0.10	15	3,133,796	1,411,620
Tool		47,054	0.14	20	806,640	941,080
Jujube		9,656	0.13	79	667,471	762,824
Leung	F, C	5,378	0.20	60	258,144	322,680
Roots and bark	M	807	0.13	250	174,850	201,750
Soon	C	2,958	0.09	55	147,900	162,690
TOTAL					718,794,412	789,151,994
Total value of own-consumption				70,357,582 (9%)		

4.2 Game, Bushmeat and Other Animal Products

Game resources are not effectively protected even within protected areas.



Wart hog: *Phacochoerus aethiopicus*

This section describes the results of surveys concerning the production, trade and consumption of bushmeat and other animal products. It includes findings related to both traditional and modern (sport) hunting, eco-tourism, and consumption of wild animals as food, as well as trophies, religious or decorative objects and other uses.

Two surveys of bushmeat consumption and traditional hunting were undertaken by ISRA/BAME. One of these focused on the importance of wild meat as a source of edible protein in rural areas (CAF6541). This survey targeted households in 17 rural communities (RC) surrounding the Niokolo Koba National Park (PNNK) and the adjacent official hunting reserve (*Zone d'Interet Cynegetique* or ZIC) of Falémé.²⁶ The sample frame selected four households at random from each of four randomly chosen villages in each RC, generating a total sample of 272 households and 269 fully completed questionnaires over the period October 1999 to February 2000. In each case the head of household was approached, with the result that the information collected largely reflects the perspective of adult, married men (98% of respondents were male).

A second survey by ISRA/BAME focused on the economics of traditional hunting in Tambacounda and Kolda Regions (CAF6540). This involved the use of informal methods, due to the fact that the survey concerned illegal practices (i.e. poaching). In fact, many potential respondents declined to cooperate with the researchers, fearing reprisals. This seriously limited the scope and reliability of the survey, as the resulting sample is very small and possibly biased. The Kolda region was almost dropped altogether, as hunters there refused to cooperate in a majority of RC.

The latter study lasted five months (October 1999-February 2000). 57 hunters were interviewed, based on the selection of two hunters from each of the villages visited for the game and food security study described above. The studies covered the resource-rich departments of Kédougou and Tambacounda, in Tambacounda Region, and Vélingara department in Kolda region. Information regarding the socio-economic characteristics of hunters was gathered, followed by questions about hunting itself. Data was collected on bushmeat volumes, type/species, prices, and transport costs and methods. Legal (permitted) hunting and poaching were not distinguished.

4.2.1 A profile of hunters and hunting

²⁶ The Niokolo Koba National Park (PNNK) is a protected area of world status and hunting within its boundaries is strictly forbidden. Falémé ZIC is a designated hunting reserve and local residents are entitled to hunt in the ZIC on payment of a small fee.

The average age of hunters was 46 years (CAF6540).²⁷ All of them were men. Interestingly, the Mandingue ethnic group dominates hunting (37%) followed by the Peulh (33%), whereas the general population is majority Peulh (55%) followed by Mandingue (28%). Hunters were less educated than their peers (47% against 65%), although the same proportion had attended primary school as children. Religious backgrounds are similar with the vast majority professing to be Moslem (87%).

Hunting is undertaken all year round by 47% of those interviewed. The rainy season attracts 20% of them and the dry season 36%. Most hunting (73%) takes place on the outskirts of villages and in nearby agricultural fields. This influences the types of species most often exploited. However, a substantial 20% of kills was acknowledged to have taken place within protected areas. This is mirrored by information collected in the food security survey, where 37% of hunting was effectively illegal, including hunting without a permit in the ZIC and penetration of the PNNK (CAF6540).

Game resources do not appear to be effectively protected even within “protected” areas. Some respondents stated that heavily armed gangs of poachers from Medina-Gounass (Kolda Region) routinely invade the PNNK (CAF658). Others suggest that weaponry is smuggled from Mauritania, where some traders are alleged to barter cured wild meat for arms. More generally, none of the hunters interviewed expressed any concern about the potential threatened status of particular species, nor did any of them appear to limit their activity in terms of species, size or gender.

Income from hunting

Hunting complements agriculture and earnings are modest for most hunters.

Taking all species together, more than 14 tonnes of game were reported killed or trapped in 1999 by the 57 hunters interviewed (CAF6540). This is equivalent to an average of 4 animals or 250 kg per hunter per annum. Note however that 9.7 tons resulted from hunting in the department of Kédougou only. Both the proximity to the PNNK and the more cooperative nature of respondents in Kédougou explains this large difference compared to other departments surveyed. The true average number of kills and volume of production per hunter may therefore be somewhat greater.

In terms of sheer numbers, wild birds (e.g. Guinea fowl, Partridges, etc.) account for a large proportion of the kills declared by hunters (Table 4.5). However, differences in the average weight of species imply a different ranking by volume. Anecdotal reports indicate that two lions are illegally killed each year for their skin, with the meat given to the inhabitants of surrounding villages.



White-faced Whistling Duck: *Dendrocygna viduata*

²⁷ Given the very small size of the sample, mean values may not be representative.

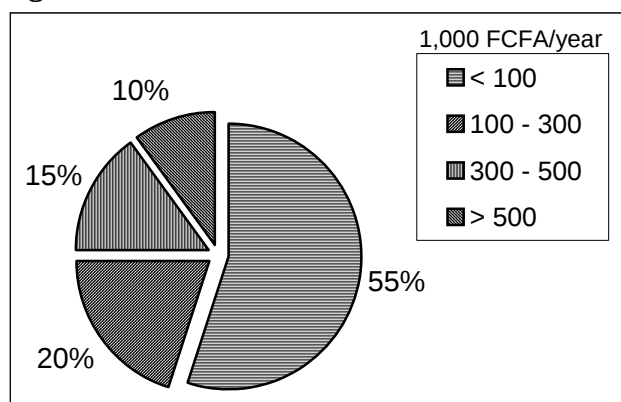
Table 4.5. Species and number of kills reported by hunters

Species	Number	Percent
Pintade	56	22.4
Guib Harnaché	30	12.0
Porc-épic	29	11.6
Perdrix	22	8.9
Lièvre	19	7.6
Phacochère	17	6.9
Cephalophe	16	6.4
Cob de buffon	15	6.1
Biche	12	4.8
Cob onctueux	10	4.0
Buffle	9	3.6
Coba	7	2.8
Gazelle	2	0.8
Chacal	2	0.8
Antilope	2	0.8
Bubales	1	0.4
Babouin	1	0.4
Total	250	100.0

Note: All regions together (Kédougou dominates with 174 of reported 250 kills)

Source: ISRA/IUCN doc. CAF 6540

Hunting generally complements revenues from agriculture and earnings are modest for most hunters (Figure 4.4). Note however that this chart only reflects the annual income derived from hunting by those interviewed. Information on hunters' total income was not collected in the survey (i.e. income from other activities + own-consumption + revenues from hunting). It is therefore not possible to determine the extent to which hunters depend on this resource.

Figure 4.4. Annual revenue from traditional hunting

Source: ISRA/IUCN 2001 (CAF6540)

Data from the larger food security survey provide additional information on total household income. These data suggest average annual *cash* income of about FCFA

250,000 per household.²⁸ Moreover, natural resources appear to be more important as share of total cash income for poorer households (Figure 4.5). However, this relation is only apparent for those who reported some cash income from such sources.

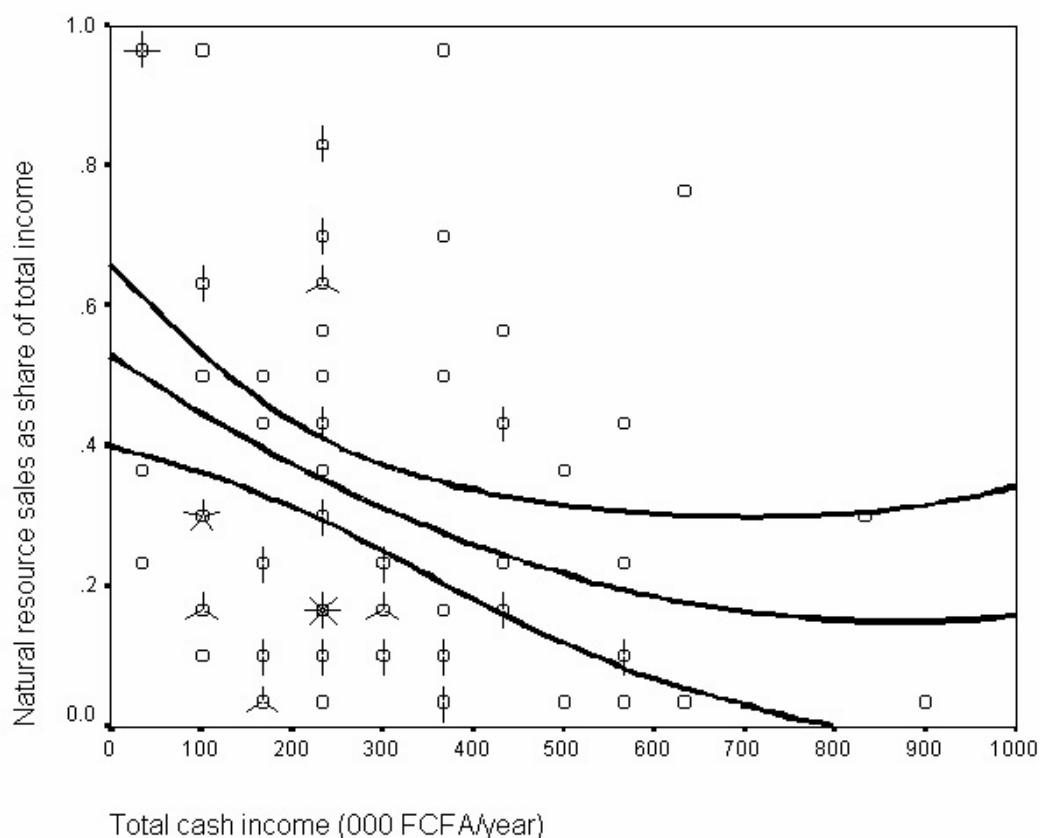
Natural resources account for a greater share of cash income for poor households.



African Buffalo: *Synceros caffer*

²⁸ Compare to a *per capita* GDP of about FCFA 300,000. Assuming a mean household size of eight, the average income per household in Senegal is about FCFA 2.4 million. Most rural households earn far less than this, with much of their income comprising own-consumption of agricultural products.

Figure 4.5 Relative importance of gathered natural resources to poor households



Note: Natural resource sales include wild plants, game and minerals (salt and gold). The three lines represent the best fit regression line (middle line) and the 95% confidence interval (+/-).
Source: Analysis of survey data by the authors.

The food security survey further reveals that female-headed households report less cash income from hunting but more from other wild products and from artisanal mining, although the latter differences are not statistically significant. Women also report less cash income in total (5% significance using the ANOVA test of difference in mean values). Finally, household heads with little or no formal education reported more cash income from gathering wild resources (not hunting), on average, than those who had attended primary school or received Quoranic instruction (10% significance using a test of linearity). Less educated household also reported lower levels of cash income overall, although the difference is not statistically significant.

