Djibouti Biodiversity: Economic Assessment

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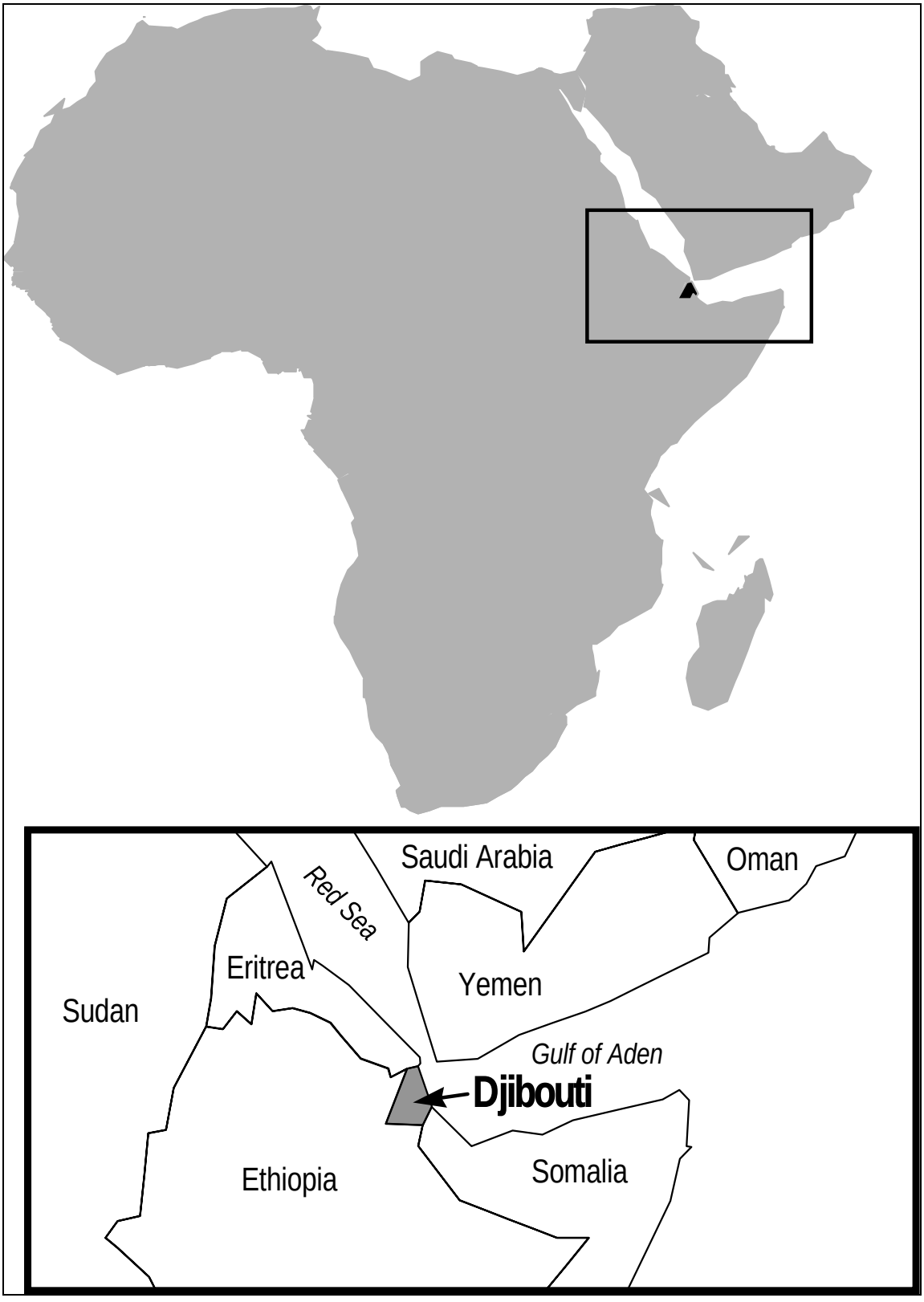
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1. INTRODUCTION

1.1 Background to the assessment

This assessment was carried out between October 17-31 1998. The terms of reference for the assessment were to:

i) Provide basic training materials, including a manual of economic tools for biodiversity planning, and create an awareness of the use of economics for biodiversity conservation;
ii) Carry out an assessment of the major impacts of current and planned national economic policies and strategies on biological resource use and conservation; the economic value of biodiversity in the main sectors of the economy; the possible economic impacts of biodiversity loss including consideration of national and sectoral income, income distribution, foreign exchange earnings and employment; and the possible positive economic impacts of improved biodiversity conservation;
iii) Provide assistance in developing and presenting recommendations for economic measures and instruments which can act as incentives and financing mechanisms for the conservation and sustainable use of biodiversity in Djibouti.

The economic assessment forms a component of a wider assessment of Djibouti's biodiversity being carried out by the Bureau Nationale de la Diversité Biologique (BNDB) of the Government of the Republic of Djibouti, as part of the preparation of a National Biodiversity Strategy and Action Plan.

The assessment relied on the support and assistance of Mohamed Ali Moumin (Directeur de l'Environnement, Ministère de l'Environnement, du Tourisme et de l'Artisanat), and of Omar Habib and Chris Magin of BNDB.

It also benefited greatly from discussions held with Ahmed Djibril Darar (Chef de Service des Pêches), Hassan Ali (Chargé de Programme et Responsable de l'Environnement au PNUD), Idriss Abdillahi Orah (Chef de Project UCSALP), Mohamed Awaleh (Secretaire Général du Ministère de l'Agriculture), Mohamed Moussa (Chef de Service Agriculture et Forêt) and Mohamed Zikieh (Directeur de la Planification) as well as from information kindly provided by Sarl de Mer Rouge Pêche and the Plan Action pour l'Environnement/DINAS.

All data in this report refer to gross values expressed at current prices unless otherwise indicated. At the time of writing US$ 1 was equivalent to 177.72 Djibouti Francs (FD).

1.2 Constraints and limitations to the assessment

The most binding constraint to carrying out an economic assessment of Djibouti's biodiversity is lack of data. There is no published or compiled information on the economics of biodiversity for Djibouti, and little up to date economic, environmental and biodiversity data for the country. Different data sources are often contradictory, or present widely differing estimates of the quantity and diversity of biological resources, their use and value.

Economic aspects form one of the final stages of biodiversity assessment in most countries because they rely so much on the information provided by other components – for example social, institutional, policy, biological and ecological aspects. Unusually, the BNDB decided that economic analysis should precede all other components of the biodiversity assessment in Djibouti. No other BSAP documents were therefore available to the consultant. This led to major problems in carrying out this study. The short time allocated to the economics assessment – at a total of 15 days, only just over half as long as the time allowed for economic aspects of BSAPs in other countries of Eastern Africa, also seriously constrained the coverage and quality of this study.

Because of the dearth of available material presenting a broad overview of the Djiboutian economy, dealing with levels and types biological resource utilisation or analysing the role of biodiversity in local and national economies, these topics are presented in some detail in this report. The primary data statistics upon which calculations are based are presented in the data annex to this report.

Where biodiversity economics analysis has been carried out for Djibouti it is important to recognise that the resulting conclusions and figures are partial, and rely on a number of unproved hypotheses and assumptions. The results of the assessment should be seen as a minimum estimate of the economic value of Djibouti's biodiversity, and inevitably exclude a number of biodiversity benefits – especially non-commercial activities and non-market values. The total economic value of biodiversity, and total economic costs associated with its loss, far exceed those which have been able to be quantified in this report.

Caution should therefore be exercised in interpreting the quantified data contained in this report. This assessment comprises a first attempt to look at the economics of biodiversity conservation for Djibouti – it provides only a number of indicative values and recommendations which have been generated for planning and management purposes, and should not be seen as definitive or absolute.

2. ECONOMIC STRUCTURE, POLICY AND BIODIVERSITY

2.1 Overview of the Djibouti economy

Djibouti covers a land area of some 23,300 km^2 and has jurisdiction over an exclusive economic zone of 7,190 km^2 of sea[1]. It lies in the Horn of Africa at the entrance to the Red Sea, and is bordered by Eritrea, Ethiopia and Somalia. What is now the present-day state of Djibouti was created in the 19th century by France as the *Territoire Français des Afars et des Issas*, after the opening of the Suez canal in 1869, as a bunkering station for ships travelling between Europe, Asia and Eastern Africa. The opening of a rail link with Addis Ababa in 1917 further increased Djibouti's role as a transit station for both passengers and freight. Djibouti gained independence from France in 1977.

Today Djibouti still functions as a major port, transit and communications hub for the Horn of Africa. Although advances in shipping and aircraft technologies have overcome the need for a refuelling point, the country continues to be of strategic importance by virtue of its position at the mouth of the Red Sea close to the Gulf States. Djibouti also represents a country with relative political stability, economic freedom and modern financial, transport and communications infrastructure in an otherwise underdeveloped region which is subject to recurrent civil unrest and economic uncertainty.