4.2.2 Commercialisation of game

Bushmeat prices are lower than domestic meat products, despite strong demand.

Hunters directly sell their products in the form of fresh or cured/smoked meat, both to local villagers and residents of near-by towns (CAF6540). As the majority of hunting takes place near villages, transport costs are low, representing less than 2% of revenue (Kédougou and Vélingara). Transport is generally on foot, bicycle or donkey and

labour inputs are not included in estimated transport costs. Large animals (e.g. buffalo, wart hog, hind) are usually gutted before transport.

The weighted average price of fresh bush meat (all species) was estimated at FCFA 400-500 per kg (about 70 US¢) at the time of the survey. This may be compared to an average market price of about FCFA 1200/kg for beef, in Kolda, or FCFA 1500/kg in Dakar. In other words, bush meat does not appear to be an expensive commodity.

One interpretation of low prices is weak demand, but this seems inconsistent with the strong local demand for bush meat revealed by the food security survey. In fact, prices may be subject to several countervailing influences. Firstly, some hunting takes place within a framework of open access competition. Economic rent potentially captured by the individual hunter is eroded, limiting interest in selective hunting.²⁹ Therefore price covers labour, capital and transport costs with little room for surplus profit. Other factors can counter balance this and allow hunters to capture some resource rent. Those who enjoy relatively good relations with park wardens, for example, may have easier access to this rich area. Another factor is weaponry, which may require a large capital investment not accessible to all.

The illegal nature of most local hunting could have conflicting effects on prices. On the one hand, poachers need to clear their stocks quickly without spending much time on negotiations, in order to avoid being caught.³⁰ As in other parts of West Africa, hunters may also have long-standing links with particular bushmeat traders, who often provide ammunition and other supplies in return for preferential low prices. At the same time, the risk incurred by poachers in pursuing their activities should allow for some risk premium (although much of this risk may in fact be borne by traders).

4.2.3 Skins, trophies and other game by-products

The trade in animal by-products is highly profitable, with an estimated total return of 57% on capital invested over a six-month period, in the year 2000.

Fifteen vendors of wild animal by-products were followed (CAF6542), of which ten traders from Soumbédioune market and five from Blaise Diagne market (both in Dakar). The total number of vendors involved in the trade in animal by-products in these markets was estimated at 130-150. The relatively small number interviewed reflects a lack of cooperation from many traders. Indeed those who cooperated were only willing to provide information over a six-month period (May-December 2000), instead of a full year as originally planned.

The products supplied by these markets can be grouped in eight categories:

- Skins (caiman, lion, boa, monkey, lizard, hyena, chameleon, jackal, panther, hedgehog, rabbit, *Geule Tapée*)
- Horns (hind, antelope, *buffle*)

²⁹ When the harvest of a particular NTFP is profitable, the absence of exclusive property rights may attract competition and/or domestication to the point where economic rents are diluted and ultimately dissipated (Chomitz and Kumari 1998; Pearce and Pearce 2001).

³⁰ Reciprocity may also dissuade hunters from demanding unreasonable prices ("today I sell but tomorrow I may buy from the same people").

- Heads (caiman, jackal, guinea-fowl, snake, partridge, rabbit, hyena)
- Teeth (caiman, wart hog)
- Noses (hyena)
- Feathers
- Fat (lion, boa)
- Claws (panther, lion)

The questionnaire was designed to provide data to determine added value in the trade in animal products, as well as information on the socio-economic characteristics of traders. Data was collected on sales of selected products, including the product type, date and place of sale, the price and the nature of the purchaser (CAF6542). Data on operating expenditure by traders was also collected, permitting the calculation of added value (Table 4.6). Financial returns seem impressive, with total profits of about 57% on capital invested for all 15 traders together during the six-month survey period.

Table 4.6 Value added from sales of game by-products
(Consolidated account for 15 traders in 2 Dakar markets, 2000)

Item/transaction	FCFA
Total sales revenue	4,390,974
<i>Less:</i>	
Cost of inventory	1,289,015
<i>Equals:</i>	
Gross margin	3,101,959
<i>Less:</i>	
Storage	73,275
Handling	13,750
Commission	19,500
Duty	22,500
Forestry permits	55,500
Transport	109,500
Other costs	26,176
Sub-total intermediate inputs	310,201
<i>Equals:</i>	
Value added	2,791,758

Source: CAF 6542.

Extrapolating from this data, assuming that other traders had similar turnover and that sales were similar during the rest of 2000, we can estimate the total added value from the sale of animal by-products in these two Dakar markets at about FCFA 56 million (US\$ 78,300). The products on offer in urban markets derive from national sources (55% mainly from Tambacounda, Kolda and Casamance) as well as imports (45% mainly from neighboring African states). The survey suggested that supplies of these products reached record levels in the year 2000, in the two markets surveyed.

Prices are reported to be sensitive to seasonal factors such as animal reproduction periods (*supply factor*) and to public events such as exams, elections and celebrations (*demand factor*). About 20% of buyers are other traders, with the bulk made up of final consumers. The survey in Soumbédioune further revealed that 65% of craft

production is destined for export, through sales to foreign tourists. It was also noted that importers compete fiercely for the Senegalese market.

4.2.4 Private hunting concessions

Sport hunting is an important source of foreign exchange.

The development of tourism is a central part of the government's strategy for realizing the economic value of faunal resources. Target activities include wildlife viewing as well as sport hunting. Investors are encouraged to develop wildlife-based tourism through the temporary concession of exclusive rights for sport hunting and/or animal viewing in designated hunting reserves or *Zones d'Intérêt Cynégétique* (ZIC). This investment option was created in the early 1970s, starting with the *Djeuss* ZIC on the Senegal River Delta. The objectives of the policy were to:

- eradicate common hunting;
- promote private management of fauna resources; and
- generate employment on the sites by the activity itself and through the development of tourism in general.

To reinforce the initiative an association of hunters was created (*Association des Chasseurs et Tireurs du Senegal* or ACTS). However it was not until 1988 that the practice of leasing wildlife concessions to private operators was generalised. In the first five-year phase 31 concessions were leased out, covering 3.2 million ha or about 16% of the national territory. Each concession covered 104,000 ha on average. In the second phase the surfaces conceded were reduced in size, to a maximum of 20,000 ha in humid areas (richer in fauna) and 60,000 ha in dry areas. Concession rights are let by the State and as yet no attempt has been made to decentralise this aspect of wildlife management (Box 4.2).

Box 4.2 State hunting reserves and hunting concessions

State hunting reserves (*Zones d'Intérêt Cynégétique* or ZIC) are created by decree and may be managed by the forestry service or by private firms under concession. Out of eight ZICs currently in existence in Senegal, covering 2.3 million ha, four have been rented to private investors (*Djeuss*, *lac de Guiers*, *Baobolong* and *Niombato*). One is directly managed by the forestry service (*ZIC de la Falémé*) and three are considered to be "under-utilised" (*Kayanga*, *Guelowar* and *Mbeque*). Falémé ZIC is the largest, covering 1,936,000 ha or about 10% of the national territory. It harbours the last remaining reserves of large fauna available for hunting (legally) in Senegal. Several private hunting camps are active within the ZIC.

Two regions containing several wildlife concessions between them were studied by ISRA/BAME from 9-14 April 2001, namely Saint-Louis and Tambacounda regions (CAF65410). In the former region 10 zones have been conceded in the Department of Dagana, covering an area of almost 150,000 ha including the original concession of the *Djeuss*. A total of 11 hunting camps have been created of which seven managed by ACTS. Some of the camps welcome visits from both hunters and non-hunting tourists.

While Saint-Louis hosts the oldest commercial wildlife concessions in Senegal, Tambacounda attracts the great majority of sport hunters (650 out of a total of 692 during the 2000 season). This region is the largest administrative area in the country, containing both the PNNK (913,000 ha) with its important game reserve as well as the Falémé ZIC (1,936,000 ha). The region has a rich and diverse fauna, including aquatic birds, large and small game, and supports 18 hunting camps of which 3 in the Falémé ZIC. However, wildlife resources have suffered recently from shifting agriculture, bush fires, itinerant grazing, drying of water springs, poaching, etc.

Benefits from sport hunting in both regions include employment creation as well as improved communication and infrastructure in areas that were historically isolated, enhancing market opportunities for agriculture and other sectors. More concretely, ISRA/BAME has estimated the economic contribution of sport hunting in Senegal at more than FCFA 400 million per annum (Box 4.3).

Box 4.3 Value added from sport hunting

Interviews with sport hunting firms in Tambacounda and Saint Louis regions allowed ISRA to estimate average tourist expenditures (FCFA 650,000) as well as commercial operating costs. During the 1999-2000 season (four months duration) 692 hunters were registered, implying total revenue of about FCFA 450 million. Intermediate inputs (e.g. transport, marketing) are estimated at just 3% of total revenues, implying value added to the economy of about FCFA 436 million. Total taxes paid by the industry amounted to FCFA 142.9 million.

Source: CAF6540.

In addition to sport hunting in ZICs, other protected areas also attract many visitors (CAF65410). For example, the famous bird reserve of the *Djoudj* (PNOD), in Saint Louis region, receives about 10,000 tourists annually (15% Senegalese and 60% French) and generates total revenues of about FCFA 25 million.³¹ This figure does not include revenues earned by local businesses as a result of tourist visits.

4.2.5 Live bird exports

Live bird exports for the pet trade have declined in recent years.

Research on live bird exports was conducted by two consultants to IUCN, Cheikh Ly and Bocar Sall, as part of a larger study of the international trade in wild plants and animals in Senegal (CAF6520). Information was obtained from literature as well as interviews with agents engaged in the trade. Data on exports of wild birds presented here are mainly from the Forestry Service and the Livestock Department (Airport office). Customs data are available but considered less reliable.

The export of live, wild birds for the pet trade was, until recently, a significant source of foreign exchange earnings for Senegal. During the 1980s the trade generated about FCFA 400 million per year. At their peak, shipments of live birds from Senegal were

³¹ Based on data from 1998, 1999 and 2000.

estimated at about ten cages per fortnight, with each cage containing about 150 small birds or up to 20 parrots.

Recent data (1996-99) indicate that *Serinus mozambicus* is the most commonly exported bird species, accounting for 14% of the total. This is followed in descending order, with no more than 11% each, by: *Amadina fasciata*, *Estrilda bengala*, *Estrilda troglodytes*, *Estrilda melpoda*, *Lagonosticta senegala*, *Euplectes orix*, and *Quelea quelea*. Birds not subject to quota such as *Passer luteus* represented less than 4% of total exports. Total exports in 1998, by family, are presented in Table 4.7.

The main destinations for live bird exports are Portugal and Italy, accounting for 35% and 34% respectively, with a further 8% exported to France. Some birds may be re-exported elsewhere within the European Union. Similarly, Senegal has occasionally re-exported species obtained from other countries, e.g. Grey Parrots from Gabon.

Table 4.7 Bird exports by family (1998)

Bird family	Number exported	%
<i>Estrillidae</i>	214,995	53
<i>Ploceidae</i>	80,117	20
<i>Sturnidae</i>	12,212	3
<i>Fringillidae</i>	74,956	19
<i>Columbidae</i>	12,779	3
<i>Psittacidae</i>	9,310	2
Total	404,369	100

Source: Official statistics reported in CAF6520

Organisation of trade in live birds

The live bird trade can be divided into three stages: collection, concentration and export (CAF6520). Actors along the chain include those who catch live birds, middlemen who gather birds from different catchers (generally employed by exporters), and exporters themselves. There is a small national market for live birds, but the export trade has traditionally been the main driver of the activity.

Bird catchers are typically rural residents living near the natural habitat of target bird species. About two-thirds of the total catch is from Tambacounda Region. Birds are caught using nets, with seed as bait, and then kept until the arrival of the exporter's agent. Particular species and quantities are typically ordered in advance. Those who collect for export are considered more likely to obtain prior authorisation from the Forestry Service, while those serving the national market are thought to engage in clandestine (illicit) harvesting. Note that catching birds is exempt from tax, while the collection and transport of live birds is taxable.

The middleman (or concentrator) is employed by the exporter to place orders, provide pre-financing to bird catcher if necessary, receive and stock captured birds, and finally convey them to Dakar. The latter step normally requires authorisation confirming the involvement of an established trader recognised by the Forestry Service. Exporters are based in Dakar, with three of them alone accounting for 45% of the trade in live birds. Exporters are registered with the Forestry Service, which since 1982 has issued annual

quotas for live bird exports under the provisions of the Convention on International Trade of Endangered Species (CITES).

Exporters are thought to pass on roughly 50% of total revenue to their suppliers, with 15% of the total accruing to bird catchers and the remainder paid to concentrators. For parrots and *Estrillodae* net returns to exporters are estimated at about 40%. The high returns earned by bird exporters may reflect their privileged position as the holders of official quotas, as well as their small number, which could provide some leverage when negotiating prices with concentrators and/or bird catchers. It is not clear if the apparent market power of live bird exporters translates into concern for the long-term sustainability of supply.

Recent decline in live bird exports

Exports of live birds from Senegal have declined dramatically in recent years, falling from about 750 thousand in 1997 to under 500 thousand in 1998 and 368,000 in 1999 (CAF6520). Official quotas are increasingly unused (Table 4.8). Data on revenues from live bird exports over the period 1987 to 1995 show a similar downward trend (Figure 4.6), with an upturn evident following (and possibly due to) the devaluation of the CFA Franc in 1994.

Table 4.8 Live bird export quotas and volumes (1996-99)

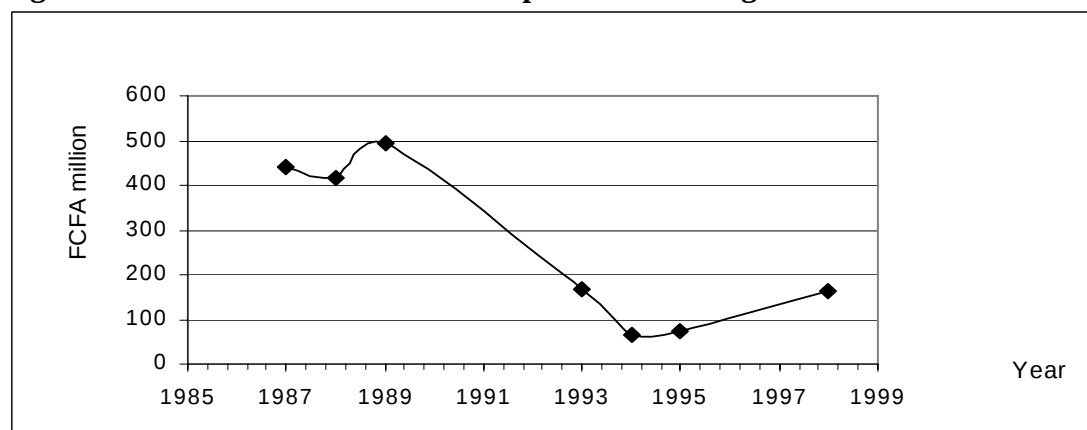
Year	Quota	Total exported	% of quota
1996-97	984,000	777,811	79 %
1997-98	994,000	495,598*	50 %
1998-99	783,000	368,403**	47 %

Notes: * Data from Forestry Service records, Dakar Airport.

** January to October.

There is no evidence of a decline in bird populations in the wild, nor any increase in prices that might support claims of increasing scarcity. In fact, the decline in exports appears to partly reflect campaigns led by animal right activists in importing countries, especially the United States. As a result of these campaigns several airlines no longer accept live cargo, e.g. Air France from 1997. A resumption of trade has been hampered by delays in meeting conditions set by international certifying bodies, further undermining relations between importers and exporters. Additionally, CITES has fixed precautionary but arbitrarily low quotas for several species, even relatively common ones, as no comprehensive or reliable data exists on Senegalese stocks.

Figure 4.6 Revenues from live bird exports from Senegal



4.2.6 Demand for bush meat and game by-products

Bush meat is mainly consumed in rural areas.

Game has a wide range of uses. Meat from wild animals, fresh or preserved, is of course widely consumed as food. However, the meat of certain wild animals is also used for medical purposes, as are some animal by-products such as skins, feathers and horns. The latter are likewise used as raw material for craft creations and traditional rituals. Finally, as described above, live wild animals provide targets and trophies for sport hunters, as well as entertainment for tourists.

Focus groups organized by IIED Sahel indicate that bush meat is consumed more often and in greater variety in rural areas than in urban centres (CAF6545). Consumption of game products is generally controlled by men, reflecting perhaps a cultural phenomenon³², while children trap some small game for food (e.g. birds and rodents). There is a widespread perception that consumption of bush meat has declined compared to 25 years ago. Participants attributed this to increasingly strict regulation of hunting by the State, and decline in wildlife populations.

61% of rural households interviewed by ISRA/BAME in Tambacounda and Kolda Regions reported consuming bush meat no more than once or at most three times per month (mainly buffalos, partridges and guinea fowls). (CAF6541) However, these results may be biased due to the prevalence of poaching. While the customary hunting rights of rural communities are recognized under Senegalese law, there is widespread evidence of incursions into strictly protected areas such as the PNNK. Some under-reporting of bush meat consumption is thus to be expected.³³

Both urban and rural populations use certain wild animals for ritual, cultural and/or medicinal purposes. Non-consumptive use of fauna is mainly linked to totemic values

³² It is not uncommon that preparation, butchering, and consumption of meat are all in the male domain. The prescribed pattern of exchange relations surrounding the process of butchery is also often important and within the male sphere.

³³ Initial estimates by ISRA/BAME of 2 kg of bush meat per household per day were not plausible, and a revised estimate of 750 grams per household per day is also considered unlikely. Further analysis is required to determine the relative importance of bush meat as a source of animal protein in Senegal.

attributed to certain species by some ethnic groups. Wild animals may also be kept as pets, while purely contemplative values are reserved to foreign tourists.



Greater Flamingo: *Phoenicopterus roseus*

4.3 Freshwater (continental) Fisheries

Three major areas were studied by ISRA/CRODT, namely the Senegal River, the Sine-Saloum delta, and the Casamance estuary.³⁴ Studies of continental fisheries involved preliminary census (CAF655 and 6518) and description of 'fishing units' and 'landing sites', followed by continuous monitoring of a representative sample of fishing units over the course of a full year. Additional data on fish exports was collected from literature and official statistics by Drs. Ly and Sall, while information on the consumption of freshwater fish was obtained by IIED Sahel from focus groups.



Women Carrying a Garland of Oyster Spats (Saloum Estuary)

4.3.1 Fisheries production

Methodology

In the Senegal River valley, 74 villages and fishing camps were visited during the dry season, against 71 during the rainy season (Table 4.9a). In the Sine-Saloum, 53 villages and fishing camps were visited during the dry season, against 83 during the rainy season (Table 4.9b). Finally, in January 1999 ISRA/CRODT undertook a preliminary study of mollusc production (oysters, murex, etc.) in the southern region of Ziguinchor (CAF655). 17 sites were visited with four selected for further study (Kafountine, Tendouck, Ourong, and Ziguinchor) due to the importance of fishing in these areas.

Table 4.9a Fishing units monitored in the Senegal River

Area	Downstream Diamas	Upstream Diamas	Guieres Lake	Low Valley	Total
Dry season	249	216	258	147	1,056
Rainy season	280	115	246	98	982

Source: CAF6522Txt

Table 4.9b Fishing units monitored in the Sine-Saloum

Area	Continental Saloum	Continental Diomboss	Continental Bandiala	Insular Villages	Total
Dry season	423	84	197	2,514	3,218
Rainy season	768	86	228	1,682	2,764

Source: CAF6522Txt

³⁴ The Senegal River study area was divided into five sections: downstream of Diamas dam, upstream of Diamas dam, the Guieres Lake, High delta and Lower Valley. The Sine-Saloum study area was similarly divided into the Saloum river, Diomboss river, Bandiala river and villages located in the delta itself.

Information collected on fishing units includes their gear (size and type), the number of fishermen (and crew when relevant), and the type and level of activity. Note that fishing units include not only boats but also those who fish on foot. Data on landing sites includes characteristics such as infrastructure, activities and services linked to the fishing sector (see Annex 1, Table A.6). The results of the preliminary census helped to guide the follow-up surveys, by highlighting representative areas, fishing units, catches, activities and time frames.

Follow-up surveys of a representative sample of fishing units were undertaken to gather data on costs and benefits, in order to establish value added in the fishery (CAF6531Txt). Mixed catches and the diverse units of measure used for different species were taken into consideration when estimating the volume of landed product. Daily catch was recorded by species and a table relating size to weight was used to establish the price per kg. Moreover, prices were recorded for each species no less than three times per day, to account for fluctuation in prices (or barter price equivalents) throughout the day. Data was also collected on the amount of time spent by fishing units, which would allow for estimation of labour inputs/costs, although this has not yet been done. Finally, additional information was obtained on the composition of fishing units, capital equipment and systems for the distribution of products.

The economic value of the inland fisheries was estimated for primary production (fishing), transformation/processing, through to distribution via wholesalers but excluding retailing. The total catch was calculated through successive multiplication from daily registered volumes to obtain weekly and monthly estimates. Turnover was calculated using producer prices. In some cases market prices were deflated to account for distribution costs, when not directly derived from producers.

Fishing in the Senegal River (CAF6543)

Just two freshwater species account for 70% of the catch in the Senegal River.