2.1.1 Population

The 1998 population of Djibouti is officially estimated to be in the region of 600,000 persons, comprised of two main ethnic groups – the Afars (related to tribes in eastern Ethiopia) and the Issas (related to tribes in northern Somalia), both traditionally pastoralist populations. Unlike other countries in sub-Saharan Africa the population of Djibouti is predominantly urban – three quarters live in towns and cities, and over two thirds are concentrated in the capital, Djibouti Ville. Population is estimated to be growing at a rate of some 3% overall, and 5-6% in Djibouti Ville[2]. As well as a small but significant minority of Yemenis and French residing in the capital, Djibouti contains a substantial population of refugees and immigrants from surrounding countries. In 1991 the foreign population of Djibouti was estimated to be 61,400 (or approximately 11% of total population), including 5,000 expatriate French (World Bank 1998).

Table 1: Population estimates for Djibouti 1983-98

Year	Population estimate	Source
1983	330,000	*World Bank 1984*
	341,000	*Government*
1986	393,000	*World Bank 1991*
	456,000	*Government*
1988	500,000	*CNE 1991*
1989	510,000	*CNE 1991*
1991	520,000	*Government*
1994	570,000	*United Nations*
1996	420,000	*World Bank 1998*
1998	± 600,000	*Government*

[1] Comprised of 4,877 km^2 of territorial waters, a 1,513.5 km^2 contiguous zone and 799.5 km^2 economic zone (El Gharbi 1987).

[2] At least half of this high growth rate is accounted for immigrants from rural areas and neighbouring countries (World Bank 1998). The foreign proportion of Djibouti's population was estimated to have grown from 3% in 1983 to 11.5% in 1988 (CNE 1991).

It is important to note that the exact population of Djibouti is uncertain. Although national censuses were carried out in 1983 and 1991, their results were disputed both by government and by international agencies. As illustrated in Table 1, many – widely varying – estimates of Djibouti's population have been made over the last decade and a half.

Various factors contribute to this uncertainty about population numbers. The nomadic lifestyles and physical inaccessibility of most the rural population of Djibouti make it difficult to carry out any kind of census, and resulting figures are necessarily partial and approximate. There have also been large and variable influxes and outflows of both official refugees and unregistered immigrants at different times over the last three decades. Although it has been estimated that some 40-50,000 immigrants found asylum in Djibouti between the mid 1970s and mid 1980s (World Bank 1984), that in 1990 there were a total of 60,000 refugees and immigrants of whom over 11,000 were unregistered (World Bank 1991) and that some 120,000 Somali and Ethiopian refugees entered Djibouti during 1991 (World Bank 1998), the exact refugee population is unknown. These figures however suggest that, today, more than a tenth of Djibouti's population may be accounted for by expatriate workers, refugees and unregistered immigrants.

2.1.2 Economic status

According to the UN classification system, Djibouti belongs to the Least Developed Country (LDC) group of states. Although national income is relatively high compared to other LDCs in sub-Saharan Africa – per capita GDP is in the region of US$ 800 – this figure is distorted upwards by a small cadre of well-paid civil servants and the high cost of living in the capital. Whereas a minority of government and private sector employees have an estimated GNP per capita of over US$ 1,000, most Djiboutians live at or below the subsistence level with an estimated per capita GNP of approximately US$ 300. The incidence of poverty is high with nearly half of the total population living below the poverty level[3] and a tenth living in extreme poverty[4], and almost 90% of rural households are classified as poor (World Bank 1998).

2.2 Economic structure and composition

Djibouti's economy is characterised by extreme duality, as it is divided between a modern, outward-looking urban commercial sector and a rural, subsistence-based pastoralist economy which has little access to infrastructure, services and markets. Changes which have taken place over recent decades in national economic indicators and activities have had little impact on the rural population, who continue to engage in semi-nomadic, subsistence-level livestock production activities largely unaffected by economic decisions made in the capital.

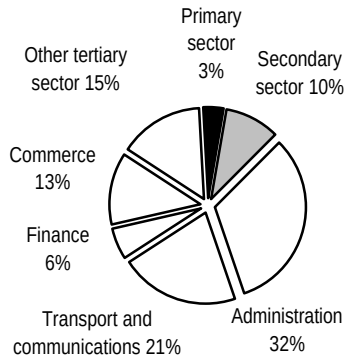
[3] Defined as households with expenditures below a level necessary to provide for basic needs (World Bank 1998).