The activity employed 2,380 fishermen during the dry season against 2,059 during the wet season, a seasonal variation of 16%. Most fishing units used boats: 94% during the dry season and 89% during the rainy season. Only 20-26% of these boats were motorised, typically using very small engines (4-8 horsepower). About 90% of the total fishing effort relied on just four types of gear: *filet maillant encerclant*, *senne de rivage*, *épervier* and *filet maillant derivant de surface*. Women are generally less involved in fishing itself but play an important role in processing and distribution.

The number of active fishing units was stable over the 12 months of data collection, with no significant seasonal variation except for the upstream Diama section of the Senegal River. On the other hand, the results for fishing units by area and for units by origin revealed some migration within the Senegal River.

Annual catches are estimated at 30,540 tons in the areas studied, which are thought to be the most productive sections of the Senegal River.³⁵ While a great variety of fish species were encountered and 134 different species recorded by ISRA/CRODT, just 20 species account for over 90% of landings. A single species, Cobo or *Ethmalosa fimbriata*, represents fully 40% of all registered landings, while Tilapias (principally *Sarotherodon melanotheron*) make up a further 30%. The predominance of these species is explained by their affinity with marine and estuarine environments. When saline levels rise during the dry season, fresh-estuary water species migrate upstream.

Fishing in the Sine-Saloum (CAF6543)

Women fishing on foot account for up to half of the catch in the Sine-Saloum.

The activity employed 7,588 fishermen in the dry season against 7,127 during the humid period, a seasonal variation of just 6%. In contrast to the Senegal River area, women are active participants in fishing, especially during the dry season when they harvest molluscs. 52% of the fishing units of the insular villages and 29% of units in the Continental Diomboss are made up of women during the dry season. Half of them use boats. The majority of the landings are obtained using shrimp nets, *filet dérivant de surface + fond*, *filet maillant encerclant*, *senne de rivage*, *filet maillant dérivant de surface*, together with hand harvesting for molluscs.

Most areas of the Sine-Saloum delta exhibit little seasonal variation, although there is more activity in the archipelago of the delta during the dry season and less activity in the Saloum river. Mollusc harvesting is more common during the dry season, while in the rainy season many units turn to shrimp production. Migration is strong throughout the Sine-Saloum, and the region also attracts fishermen from Gambia, Guinea Bissau, Guinea Conakry and as far as Burkina Faso. Foreign fishermen are mainly attracted by shrimp during the rainy season and invertebrates (molluscs) during the dry season.

Annual landings for the areas studied totalled 15,370 tonnes including fish and shrimp. This differs significantly from previous studies of continental fisheries in the Sine-Saloum area, which estimated catches at about 8,000 tonnes.³⁶ One reason that previous estimates are so much lower is that earlier studies considered only fishing with boats, ignoring fishing on foot (mainly by women). In contrast, ISRA/CRODT found that 20 % of all units in the Sine-Saloum area undertook fishing on foot.

As in the Senegal River, Cobo (*Ethmalosa*) dominates the picture with 80% of total volume, followed by mullets with 6%. The Sine-Saloum area has far less diversity in terms of fish species than the Senegal River. Production of molluscs was recorded as 2,601 tonnes, with *Arca senel* the dominant species (66% of the total), followed by Murex (19%), oysters (13%) and Cymbium (2%).

Preliminary research in the Casamance (CAF655)

Interviews with local populations revealed the importance of mollusc production in this area. Both oysters and *Arca senel* are key species, mainly produced for sale by women during the dry season (i.e. January to June; most producers cultivate rice

³⁵ This excludes fish kept for home consumption, estimated at 5-10% of the total catch.

³⁶ See Bousso (1996) and Diouf (1996).

during the rainy season). Oysters are typically dried and a large share of production is shipped to Dakar.

Sustainability of continental fisheries (CAF6543)

Lack of reliable biological data on fish stocks prevents a definitive assessment of the sustainability of continental fisheries. One recent study of the Sine-Saloum suggests that shrimps stocks may be over-exploited (Le Reste and Diallo 1994). Data on fish size distribution for the 1992-94 period are available from another study, but have not yet been analysed with respect to population dynamics (Bousso 1996).

Only very limited data exists for mollusc stocks. Some producers in the Casamance region stated that the average size of oysters had declined in recent years (CAF655). In certain areas of the Sine-Saloum, on the other hand, Bay (2002) suggests that the collection of oysters by women is highly selective and does not damage the roots of mangrove trees where the oysters are found (CAF6543 and CAF65413). In that area, approximately 25% of the stock is harvested annually. This may be partly attributable to education campaigns on responsible fishing organized by authorities of the Saloum Biosphere Reserve, together with IUCN and others. Nevertheless, deforestation of the Saloum Delta mangroves combined with the effects of prolonged drought is leading to rising salinity levels, erosion and disturbance of mollusc nesting areas (CAF65413).

In the Senegal River area, fish populations seem to benefit from the recent expansion of aquatic plants (lotus, etc.). This has reduced access to fishermen in some areas of the river, which may have become biological havens for certain fish species. The effect seems to be confirmed by the exceptional size of fish caught near these areas.³⁷ A similar effect is achieved by the release of water from the Diama dam, which temporarily dilutes the river waters making fish less accessible.

4.3.2 Processing and distribution of freshwater fish products

Poor infrastructure and especially lack of refrigeration limits the commercialisation of continental fish products.

The products of inland fisheries can follow several different pathways to three major destinations: (1) home consumption by fishermen themselves, accounting for an estimated 5-10% of total production; (2) sale in local markets in fresh or processed form; and (3) export to foreign markets in the form of frozen or processed products.

Fish processing (CAF6543)

A significant share of total output is sold in processed form. This is especially true for relatively abundant and lower value species. Methods of processing are similar to those for sea fisheries, and rely heavily on artisanal (craft) methods (see Table 4.10). Women play a key role in traditional fish processing.

³⁷ The implication is that fish elsewhere are smaller than they could be, although allowing the resource to attain its maximum size is generally not optimal from an economic perspective.

Table 4.10 Processing of freshwater fish products

Method	Process / product	Principle	Species
Traditional	<i>Tambadiang</i>	Product resulting from sun-drying the whole fish after leaving it to macerate in salted water overnight.	Mullet-sized fish
	<i>Guedj</i> (widely used in Senegal River)	Fermented-dried product; the fish is first buried whole overnight, then gutted, skinned and pieces left to sun-dry for 3 to 5 days.	All species; used for larger fish to facilitate gutting.
	<i>Yeet</i>	Product obtained by anaerobic fermentation in plastic bags buried for 2-4 days. Exclusive to this species.	Cymbium (large water snail).
	Salted and dried	Salted for 3-4 days, de-scaled fish chunks are then left to sun-dry.	Mainly larger species such as shark, Capitaine (<i>Polydachylus quadrifilis</i>), etc.
		<i>Yokhoss</i> : dried oyster	Oysters
	<i>Méthorah</i> (smoking)	Product resulting from smoking over 24-72 hours. Mainly used for oily species as others produce unpalatable flesh.	Silurid, sharks, skate, sardine and Cobo <i>Ethmalosa</i> .
Improved or modern	Cold smoking	Industrial process.	Marine species (barracuda, tuna, etc.)
	<i>Surimi</i>	Cooked and blended product. The resulting pulp is reshaped and coloured. Cheap substitute to crab meats.	Capitaine, Otolithe, prawns, sardine.
	Modern drying and improved <i>Méthorah</i>	Industrial process.	Murex, <i>Arius sp.</i> , prawn, oyster.

Source: CAF6543

Average rates of conversion from fresh to processed product by species/method are shown in Table 4.11. Value added is limited in part by poor infrastructure and hygiene conditions. Post-fishing losses are high, representing 20-25% or as much as 50% under typical conditions (FAO 2001).³⁸ The improvement of fish processing and conservation methods is a key strategy for improving incomes without putting more pressure on the resource.

Table 4.11 Conversion rates for processed fish products

Product	<i>Méthorah</i>	<i>Tambadiang</i>	<i>Guedj</i>	Salted & Dried	Oysters
Net output (% of fresh product)	25-33%	≈100 %	33%	50%	69 kg fresh for 1kg dried (<i>yokhoss</i>)

Source: CAF6543

³⁸ Only 5% of post-fishing losses represent deterioration of the product beyond use, while the remainder may be classified as “economic” losses.

Commercialisation (CAF6543)

In both the Senegal River and Sine-Saloum regions, the distribution of freshwater fish products is concentrated in large trading centres, where wholesalers receive landings for onward shipment and sale further inland. Nevertheless, there are some important differences in the pattern of fish product distribution in the two regions.

The Sine-Saloum region enjoys the benefit of a dedicated Fishing Centre, located in Missirah. The centre supplies ice to the trade and provides an important market for landings, operating in parallel to purchases by local wholesalers.³⁹ Two other major distribution centres in the region are Ndangane and Sokone, while Betenty ensures the commercialisation of fresh prawns via three refrigerated trucks. For landings from the Senegal River, the urban centres of Richard-Toll and Saint-Louis play a double role of re-distributors and consumers. Although wholesalers are very active in proportion to the larger volume of landings, in this region they rarely participate in production and are more likely to have a background in commerce or agriculture.

The lack of refrigeration infrastructure is one of the biggest challenges limiting the commercialisation of continental fish products, followed by high post fishing losses and low conversion rates (CAF6543). Prawns are the only product to be transported fresh to industrial complexes in and around Dakar for processing and, in most cases, for export. Smoked products (*méthorah*), dominated by *Ethmalosa*, are also mainly exported to countries of the sub-region such as Burkina Faso, Ghana and Guinea, due to limited local demand. Foreign citizens of these countries resident in Senegal often participate in fish processing and distribution, or facilitating exports, e.g. through Gambia for products from the Sine-Saloum. Total exports were not estimated, but the main export products and destinations are shown in Table 4.12 (CAF6520).

Table 4.12 Exports of freshwater fish products

Species	Local name	Form of product exported	Destination
<i>Ethmalosa fimbriata</i>	Cobo	<i>Méthorah</i> (smoked) or fresh	Guinea Conakry, Gambia*
<i>Clarias spp.</i>	Conocono	<i>Méthorah</i> , salted or dried	Mali
<i>Penaues notialis</i>	Shrimps, Sipakh	Fresh	Europe
<i>Arius spp.</i>	Kong	<i>Méthorah</i>	Guinea Conakry, Gambia*
<i>Liza spp. & Mugil spp.</i>	Tambadiang	Fresh, salted or dried	Gambia*
<i>Mustulus spp.</i>	Gaindé guédj	Salted or dried	Gambia*
<i>Cymbium spp.</i>	Yeet	Fresh	Asia
<i>Thais spp.</i> <i>Semisefus spp.</i> <i>Murex spp.</i>	Touffa	Opercula (valve)	Middle-East
<i>Crassostrea gasar</i>	Mangrove oyster <i>Yokhoss</i>	Fresh or dried (<i>Yokhoss</i>)	Gambia*
<i>Arca senelis</i>	<i>Pagne</i>	Dried mollusc	Gambia*

Source: Dème M. and Diadiou, H.D. ISRA-CRODT, June 2000, interviews. (CAF6520)

*Note: Products are often re-exported from Gambia to onward destinations.

³⁹ Wholesalers often have a background in fishing and may invest in production by hiring seasonal and migrant fishermen. This implies that prices may be fixed at the beginning of each fishing season.

Consumers perceive a general decline in the availability and affordability of freshwater fish. However, this may not necessarily reflect declining fish stocks.

Local populations generally prefer fresh over processed fish products, and a large share of the household budget is devoted to the purchase of fish. For example, focus group discussions in the riverside town of Sokone revealed that women in households where no one is directly involved in fishing spend the largest portion of their food budget to purchase fish (FCFA 300-400 per day). The leading position of fish in spending was also encountered in Richard-Toll, where fresh water fish is king, although some cheap sea species also compete for consumer demand.

Growing interaction with migrants from other parts of Africa has influenced consumer tastes and habits, introducing new ways of processing and consuming fish. Direct competition with imported products is apparent in the case of fermented molluscs (*Yeet*), which were traditionally used as condiments but are increasingly replaced by industrial stock cubes despite their higher price (FCFA 30 compared to FCFA 15 for an equivalent quantity of *Yeet*).

Consumers in producing regions perceive a general decline in the availability and/or affordability of freshwater fish. This is attributed to demand-side competition from growing numbers of wholesalers and increased exports, as well as a perception that fish have become more elusive due to the increase in fishing activity.

4.3.3 Conclusion: The economic value of freshwater fisheries

Annual value added from freshwater fish production through to wholesale markets is estimated at between FCFA 10 and 14 billion per annum. This excludes additional value added in distribution to retail markets.

ISRA/CRODT estimated the total costs and value added from freshwater fisheries production in the two major regions studied, i.e. the lower reaches of the Senegal River and the Sine-Saloum delta (CAF6526 and CAF44 for methodology and CAF6543 for results). The resulting estimates are based on volumes and prices recorded for commercial sales over the study period, extrapolated from the survey sites to the sector as a whole.

Production costs are generally low. All non-labour inputs together represent 15% of the commercial value of landings. Most of this is fuel for the few fishing units that used motorboats, implying much higher unit costs for motorised fishing. Payments to hired labour may be in cash or 'in kind', in the form of a share of output. Non-labour inputs for processing and distribution are estimated at 25% and 40% of commercial value, respectively. Note that continental fisheries are not subject to taxation.

Added values for commercial sales of both fresh and processed fish (excluding payments to labour and capital) are estimated at FCFA 7.3 billion for the Senegal River area and FCFA 1.9 billion for the Sine-Saloum delta, or FCFA 9.2 billion per

annum in total (US\$12.9 million). These figures exclude own-consumption, which is estimated at 5-10% of total volume (Deme, M. 2001. Personal communication). They also exclude value added in distribution to retail markets, as well as the value of by-products of fish processing, e.g. shells for construction or fish guts for fertilizer or animal food. To put these results into perspective, they are equivalent to about 17% of estimated value added in the marine fisheries sector in Senegal (Table 4.13). The ratio of employment in the two sectors is similar, with about 70,000 engaged in marine fisheries (mostly artisanal) compared to 9-10,000 in the two continental fisheries for which data are available (Deme, M. 2001. Personal communication).

Table 4.13 Comparing continental and marine fisheries

Sector	Added value (Billion FCFA)
Marine fisheries*	54.7
Continental fisheries**	9.2

* Source: MEF 2001. Estimated for the year 2000.

** Note: Based on survey data for the Senegal River and Sine-Saloum only; excludes own-consumption and value added in the distribution of products to end use markets.

Including freshwater fisheries output in the Casamance region would add at least as much as the Sine-Saloum and possibly more, due to the high value of prawn fishing in the Casamance. With home consumption contributing at least another 5% the total value of the sector may be conservatively estimated at between FCFA 10.2 billion and 14 billion per annum (US\$ 14.5 to 19.6 million). These estimates exclude other areas of Senegal and most importantly the value added in the distribution of freshwater fish products to end use markets. The latter stage of the supply chain is likely to generate substantial added value, as we saw in the case of NTFPs and animal products, where distribution and marketing accounted for almost half of total value added. On this basis we may surmise that including value added from freshwater fisheries would increase total output in the fisheries sector by *at least* 19% and perhaps up to 50%.

5 General Conclusions and Policy Implications

The research carried out by IUCN and its partners in Senegal, briefly summarized in the preceding pages, has provided significant new information on the production, trade and consumption of non-timber forest products, game and freshwater fisheries. A major new dataset has been developed, which is beginning to provide important insights into the economic importance of wild resources.

Further dissemination and analysis of the data can help guide policy reforms and investment proposals, for more productive and sustainable use of wild resources in Senegal and other countries of the region. A priority for research and policy analysis is to explore the role of wild resources in new strategies for poverty reduction.

5.1 The Economic Value of Wild Resources

Non-timber forest products

Preliminary results indicate that NTFPs are mainly produced for sale, with about 10-20% destined for home consumption. Wild plants appear to be especially important to poorer households, contributing up to 50% of their total cash income. Rural producers earn about half of total added value, with the remainder going to wild product traders.

The “forest gate” value of NTFP harvests in the two major producing regions of Tamba and Kolda (actually surveyed and analysed), including both production for sale and home consumption, is estimated at FCFA 1.4 billion per annum (US\$2 million). If output in other regions of Senegal is added together with value added in distribution to urban markets, the annual economic contribution of NTFPs probably lies between FCFA 3.5 billion and 11.1 billion⁴⁰, with a median estimate of 4.5 billion (US\$ 6.3 million). These values are not normally included in conventional estimates of value added in the forest sector, which mainly comprise timber, fuel wood and charcoal. Including NTFPs in estimates of the economic contribution of forests would increase value added in the sector by about 14%, based on data for 2000.

The surveys reveal that different regions exploit different wild resources, reflecting variations in climate and other conditions. Thus in Tambacounda Region, the most important NTFP harvests in terms of volume are *Mbepp* gum and *Karité* butter, while in Kolda Region the dominant products are honey, palm oil and *neté*.

In terms of the sustainability of resource extraction, the survey data provide few hints, although many harvesters stated that the time needed to gather a particular volume of plant material had increased. Further analysis of the survey data is likely to provide additional insights into the management and use of NTFPs.

Game, bushmeat and other animal products

Bushmeat and other game products appear to contribute significantly to the nutrition and income of rural households, although reliable data are difficult to obtain due to the illegality of most traditional hunting. Limited information on was obtained from a small sample of households in some CR in Tambacounda Region, near the PNNK.

Wild birds (e.g. guinea fowls and partridges) were the most commonly noted animals hunted. Hunters also reported killing large game (e.g. buffalo, wart hog), but the data are not sufficient to draw conclusions regarding the frequency distribution of different prey species. Data on consumption of bushmeat are also probably unreliable, due to the reluctance of households to admit consuming animals caught illegally.

Animal by-products (e.g. skins, feathers, horns, teeth, etc.) are highly prized by local populations for ritual/medicinal purposes. They are also used as raw material in the production of craft items for export via the tourist trade. Trade in animal by-products could be worth as much as FCFA 56 million (US\$ 78,300) per year in Dakar alone.

Modern sport hunting on privately operated concessions has grown in importance in recent years, while live animal exports (specifically ornamental birds) have declined. Together with wildlife-based tourism (e.g. ‘photo safaris’), these officially sanctioned activities generate at least FCFA 1 billion per annum in value added. While detailed

⁴⁰ Note that this amount could be as high as 9 times that of producers (if all sold product runs through the full trade chain).

information on consumer willingness-to-pay is not available, limited data on official tax receipts from these activities suggests that the state, as the owner of the resource, captures only a small share of the potential producer surplus.

Freshwater (continental) fisheries

Freshwater fish, like NTFPs, are mainly produced for sale. Total value added from commercial sales of freshwater fish caught in the lower reaches of the Senegal River and the Sine-Saloum delta is estimated at FCFA 9.2 billion. The bulk of this value is concentrated in the Senegal River region. Total employment in the two regions varies between 9,000 and 10,000 people according to the season.

Assuming conservatively that production in the Casamance region contributes another FCFA 2 billion, and adding 5% for own-consumption by fishermen, we may obtain an estimate of the total value added from freshwater fisheries of about FCFA 10 billion to 14 billion per annum (US\$ 14.5 to 19.6 million). This is equivalent to 19-26% of the total value added estimated for marine fisheries in Senegal in 2000. Note however that for a fair comparison one would also need to include the additional value added in the distribution of freshwater fish products to retail markets.

In both the Senegal River and Sine-Saloum fisheries, the most important species are the *Ethmalosa* family (Cobo). However, while the Senegal River is rich in fish species it does not harbour as many marine invertebrates. Conversely, the Sine-Saloum delta presents a less diverse range of products but has an important seasonal harvest of molluscs. Another distinguishing feature of the delta is the relative importance of fishing on foot, especially during the dry season, and the dominance of women in harvesting molluscs as well as fish processing.

Demand for wild products

Focus group discussions with consumers revealed widespread use of wild products, as well as intriguing differences between urban and rural populations. Urbanization, migration and cross-cultural exchange seem to have resulted in greater diversity but also more homogenous use of wild products. This is most apparent in large cities, where consumers' knowledge and uses of wild plant resources (e.g. for food and medical purposes) seem more diverse, in spite of their distance from sources of supply. Consumption of bushmeat, on the other hand, is mainly limited to hunting regions and their periphery, possibly due to the illegal nature of most traditional hunting. Non-use values are not strongly felt by urban residents, while in rural areas they are linked to perceived super-natural forces. Contemplative use of wild species (e.g. eco-tourism) is limited to foreign tourists.

Many consumers believe that wild products are more important for poor households. This is thought to apply especially to the use of medicinal plants, in both rural and urban settings. If true, this would imply that as average incomes rise, consumption of wild products would not increase proportionally. Further analysis of the survey data is needed to validate this perception, focusing on the relation between household income and wild resource consumption while controlling for other factors. If the observation holds, it would reinforce arguments that wild resource use and management are central to poverty alleviation not only in rural areas but among deprived urban populations also.

No clear relation was observed between consumers' education, age or sex and the level of demand for wild resources, although there are some differences in uses. Thus women are generally responsible for acquiring wild products for the household, with the exception of bushmeat, which is a male preserve.

The perceptions of urban consumers with regard to the sustainability of wild resource use are based entirely on the availability and prices of products in the marketplace. Higher prices are taken as a sign of greater scarcity. Urban focus groups noted that weak prices and the consequent lack of investment in resource conservation are the greatest challenges for sustainable use of wild resources.

Urban consumers put more emphasis on the inconsistent quality of wild products, due to lack of product standards and inadequate regulation by local authorities. Word of mouth is the most important source of information about wild products, especially for low-income groups, while wealthier urban consumers also rely on modern media. In rural areas the use of wild products is still largely ruled by custom.