[4] Defined as households unable to purchase foodstuffs required necessary to maintain a minimum level of calorific consumption (World Bank 1998).

2.2.1 Composition of the economy

Since its creation, Djibouti's economy has been characterised by an extremely high level of external dependence and reliance on the service sector. Djibouti has few natural resources and, with less than 150 mm of rain a year and no permanent rivers, has extremely limited possibilities for agricultural production. Activities in the primary sector therefore make a negligible contribution to the national economy although are extremely important at the rural level, where livestock forms the basis of household livelihoods. The secondary sector – industry and manufacturing – is poorly developed because of a small domestic market, lack of locally-available raw materials and a largely untrained labour force. As illustrated in Figure 1 the Djiboutian economy is dominated by the tertiary sector, with services accounting for over three quarters of value-added and GDP and providing almost all foreign exchange earnings. Of particular importance are services provided to the French military, accounting for up to 30% of GDP (World Bank 1991), and services related to Djibouti's role as a regional centre, its port, private banking and communications facilities.

Figure 1: Share of GDP by sector



(From World Bank 1998)

Aside from sales of services, Djibouti makes few domestic exports – the majority of exported goods are re-exports of goods originating, or in transit, from other countries. While domestic exports contribute less than a tenth of total exports (which together accounted for less than 3% of GDP in 1995), the import bill in Djibouti is significant at over a third of GDP and is reflected in high prices for most commodities and consumer items (World Bank 1998). The economy depends almost entirely on imported food and other basic commodities, mainly from France and the Gulf States. Khat, a plant with mild narcotic properties which is imported from Ethiopia, is sold in large quantities in Djibouti and is also economically important as an imported consumer good (purchased by up to 75% of urban male household heads) as well as a source of government fiscal revenues (accounting for up to 9.5% or US$ 13 million of total tax revenues, or more than a tenth of the programmed government budget, in 1995) (World Bank 1998).

2.2.2 Structure of the economy

Djibouti's economy is unusually liberal in comparison to other countries in the region. With only three exceptions, prices are market determined. The prices of wheat, oil, sugar and bread are subsidised by government, through the Office Nationale d'Approvisionnement et de Commercialisation, for reasons of social equity. Oil prices have been subject to special subsidy systems over the last two decades and are equalised at a price equivalent to US$ 25/barrel, initially supported by grants from Saudi Arabia (World Bank 1984) and now financed by means of a government-controlled fund comprised of taxes levied on multinational oil companies and revenues generated when oil prices fall below this set level. The price of water is also selectively subsidised, as wells and boreholes are made available to farmers and pastoralists at zero cost.

There is complete freedom of trade in Djibouti, and all financial and banking services are unrestricted. Although the Djibouti Franc is freely convertible, the exchange rate has since 1949 been pegged to the US Dollar – initially at a rate of US$ 1:FD 214.39, changed to the current rate of US$ 1:FD 177.72 in 1973. In order to underpin this equivalence the Treasury maintains a US Dollar account with the French American Banking Corporation of New York with a coverage of over 100% of money supply, debited or credited whenever new coins and notes are issued or withdrawn from supply.

Despite – or perhaps because of – its important international service role, the economy of Djibouti, and its stability and growth, is driven largely by external aid. Between 1978-82 external aid in the form of grants represented an average of 57% of all consumption and public investment in the country (World Bank 1984), and in 1991 foreign aid – much of which was received in the form of direct budget support – financed about 40% of government expenditure and was equivalent to up to a quarter of GDP (World Bank 1998). Fiscal revenues are largely raised from taxes paid by foreign residents on their income and consumption. France provides the major part of this external assistance through civilian and military technical assistance, budget subsidies, pensions and other miscellaneous payments. Arab states also make a significant contribution to aid inflows, in addition to a range of other bilateral and multilateral donors. Overall Djibouti faces both internal and external deficits and a negative domestic savings rate because, with grant aid from abroad, final consumption exceeds GDP.