5.2 Orientations for Future Research

As a guide to further research on the economic value of wild resources in Senegal, it is worth reviewing some of the major gaps and shortcomings of the current study:

- The surveys of NTFP producers failed to include questions about household income and expenditure, hence it was not possible to assess the importance of wild resources to households in different income groups.
- Although certain women were approached during the surveys (i.e. mollusc collectors), in most cases the household representatives were male. This may have produced some gender bias in the resulting data.
- While detailed information on NTFP volume and value was collected in the ZSP, the data has yet to be analysed as in the two southern regions.
- The potential of the survey data for production modelling – particularly significant in the case of inland fisheries – has yet to be realised.
- Estimates of the share of output destined for different end use markets, as well as the value added in distribution, is tentative at best and in some cases missing altogether (i.e. inland fisheries).
- A major gap with respect to all wild resources concerns their biological status and the sustainability of harvests. This remains a priority area for future research.

5.3 Monitoring the Use of Wild Resources

Better information on wild resources is an essential input into national and regional planning and policy processes, as well as public and private investment decisions. Estimates of wild resource values can and should feed into macro-economic and sectoral forecasting, economic policy, and investment planning (both public and private), especially when these are likely to entail significant changes in land use, river water flows, or transport costs (e.g., road construction).

Information on the role of wild resources in household livelihood strategies is also an essential input in efforts to monitor and reduce poverty. Where wild resource values are high or of particular importance to poorer groups, conventional policy analyses

and investment appraisal results may need to be reconsidered. Community-based development interventions may also need to be revised, in light of new data on the relative importance of wild resources in household income and nutrition. In this regard, it is encouraging to note that natural resource management and the conservation of critical natural capital feature prominently in the government's recently published strategy for poverty reduction in Senegal.

A key challenge for future research in this area is to ensure that the information collected by IUCN on wild resource values and costs is adequately documented, maintained and made available to decision-makers. One priority is to produce and present information on wild resource production and consumption in a form that can be readily integrated into the national income accounts and other key indicators. This will require efforts to identify data needs in consultation with potential users, as well as procedures for maintaining and accessing the existing data.

Looking further ahead, permanent systems of data collection and analysis are needed to monitor both economic and ecological aspects of wild resource use. These should include methods for monitoring the production, distribution and consumption of wild resources on a periodic basis, taking account of the specific needs and capabilities of data users. They should build on existing market and resource monitoring systems maintained by state agencies. Economic monitoring may involve routine up-dates through annual market surveys, focusing on products selected on the basis of their total economic value, or their value to particular groups (e.g. poorer households). Another priority is to identify economic indicators that can be monitored at relatively low cost (e.g., price, quality, volume, origin). Mechanisms for involving wild product producers/traders in resource monitoring activities could also be explored.

As a complement to annual monitoring, one can also envisage further rounds of in-depth household surveys. As in the case of the national agricultural census, detailed surveys every 5 to 10 years are an invaluable means of assessing long-term trends in supply and demand. The aim of such surveys would be to monitor the role of wild resources in the household and national economy of Senegal on an on-going basis.

A major gap in research carried out to-date is the lack of information on wild resource stocks and the sustainability of harvesting. Significant efforts are required to develop appropriate methods for on-going monitoring of resource status. This could include efforts to identify certain 'index' species or products that can provide an overall assessment of the productivity of ecosystems (e.g. wild honey harvests). In some cases, rural communities may be enlisted to compile periodic data on selected sites or species.

Other areas where further research is required include:

- Quantitative analysis of the magnitude, trends and socio-economic determinants of demand for wild resources, including the significance of wild resources for poorer households, women and children;
- Production and marketing of wild resources in resource-poor regions;
- Rural-to-rural flows of wild products;
- Home consumption and the economics of marketing in the continental fisheries sector; and
- Continental fisheries outside the study zones targeted by IUCN.

5.4 Policies and Institutions for Sustainable Use of Wild Resources

Information on the value of wild resources is necessary but not sufficient to ensure their sustainable use, let alone to eliminate poverty. Supportive policies, institutions and procedures are also needed so that wild resource values are better reflected in public and private decision-making, and more productive and sustainable use of these resources is encouraged, particularly for the benefit of the poor.

There are many reasons why wild resources are often managed unsustainably, and why their potential contribution to poverty reduction is not fully realized. Among the most important factors in Senegal are:

- Poorly defined and/or insecure tenure over wild resources, favouring short-term opportunistic extraction over long-term sustainable management;⁴¹
- Lack of effective and affordable technologies to improve the yield and quality of wild products, resulting in low profits and limited demand;
- Lack of skilled labour and weak infrastructure, discouraging efforts to tap high-value markets such as sport-hunting and eco-tourism; and
- Subsidies that reduce the prices of competing products and services, or which increase competition for essential inputs such as land and water.

One major issue is the implication of government efforts to liberalize the economy for wild resources. Liberalization will create new opportunities and incentives to invest in wild resources, but it is also likely to increase pressure on resources. A priority for future research is to identify the key actors engaged in wild resource production, transformation and distribution, and to explore opportunities for (and constraints on) more efficient and productive use and marketing of wild resources.

Economic liberalization is also likely to stimulate activities that compete for markets with wild resources (e.g. imports of substitute goods), or that compete for inputs with wild resources (e.g. agriculture). In short, sustainability could be undermined if the policies and institutions needed to ensure effective management of wild resources are not in place. An important task is to identify those wild resources (and users) that are most vulnerable to economic trends and policy reforms, together with potential mitigating measures. Similarly, efforts should be made to identify on-going and proposed investments that are likely to have significant (adverse) impacts on wild resource users and values.

Another strategic policy affecting the use and management of wild resources is the decentralization of governance, initiated in 1972 with the legal recognition of rural communities, and reinforced since 1996 through the creation of elected councils at regional level. On the one hand this process should improve the management of wild resources, as policies and practices become more attuned to local needs and constraints. However, decentralization can also place new pressures on wild resources. For example, as the responsibilities and ambitions of local authorities

⁴¹ Legislation governing land tenure in Senegal dates from 1964 and distinguishes four categories, of which the largest is the *zones de terroir* comprising most agricultural lands. Individual use rights are recognized where land is managed “productively” (*mise en valeur*), typically excluding wild resources except in cases where an approved forest management plan has been registered.

increase, some may come to view the conservation of wild resources as an impediment to development. Case studies of experience on the ground can provide useful insight into the process of decentralization, and its impacts on the use of different wild resources.

Armed with a better understanding of the policy, institutional and socio-economic context, and the opportunities and threats that affect wild resources, the next step is to develop appropriate responses. The latter may include proposals for policy reform or changes in institutional responsibilities, development of new incentive measures or technologies, as well as feasibility studies for public and private investment. In all cases it is essential to involve a range of stakeholders in the process of formulating policy responses and investment proposals.

Where wild resources are not threatened by over-harvesting, potential development proposals could include:

- Technological options for increasing the efficiency of transformation and/or the conservation of products derived from wild resources (e.g. smoked fish);
- Encouraging investment in export-oriented and non-consumptive uses of wildlife (e.g. tourism and bio-prospecting); or
- Developing high value consumptive uses (e.g., sport hunting), subject to sustainability constraints.

In other cases the aim may be to ‘internalize’ sustainability constraints, or to level the playing field between wild resources and competing products/activities. A range of policy and institutional measures can be used in such cases, to modify the incentives and behaviour of producers, traders and/or consumers. While it is not possible to anticipate the feasible set of policy options, potential measures could include:

- Reform of tenure and licensing to clarify and strengthen rights of access, use and/or sale of wild resources, particularly for the benefit of poorer households;
- Introduction or reform of resource user charges (e.g., permit fees, royalties, taxes) to increase the recovery and reinvestment of wild resource revenues in more sustainable management;
- Redirection or reduction of government subsidies to competing sectors (e.g., marine fisheries) or to activities that compete with wild resources for land and water inputs (e.g., agriculture); and
- Development of wild resource certification schemes, to help traders and final consumers discriminate on the basis of product quality and/or sustainability.

User charges on the production and trade in wild products and services are likely to be a particular focus of concern, as government officials (local, regional and national) become more aware of the economic significance of wild resources. Such charges can provide important new revenue to local governments, at a time when demands on them are increasing. However, poorly designed or enforced charging systems can have significant adverse social and environmental impacts, or even perverse incentive effects. An important task is to assess the feasibility, potential revenue and impacts of introducing or raising user fees. This should include an assessment of willingness-to-pay for visits to national parks and for sport hunting by foreign tourists. Lessons should also be learned from experience with alternative charging systems in other sectors or countries.

VALEURS Project Technical Reports⁴²

Terrestrial resources

ISRA/BAME. (Févr. 1999) Ressources sauvages de la région de Kolda : diagnostic participatif du 23/01 au 03/02/1999 (CAF657)

ISRA/BAME. (Févr. 1999) Ressources sauvages de la région de Tambacounda : diagnostic participatif (CAF658)

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⁴² For purposes of identification all publications of the VALEURS project are given a reference code of the form: CAF00... (some of the reports have two codes). Technical reports listed here are grouped under general thematic headings and in chronological order of publication.

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Diouf Niasse, S. (Oct. 2001) Evaluation socio-économique des ressources végétales: cas de *Cordyla pinnata* (Dimb) à Karang Poste et *Detarium senegalense* (Ditakh) à Bettenty. (CAF6548)

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ISRA/CRODT. (Juin 1999) Protocole de recherche : programme ressources halieutiques continentales (CAF41)

ISRA/CRODT. (Mars 2000) Résultats généraux de second recensement cadre (saison des pluies) des unités de pêche (25 octobre au 05 novembre 1999). (CAF6518)

Deme, M., Diadhiou, H.D. & Thiam, D. (Oct. 2000) Recensement des unités de pêche dans les zones géographiques du fleuve Sénégal et du complexe deltaïque du Sine Saloum en 1999. ISRA/CRODT : Dakar-Thiaroye (CAF6522couv, CAF6522txt)

ISRA/CRODT. (Oct. 2000) Dictionnaire des sites de débarquement du delta et de la basse vallée du fleuve Sénégal en 1999. (CAF6523)

Diadhiou, H.D. & Thiam, D. (Oct. 2000) Dictionnaire des sites de débarquement du Sine Saloum en 1999. ISRA/CRODT : Dakar-Thiaroye (CAF6524couv, CAF6524txt)

Deme, M. (Janv. 2001) Estimation de la valeur économique des ressources halieutiques continentales: approche méthodologique. ISRA/CRODT : Dakar-Thiaroye (CAF43, CAF6526)

Deme, M., Diadhiou, H.D., Ndiaye, V. & Thiam, D. (Mars 2001) Prix au débarquement du poisson en milieu continental: Méthodologie de collecte et premières tendances. ISRA/CRODT : Dakar-Thiaroye (CAF6531couv, CAF6531txt)

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Annex 1. Supplementary data and sample survey forms

Table A.1 : Receipts from the sale of hunting permits in Saint-Louis Region

Désignation	Année 97 / 98		Année 98 / 99		Année 99 / 2000	
	Nbre	Recettes	Nbre	Recettes	Nbre	Recettes
<u>Permis spécial Gibier d'eau</u>						
Résident	13	390 000	12	360 000	26	780 000
Touriste CD	124	1 860 000	163	2 445 000	120	1 800 000
Touriste LD	1	45 000	2	90 000	1	45 000
<u>Permis Petite Chasse</u>						
Résident	6	90 000	11	165 000	20	300 000
Touriste CD	154	2 320 000	192	2 880 000	130	1 950 000
Touriste LD	-	-	2	90 000	1	45 000
<u>Divers permis</u>						
Permis coutumier	-	-	2	6 000	2	6 000
Attestation de pisteur	11	110 000	14	140 000	13	130 000
Licence Zone amodiée	6	1 800 000	6	1 800 000	8	2 400 000
Attestation de ramasseur	-	-	-	-	2	10 000
Amodiation	-	2 324 000	-	829 500	-	4 965 000
Taxe d'entrée ZIC	-	-	-	-	-	-
Taxe d'abattage phacochère	23	345 000	42	630 000	15	225 000
Contentieux	4	650 000	1	30 000	-	-
Total		9 942 000		9 465 000		11 856 000

Tableau A.2 : Receipts from the sale of hunting permits in Tambacounda region

Désignation	Année 97 / 98		Année 98 / 99		Année 99 / 2000	
	Nbre	Recettes	Nbre	Recettes	Nbre	Recettes
Permis spécial Gibier d'eau						
Résident		-		-	1	30 000
Touriste 1 semaine		-	17	255 000	16	240 000
Touriste 2 semaines		-		-	1	25 000
Permis Petite Chasse						
Résident	14	210 000	8	120 000	20	300 000
Touriste 1 semaine	65	975 000	533	7 995 000	491	7 365 000
Touriste 2 semaines	7	175 000	41	1 025 000	28	700 000
Touriste 1 mois	-	-	1	45 000	1	45 000
Permis Grande Chasse						
Résident	5	225 000	16	720 000	10	450 000
Touriste 1 semaine	52	1 560 000	147	4 410 000	124	3 720 000
Touriste 2 semaines	-	-	17	850 000	-	-
Touriste 1 mois	-	-	1	90 000	-	-
Reconversion						
PPC/R en PGC/R	2	60 000	1	30 000	1	30 000
PPC/T 1 s en PGC/T 1 s	-	-	2	30 000	4	60 000
PPC/T 1 s en PPC/T 2 s	-	-	2	20 000	-	-
PPC/T 2 s en PPC/T 2 s	-	-	2	50 000	-	-
PGC/T 1 s en PGC/R	-	-	1	15 000	-	-
PPC/T 2 s en PGC/T 1 s	1	5 000	-	-	-	-
Taxes d'abattage						
Lion	2	900 000	2	900 000 ⁴³	-	-
Buffle	2	600 000 ⁴⁴	1	200 000	-	-
Hippotrague	-	-	4	800 000	3	600 000
Bubal	-	-	1	100 000	-	-
Guib harnaché	5	300 000	2	120 000	3	180 000
Ourébi	3	120 000	1	40 000	-	-
Céphalophe	5	200 000	3	120 000	3	120 000
Cynocéphale	1	10 000	3	30 000	2	20 000
Koba	7	1 400 000	-	-	-	-
Divers permis et taxes						
Permis coutumier	7	21 000	9	27 000	7	21 000
Licence de pisteurs locaux	7	35 000	4	20 000	1	5 000
Professionnels	60	600 000	69	690 000	65	650 000
Taxe de séjour	36	72 000			161	322 000
Licence Zone amodiée	10	3 000 000	17	5 100 000	19	5 700 000
Attestation de ramasseur	-	-	11	55 000	-	-
Amodiation droit de chasse		18 791 000		23 464 000		28 235 000
Taxe d'abattage 1 ^{ère} phacochère	222	3 330 000	292	4 380 000	191	2 865 000
2 ^{ème} phacochère	2	40 000	13	260 000	3	60 000
Transactions de chasse	-	-	1	250 000	2	1150 000
Total		32 329 000		52 211 000		52 893 000

⁴³ 1 lion : 300 000 F et 1 lionne : 600 000 F

⁴⁴ Buffle 1 mâle : 200 000 F et 1 femelle : 400 000 F

Table A.3 Scientific and French names for birds and other wild animal exports

Scientific name	French name
<i>Amadina fasciata</i>	Cou coupé
<i>Amandava subflava</i>	Ventre orange
<i>Columba guinea</i>	Pigeon rônier de Guinée
<i>Estrilda caerulescens</i>	Queue-de-vinaigre
<i>Estrilda bengala</i>	Cordon bleu
<i>Estrilda larvata</i>	Amaranthe masquée
<i>Estrilda melpoda</i>	Joues oranges
<i>Estrilda troglodytes</i>	Bec de corail cendré
<i>Euplectes afer</i>	Vorabé
<i>Euplectes hordeaceus</i>	Monseigneur
<i>Euplectes macrourus</i>	Veuve à dos d'or
<i>Euplectes orix</i>	Ignicologe
<i>Lagonosticta senegala</i>	Amaranthe commun
<i>Lonchura cantans</i>	Bec d'argent
<i>Lonchura cucullata</i>	Spermette nonnette
<i>Lonchura malabarica</i>	Bec d'argent
<i>Oena capensis</i>	Tourterelle du cap
<i>Ploceus culcullatus</i>	Tisserin gendarme
<i>Ploceus luteolus</i>	Tisserin minule
<i>Ploceus melanocephalus</i>	Tisserin à tête noire
<i>Ploceus vitellinus</i>	Tisserin à tête masquée ou rousse
<i>Poicephalus senegalus</i>	Yoyou perroquet du Sénégal
<i>Psittacula krameri</i>	Perruche à collier
<i>Pytilia phoenicoptera</i>	Diamant aurore
<i>Serinus leucopygius</i>	Chanteur d'Afrique
<i>Serinus mozambicus</i>	Serin du Mozambique
<i>Sporopipes frontalis</i>	Moineau à moustache
<i>Streptopelia senegalensis</i>	Tourterelle maillée
<i>Treron waalia</i>	Pigeon vert ou à épaulettes violettes
<i>Turtur abyssinicus</i>	Émerauldine à bec noir
<i>Turtur afer</i>	Émerauldine à bec rouge
<i>Uraeginthus bengala</i>	Cordon bleu
<i>Vidua chalybeata</i>	Combassou du Sénégal
<i>Vidua macroura</i>	Veuve dominicaine
<i>Vidua orientalis</i>	Veuve à collier d'or
<i>Estrilda larvata</i>	Amaranthe masqué
<i>Quelea quelea</i>	Travailleur à bec rouge
<i>Quelea erythrops</i>	Travailleur à tête rouge
<i>Passer luteus</i>	Pinson doré
<i>Spreo pulcher</i>	Étourneau à ventre roux
<i>Lamprotornis purpureus</i>	Merle métallique pourpré
<i>Lamprotornis caudatus</i>	Merle métallique à longue queue
<i>Lamprotornis chalybaeus</i>	Merle métallique commun

<i>Psittacula erithacus</i> *	Perroquet gris du Gabon
<i>Pterocles exustus</i>	Ganga
<i>Cercopithecus asthiops</i>	Singe patas
<i>Erythrocebus patas</i>	Singe rouge
<i>Papio anubi</i>	Cynocephale
<i>Python sebae</i> **	Python
<i>Varanus niloticus</i> **	Varan
<i>Crocodylus niloticus</i> *	Crocodile

Nb : * re-exported ; ** crafts

Table A.4 Fauna encountered

Indigenous name	French Name	Scientific name
<i>Mbët</i>	Varan des sables	<i>Varanus exanthematicus</i>
<i>Bar</i>	Varan des eaux	<i>Varanus nilotica</i>
<i>Saaw</i>	Porc épic	<i>Hystrix cristata</i>
<i>Til</i>	Chacal commun	<i>Canus aureus</i>
<i>Mbonaat</i>	Tortue	
<i>Golo</i>	Chimpanzé	<i>Pan troglodytes</i>
<i>Lebeer</i>	hippopotame	<i>Hippopotamus amphibius</i>
<i>Mbaam al</i>	phacochère	<i>Phacochoerus aethiopicus</i>
<i>Leuk</i>	Lièvre	<i>Lepus saxatilis</i>
<i>Kewel</i>	Antilope	<i>Hippotragus equinus</i>
<i>Pitax al</i>	Tourterelle	<i>Streptopelia decipiens</i>
<i>Tioker</i>	Francolin	<i>Francolinus bicalcaratus</i>
<i>Naat</i>	Pintade	<i>Numida meleagris</i>
<i>Pitax al</i>	Pigeon sauvage	<i>Columba unicincta</i>
<i>Djassig</i>	Crocodile	<i>Crocodylus niloticus</i>
	Lamantin	<i>Trichechus senegalensis</i>
<i>Diaar</i>	Rat palmiste ou écureuil fouisseur	<i>Xerus erythropus</i>
<i>Sikor</i>	Civette	<i>Viverra civetta</i>
<i>Golo</i>	Singe roux	<i>Erythrocebus patas</i>
	L'élán de derby	<i>Taurotragus derbianus</i>
<i>Yèw</i>	Python	<i>Python sebae</i>
<i>Bouki</i>	Hyène rayée	<i>Hyena hyena</i>
<i>Tan</i>	Vautour	<i>Neophron monachus</i>

Table A.5 Wild Plant resources presented

Indigenous name	French Name	Scientific name
Mbepp	mbèp	<i>Sterculia setigera</i>
Bouy	Pain de singe	<i>Adansonia digitata</i>
Daxaar	Tamarin	<i>Tamarindus indica</i>
Séxaw	Quinquéliba	<i>Combretum micranthum</i>
Rat		<i>Combretum glutinosum</i>
Ngèr		<i>Guiera senegalensis</i>
Saap saap (Nebadaay)		<i>Moringa oleifera</i>
Caxat		<i>Leptadenia hastata</i>
Ditax		<i>Detarium senegalensis</i>
Golàn		<i>Ximelia americana</i>
Nep nep		<i>Acacia adansonii</i>
Loro		<i>Ficus iteophylla</i>
Danx		<i>Detarium microcarpum</i>
Kel		<i>Crevia bicolore</i>
Senjeen		<i>Cassia sieberiana</i>
Yoroxlaane		<i>Ceratotheca sesamoides</i>
Barakh	Tiffa	<i>Tiffa latifoyides</i>
Njibis	Scorbolis	<i>Eragrostis tenella</i>
Maad		<i>Saba senegalensis</i>
Seng		<i>Acacia radiana</i>
Soump		<i>Balanites aegyptiaca</i>
Sidèm	jujubier	<i>Zizyphus mauritania</i>
Sourour		<i>Acacia seyal</i>
Ron	Rônier	<i>Borassus aethiopum</i>
Bambu	Bambou	<i>Oxytenanthera abyssinica</i>
Santan	Santan	<i>Daniellia oliveri</i>
Tiir	Palmier à huile	<i>Elaeis guineensis</i>
Uul	Néré	<i>Parkia biglobosa</i>
Mbantemara		<i>Cassia occidentalis</i>
Ndur		<i>Cassia tora</i>
Gang		<i>Ficus gnaphalocarpa</i>
Diaxar	Nénuphar	<i>Nymphaea lotus</i>
Salaan		<i>Euphorbia balsamifera</i>
Solom		<i>Dialium guineense</i>
Mampatam		<i>Parinari excelsa</i>
Njandam		<i>Bossia senegalensis</i>
Nèw		<i>Parinari macrophylla</i>
Tol		<i>Landolphia heudelotii</i>
Khay		<i>Khaya senegalensis</i>
Mbêr bèf		<i>Momordica balsamina</i>
Dugor		<i>Annona senegalensis</i>
Lêng		<i>Vitex madiensis</i>
Karute	Karité	<i>Vitellaria paradoxa</i>

Table A.6 Dictionaries of fish landing sites
(Sample data sheet for Sokone, in the Sine-Saloum).