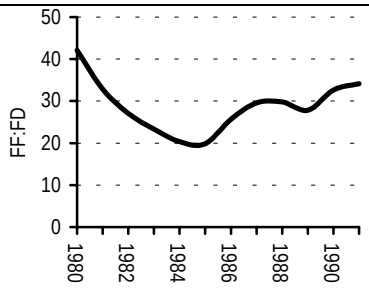
2.2.3 Changes in economic status and activity since Independence

In the context of this economic structure, four major phases of economic status and activity have characterised the Djiboutian economy since Independence in 1977:

- ***After Independence: late 1970s and early 1980s***
  In the period immediately after Independence the Djiboutian economy performed well. Both public and private sector investment grew substantially in real terms between 1978-82, resulting in a real growth in GDP of 3% per annum (World Bank 1984) as illustrated in Figure 3. Foreign exchange reserves were also high, and external debt low, over this period.

- ***Global recession and the depreciation of the French Franc: mid 1980s***
  Due to its dependence on imports and the provision of international services, the Djibouti economy is highly vulnerable to external shocks. Through the latter half of the 1980s demand for local goods and services from expatriates declined significantly, and the value of services provided on the international market decreased. French grant funds were simultaneously affected by a rigorous budgetary programme instituted in Paris in response to the global recession. This resulted in a weakening of the French Franc against the US Dollar and consequent appreciation of the Djibouti Franc against French currency. By 1986 the value of French Franc had fallen to some 47% of its 1980 value as illustrated in Figure 2. Budgetary deficits arose, financed largely through drawing on government cash reserves. With these cash reserves almost depleted in 1987 the government adopted

Figure 2: French Franc:Djibouti Franc exchange rates 1980-91

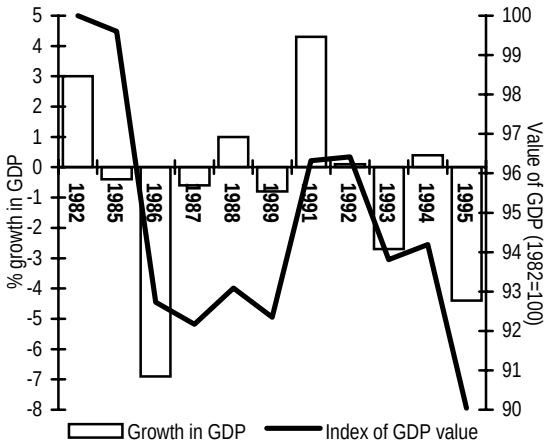


austerity measures to curtail expenditures, and obtained increased support from France. Although the overall budgetary deficit declined, Djibouti increased still further its dependence on external aid. Over the period 1984-87 real GDP in Djibouti declined by 2.7% (World Bank 1991) as illustrated in Figure 3.

- ***National and regional instability: late 1980s and early 1990s***
  Although there was a slight upswing in economic activity in 1988, the Djibouti economy suffered a further setback as a result of the Gulf Crisis in 1989. Insecurity in and around the Gulf States led to significant losses in sales of Djiboutian services due to a decline in commercial shipping traffic, and Djibouti's import bill also increased substantially. After growing by 1% in 1988, GDP registered a fall of about 0.8% in 1989 and further declined in 1990 (World Bank 1991) as illustrated in Figure 3.

  The early 1990s saw both regional and national instability, which further undermined the Djibouti economy. The impacts of widespread floods in 1989-90, national civil unrest between 1991-94 and wars in both Ethiopia and Somalia in the late 1980s and early 1990s which led to a large influx of refugees, all placed additional burdens on an already weakened economy. This situation was exacerbated in the early 1990s by economic reconstruction in the newly Independent Eritrea, and increased competition for the provision of port and transport services to the region. The government of Djibouti continued to incur large internal and external deficits.

Figure 3: Growth in GDP 1982-95



(*Source: World Bank 1984, 1991, 1998*)

- ***Economic stabilisation and adjustment: mid 1990s onwards***
  Direct budget support from international donors has declined substantially over the 1990s and already high unemployment worsened, and GDP – after increasing and stabilising in 1991 and 1992 (a not uncommon effect of national unrest) – registered a negative growth rate over the period 1993-6 (World Bank 1998) as illustrated in Figure 3. Over this period public expenditures also grew considerably, forcing the government to draw on its credit position at the Banque Nationale de Djibouti and to borrow heavily from the more profitable parastatals. A worsening of national economic indicators and weakening of the economy led in 1996 to the adoption of increased austerity measures and the implementation of major stabilisation and structural reforms. Public expenditure

was further reduced, state-owned enterprises gradually privatised and fiscal reforms set in place.

2.3 Current economic strategies and activities

Djibouti has no system of central economic planning. This, alongside its highly liberalised economic structure, is extremely unusual in comparison with other countries in Sub-Saharan Africa, most of which have a long history of central planning and controls on markets and economic activity. Policy and economic decisions in Djibouti have until recently been made at a decentralised level on an as-needs basis by relevant line ministries and government departments.

2.3.1 Macroeconomic and development strategy

Despite the lack of centralised planning, broad development strategies exist for Djibouti. A document was prepared in 1984 for the International Donors' conference, laying out national development goals and strategies for the period 1984-88. An economic and social development plan was then formulated in 1990, *La Loi sur l'Orientation Economique et Sociale de la République de Djibouti 1990-2000*. These strategies together aimed to reinforce the role of Djibouti in international affairs, increase the income of the population and improve income distribution by means of human resources training, increased agricultural and industrial production, expanded social services and strengthened transport, communications and services. The 1990 plan also made specific mention, in Article 2, of environmental protection as a stated social and economic objective.

Due to the national civil unrest pertaining between 1991-94, neither of these plans were ultimately implemented. After 1994, with the encouragement of bilateral and multilateral donors, a new Interministerial Planning Commission was formed to co-ordinate external aid and examine investment projects, as well as to develop a rolling 3 year national development strategy and public investment plan. Economic stabilisation and adjustment are major aims of this plan. Individual sectoral development strategies and investment plans are currently in the process of being prepared.

2.3.2 Sectoral economic policy and activity

Although centrally formulated macroeconomic and sectoral policies are still in their preliminary stages in Djibouti, a number of policy strategies and directions can be identified for major components of the economy:

- ***Industrial development***
  Industry is still in its early stages in Djibouti – the small size of the domestic market, reliance on imports for raw materials and primary inputs, a poor supply of skilled labour and resulting high production costs and weak competition have constrained industrial development. Major industries include a water bottling company, animal feed factory, slaughterhouse and dairy products plant, most of which were originally state-owned and are now being progressively privatised. Currently secondary production – including manufacturing, industry and utilities – contributes less than 10% of GDP.

Industrial and urban development, transport and communications form an important focus of economic development in Djibouti, alongside a strengthening and expansion of the service sector activities which depend on them. Official incentives are being provided for private investment in industry, including the facilitation of credit, the provision of free project studies by government and a high level of domestic protection through taxes levied on imports.

- ***Arable agriculture***

  Severe climatic, water and agro-ecological constraints mean that arable land is almost non-existent in Djibouti. It is estimated that less than 6,000 ha of land have irrigated production potential (World Bank 1984), and only a tiny proportion of this area is actually under cultivation. Arable agriculture is a new activity in Djibouti – the majority pastoralist Afar and Issa groups have no history of cultivation, which was introduced by Yemeni immigrants during the last century. From a gross output of only 50 tonnes in 1970 (Guedda 1990) and cultivated area of 200 ha in 1983 (World Bank 1984), agricultural activities have grown to occupy a gross area of some 1,000 ha and to generate up to 2,300 tonnes of production[5] today, supporting up to 1,200 farming families and 2,300 workers.

  Five major zones of agriculture exist alongside watering points or intermittent water courses close to urban areas in the garden belt around Djibouti Ville and rural horticulture and oasis cultivation zones. Most agriculture is practised in small gardens of which usually less than 0.5 ha is under mixed vegetable and fruit crops, including tomato, onion, chillies, guava, citrus, mango, papaya and date palms. Maximum estimates of the gross returns to agriculture are FD 0.77-1.2 million/ha/yr in rural areas and up to FD 2.3 million/ha/yr[6] around Djibouti Ville (Habib 1998), meaning that in total arable production may have a market value of up to FD 880 million today[7]. Although farming provides an important source of household income, the bulk of urban fruit and vegetable needs are still imported from outside Djibouti. It is estimated that domestic agricultural production is sufficient to supply only some 10-11% of Djibouti Ville's fruit and vegetable demand (CNE 1991, Guedda 1998).

  Expansion of arable agriculture is an important element in Djibouti's national development strategy. Since 1981 various government projects have been implemented which aim to encourage private agricultural development (CNE 1991), and especially to develop potentially irrigable lands which have not yet been put under cultivation. The provision of water facilities in these areas forms a major incentive for agricultural expansion. Trials have also been carried out to pilot desert agriculture – for example the

[5] It is worth emphasising that available estimates of agricultural yields are extremely high at an average of 3.9 tonnes of combined fruit and vegetable production per hectare of cultivated land (calculated from from DINAS 1990).