SOKONE			
Région	Département	Communauté Rurale	
Catégorie			
<i>Fatick</i>	<i>Foundiougne</i>	<i>Sokone</i>	<i>Permanent</i>
Zone Ecologique :		DIOMBOSS CONTINENT	

ACCES : Route bitumée et voie fluviale (bolong)

	NOMBRE D'UNITES DE PÊCHE						NOMBRE DE PECHEURS		
	AVEC PIROGUE				SANS PIROGUE	TOTAL UP			
	<i>Maritime</i>	<i>Continental</i>	<i>Mixte</i>	<i>Sous Total</i>			<i>Hommes</i>	<i>Femmes</i>	TOTAL
SAISON SECHE	0	0	0	0	0	0	0	0	0
SAISON DES PLUIES	0	4	5	9	2	11	55	0	55

MIGRATION

Origine des immigrants	: Djirnda, Bassoul, Ngadior
Saison d'immigration	: Toute saison
Destination des émigrants	: Joal
Saison d'émigration	: Période de pêche du poulpe

PECHE

Principales espèces débarquées	: Ethmalose, Mulets, Tilapies, Bandas et Brochets
Saison et types de pêche utilisés	: Filets, Senne de plage et Yolal (Toute saison)
Lieu de débarquement	: Sokone
Destination des produits frais	: Autoconsommation, Micro mareyage et Mareyage
Types de produits transformés	: Métorah en avril
Destination des produits transformés	: Commercialisation à Kaolack

INFRASTRUCTURES ET SERVICES

DOPM	Oui, Poste Départemental	Groupements	1 GIE
Mécaniciens	2 Mécaniciens	Glace	Alimentaire
Carburant	1 station	Charpentiers pirogues	2 Charpentiers
Enseignement	1 CEM, 1 école Primaire et 3 Alphabétis.	Fabricants de casiers	Non
Santé	District de santé (Centre et Maternité)	Gendarmerie	Oui
Poste et Télécommunication	Oui	Police	Non
Autres Administrations	Oui	Eau	Courante
		Electricité	Oui

COMMENTAIRES

Un grand marché hebdomadaire y est organisé. C'est un des principaux lieux d'écoulement des produits transformés d'origine continentale ou insulaire. Les pirogues venant s'y ravitailler en carburant et eau douce apportent les produits séché sur les îles.

Table A.7 Markets visited by ISRA/BAME

1	Lamine Diack (Gare)	36	Makilipir
2	Elizabeth (Port)	37	Sare Sekouna
3	Tilene	38	Prokhane
4	Blaise Diagne	39	Mako
5	Soumbédioune	40	Fongolimby
6	Syndicat	41	Kedougou
7	Foutah	42	Dindefelo
8	Diaobe	43	Guinee
9	Dakar	44	Saraya
10	Casamance	45	Kothiary
11	Mboul	46	Bala
12	Dawady	47	Hamdalaye T Thiocoye
13	Sare Faring	48	Salemata
14	Sare Diawly	49	Mariniere Pont
15	Kouthiacoto	50	Medina Coura
16	Kalbiram	51	Quinzambougou
17	Diaraboguel	52	Maleme Wok Wok
18	Halte Fass	53	Fongo
19	Koussanar	54	Khossanto
20	Medina Ofadac	55	Santhiou Ndene
21	Pirgoundo	56	Boundou
22	Boudou-Boudou	57	Thies
23	Kouthiagaidy	58	Kolda
24	Patoulane	59	Diana
25	Maleme Niani	60	Kabendou
26	Boulimanga	61	Sare Yoro
27	Santhiou Maleme	62	Medina Ofadac
28	Touba	63	Mali
29	Ouromolo	64	Aere Lao
30	Tamba	65	Gambie
31	Dakar	66	Bignona
32	Kaolack	67	Diourbel
33	Fatma Sare	68	Thies
34	Santhiou Wague	69	Kounkane
35	Ndatou Ndiabar	70	Parcelles assainies

**Table A.8 Annual value added along the supply chain (for a composite NTFP)
Rural areas to provincial towns Axes**

Agents along the chain (ZSP - TOUBA)	Sales volume (kg/yr)	Sales revenue (FCFA/yr)	Value added (FCFA/yr)	V.A. (FCFA/kg)	V.A. (%/kg)
Rural household	400	146,000	128,960	357	49.3
<i>Bana-bana</i>	6,000	3,480,000	1,194,000	199	27.5
Wholesaler	3,000	2,100,000	315,000	105	14.5
Retailer	600	480,000	37,500	62.5	8.6
Total value added				723.5	
Retail price (Touba)				800	

Agents along the chain (South - KAOLACK)	Sales volume (kg/yr)	Sales revenue (FCFA/yr)	Value added (FCFA/yr)	V.A. (FCFA/kg)	V.A. (%/kg)
Rural household	267	69,333	67,352	251	53.4
<i>Bana-bana</i>	7,200	2,340,000	101,250	14	3
Wholesaler	2,400	1,140,000	312,000	130	27.6
Retailer	360	216,00	27,000	75	16
Total value added				470	
Retail price (Kaolack)				600	

Agents along the chain (South - THIES)	Sales volume (kg/yr)	Sales revenue (FCFA/yr)	Value added (FCFA/yr)	V.A. (FCFA/kg)	V.A. (%/kg)
Rural household	233	60,667	58,567	251	51.2
<i>Bana-bana</i>	6,300	2,047,500	49,950	8	1.6
Wholesaler	2,100	1,050,000	326,250	155	31.5
Retailer	420	252,000	96,900	77	15.7
Total value added				491	
Retail price (Thies)				600	

Annex 2. The VALEURS Project Database

Game (SPSS format):

Households (Kolda and Tambacounda regions): **faune.sav** + **dictionary** (from questionnaire #9 “Faune et sécurité alimentaire”)
Socio-economic variables⁴⁵, expenditures and investment with income generated by hunting, game species consumed, hunting areas, frequency of consumption.

Hunters (Kolda and Tambacounda regions): **chasseur.sav** + **dictionary** (from questionnaire # 10 “Destiné aux chasseurs”)
Socio-economic variables ([–] general cash income from all activities), game hunted, quantities sold, prices, transport costs, methods of distribution

Plant resources (SPSS format):

Households (Kolda and Tambacounda regions and ZSP): **cmenage.sav** + **dictionary** (from questionnaire # 2 “Chefs de ménage”)
Socio-economic variables, livestock assets, transport means, level, frequency and kind of wild products’ consumption.

Profile of producers (Kolda and Tambacounda regions and ZSP): **caracter.sav** + **dictionary** and **caract_zsp.sav** + **dictionary**. (from questionnaire “Caracterisation des exploitants”)

Socio-economic variables ([–] general cash income from all activities), perception of the impact on wild resources of population growth, perception of access to resources, biological knowledge of resources, perceived threats to resources, reasons for exploiting resources (uses). Also, information concerning the existence of traditional user rights has been collected along side limited data on existing resource managing systems.

Production levels & prices and commercialisation circuits. (Kolda and Tambacounda regions and ZSP):

- *Producers: exploitant.sav* + without separate dictionary (from questionnaire #1 “Exploitants”)

Location, primary and secondary economic activity, cash income, expenditures.

Information regarding the organisation and costs (including time and people at work) of production, transformation and commercialisation. Volume, kind and prices of products have been registered for the sample.

- *Itinerant traders (bana-bana): banareg.sav* + **dictionary** and **banabana_sylvo.sav** + **dictionary** (from questionnaire “Caracterisation des agents de commercialisation -collecteur/bana bana”)

Location, residence, ethnic background, education and duration in the activity.

⁴⁵ Socio-economic variables include: location, age, sex, ethnic background, religion, marital status, education, household composition when only the head of household is interviewed, primary and secondary economic activity, cash income, expenditures.

Costs (intermediaries, inputs, taxes etc...) of commercialisation, kind and prices of products and finally the nature of contacts once in the market place. The perceived stability of the demand is also documented.

- **Wholesalers: *sgros.sav* + dictionary** (from questionnaire “Grossistes”) Location and duration in the activity. Costs (intermediaries, inputs, taxes etc...) of commercialisation, kind of products and finally the nature of contacts once in the market place. The perceived stability of the demand is also documented.
- **Markets: *smarche.sav* + dictionary and *marche_suivi_sylvo.sav* + dictionary.** (from questionnaires # 3 “Suivi de marché de collecte primaire”, #5 “suivi de marches de gros et de distribution” and #8 “suivi des marches urbains”) Location. Residence, ethnic background and education of retailer approached. Volume, kind and producer’s and market’s prices of products (these can be of animal origin). Costs involved in commercialisation and nature of customers are included.
- **Pharmacopoeia: *pharmaco.sav* + dictionary.** (from questionnaire currently unavailable) Location. Residence, ethnic background and education of retailer approached. Volume, kind and producer’s and market’s prices of products (these can be of animal origin). Uses of products are also indicated in this survey. Costs involved in commercialisation and nature of customers is enquired about.

Continental fisheries (EXCEL format):

Questionnaires are available in *ISRA/CRODT. (Oct 2000) - Recensement des unités de pêche dans les zones géographiques du fleuve Sénégal et du complexe deltaïque du Sine Saloum en 1999. (CAF6522couv, CAF6522txt)*

Variable dictionaries for all CRODT files are gathered in :

ISRA/CRODT (2002) Note explicative de la base de données ISRA/UICN-VALEURS.

- *Preliminary surveys of the rainy and dry seasons in the Senegal River and Sine-Saloum (these were completed by the information under the format “dictionnaires”).* **Bases de données sur le recensement des unités de pêche** Location, date, head of fishing unit, boat, gear, species.
- *Frequent surveys in the sites selected following the trends given by the preliminary surveys.*
 - 1) **Bases de données sur les sites de débarquement**
Location, date, gear used, quantities and time needed were accounted for.
 - 2) **Bases de données sur les prix au débarquement**
Location, date, gear used, species, price.