[6] Gross returns per farm area calculated to be between 385,000-1,1,41,000. This report assumes an average farm size of 0.5 ha.

[7] This calculation assumes an average cultivated area of 0.5 ha per farming family, generating a total cultivated area of 600 ha (proportion from DINAS 1990), one third of which is assumed to be in the environs of Djibouti Ville at Ambouli. Total agricultural land is 1,000 ha.

cultivation of jojoba and desert date, although these have so far proved largely unsuccessful.

- ***Livestock production***
  The vast majority of Djibouti's rural population – up to 24,000 households or over 135,000 people – depend almost exclusively on livestock production for their livelihood. This is the only production system permitted by the harsh climatic and agro-ecological conditions pertaining in most of the country. Virtually all livestock are managed under a system of transhumance pastoralism, where human and livestock movements are based on the seasonal availability of water and pasture. The bulk of livestock production is carried out at the subsistence level, with a large proportion of recorded livestock and meat sales originating from Ethiopia and Somalia (World Bank 1984) and a small dairy sector located close to Djibouti Ville supplying urban milk needs.

  Pastoralist activities are recognised by government to form the mainstay of rural production in Djibouti, and efforts have been made to improve their efficiency and security. Several projects have been implemented with the aim of increasing livestock returns and output including various stock raising projects, marketing assistance, selective breeding and herd improvement, as well as the provision of water points in dry-season grazing areas.

- ***Fisheries***
  Djibouti has some 370 km of coastline and utilises for fishing over 2,500 km^2 of highly productive marine waters (Künzel *et al* 1996). In theory, fish stocks if developed have the capacity to make Djibouti self-sufficient in fish at the same time as generating significant exports (World Bank 1984). Although fisheries production has increased significantly since Independence – from approximately 250 tonnes immediately after Independence (El Gharbi 1987), through some 500 tonnes and 300 fishermen in 1983 (World Bank 1991) to over 800 tonnes and 600 fishermen in 1990 (CNE 1991) – activities remain low because fishing traditionally neither forms a component of livelihoods, nor do fish make a significant contribution to diet, in Djibouti.

  The fisheries sector is targeted as a major sector for development, for both domestic and export markets. Government support has focused on the organisation of fishermen and marketing, and on improving the gear and boats used. Although some mariculture trials have been carried out – in seaweed and oyster production – these have mainly proved unsuccessful (FAO 1982).

- ***Water***
  Djibouti has a low rainfall, on average less than 150 mm a year, and no permanent surface water. Water is a major constraint to production, industrial activity and urban settlement and as such is a major and cross-cutting focus of development plans and strategies. Government policy in the water sector aims to increase the supply and distribution of water throughout the country, especially to urban developments and to arable and livestock agricultural areas.

- ***Energy***
  Rural populations in Djibouti depend almost entirely on biomass energy sources, including firewood and cow dung. Industrial energy needs are largely met through the importation of petroleum products, with charcoal forming an important domestic fuel source for poorer urban households. This high urban and industrial dependence on imported fuel sources has however placed a large burden on the government budget, and power cuts are a frequent problem in Djibouti Ville and other urban centres. Development plans target the energy sector as having potential for further development and diversification, especially through the development of domestic geothermal and hydropower resources.

2.4 Economic and policy impacts on biodiversity

All of the economic policies and activities described above are linked to the status and integrity of biodiversity. Two major levels of economic impacts on biodiversity can be identified for the case of Djibouti – the direct, on-site, effects of economic activities on biodiversity, and the indirect or underlying economic and policy forces driving biodiversity conservation and loss. These are described in the paragraphs below.

2.4.1 Direct impacts of economic activity on biodiversity

Direct economic impacts on biodiversity in Djibouti include:

- ***Economic activities which utilise biological resources as primary inputs***

Economic activities impact directly on biodiversity when they consume biological resources as their primary inputs. In Djibouti four sectors of the economy rely on biological resources as raw materials – rural pastoralist production (utilising natural pasture areas and plant fodder species, as well as obtaining basic household goods such as fuel, medicines, shelter materials, wild foods and other domestic utility items from biological resources); fisheries; the hunting and sale of wild animal products (such as birds' eggs, live animals, horns and skins, shells and corals, sharkfin and turtle meat, shells and eggs); and the commercial harvesting and sale of wild plant products (such as doum palm leaves and other fibres used for handicrafts production).

There is little or no information about the levels at which these activities are being carried out, or their effects. Existing levels of fisheries production are generally thought to be well below potential sustainable yields (CNE 1991, Djibril 1998, World Bank 1984, 1981, 1998), meaning that over-fishing is not as yet a problem. There is however growing

concern that localised pressures on fishing may be beginning to arise – for example, in areas around Djibouti Ville competition between artisanal, sport and amateur fishermen are causing problems, and some reef species may be threatened by the growing international trade in aquarium fish (Djibril 1998).

A wide range of wildlife products are sold in Djibouti Ville, including live animals, skins, eggs, teeth, horns, shells, corals, leaves, gums, resins and various worked products (CNE 1991). Although many of these plants and animals originate from neighbouring countries – Eritrea, Ethiopia and Somalia – a certain proportion have been hunted and harvested within Djibouti. While the commercial utilisation of plant products seems to be very limited in scope and quantity, and is likely to be broadly sustainable at current levels, the hunting, capture and sale of animal and marine products – especially from vulnerable or threatened marine and terrestrial species[8] – gives cause for concern.

The bulk of rural households' biological resource utilisation activities are carried out at a low level, dispersed over a large area, utilise widely available plant species and are employ non-damaging harvesting methods (for example there are customary bans on felling live wood (Guedda 1998) or utilising particular tree and plant species (CNE 1991) in many pastoralist areas of Djibouti). Two sets of activities are however repeatedly cited as the major causes of biodiversity degradation in rural areas – unsustainable woodfuel harvesting and over-grazing (CNE 1991, Guedda 1998, de Saint Sauveur 1991), and have led to observed and widespread rangeland soil erosion, clearing of vegetation and deforestation.

- ***Economic activities which impact on biodiversity through their production processes***
  Economic activities also impact on biodiversity as indirect or knock-on effects when they employ destructive or damaging methods to utilise biological resources, convert and modify natural habitats or introduce wastes, effluents and pollutants into the environment. In Djibouti two sets of production and consumption activities impact indirectly on biodiversity – primary production activities such as arable agriculture (where natural habitats are converted into cropland) and fisheries (where destructive and damaging fishing methods are sometimes employed), as well as secondary sector activities such as tourism, shipping, industry and urban development (all of which introduce sewage, solid wastes, pollutants and other untreated effluents into terrestrial and marine ecosystems).

  Arable agriculture, although modifying completely areas of natural vegetation and replacing them with exotic crops, poses only a minor threat to biodiversity. The actual area under cultivation is very small – a few hundred hectares only – and has extremely limited potential for further expansion. Most farms and gardens do not encroach on important biodiversity areas, although there is some concern about the felling of Bankoualé Palm along watercourses in the Goda Massif area to make way for crops.

[8] As elaborated below in section 3.2.4, several commonly-sold wildlife species are listed in CITES.

Major threats to biodiversity arise from economic activities which impact on the marine sector. Pollution from urban settlements and industries, as well as from the port and shipping sector, has been observed to be a problem both in the Parc Territoriale de Musha and the Réserve Intégrale de Maskali Sud, impacting on water quality and fish populations (CNE 1991). Coral reefs and their component species are considered to be particularly threatened throughout Djibouti because of unsustainable collection of coral and shells, spearfishing, dredging, anchor damage from fishing and tourist boats, explosions in the course of military activity, turbidity, sedimentation, urban and shipping effluents such as wastewater, oils and industrial by-products (Djibril 1991). Of 25 individual reefs in Djibouti only 9 are currently in a satisfactory condition, 3 are considered to be of medium status, 4 bad and 8 disastrous (CNE 1991). Some mangroves areas – most notably those around Musha Island and Khor-Angar – are also beginning to show signs of degradation, with zones which are significantly over-exploited (CNE 1991).

2.4.2 Underlying structural and policy influences on biodiversity

Although economic production and consumption activities impact directly on biodiversity, it is the structure and policies of the economy which drive these activities and encourage them to take place in certain ways and at certain levels. Structural and policy factors provide the underlying root causes of biodiversity conservation, degradation and loss, including in Djibouti:

- ***Current sources of biodiversity degradation and loss – existing characteristics and incentive structures of the economy***
  Djibouti's economy is characterised by an extreme division between urban, industrial and commercial activities and rural production and consumption. Such a duality has implications for biodiversity conservation because in each of these two sub-economies exist a markedly different set of structural factors influencing biodiversity.

  The rural economy in Djibouti mainly impacts on biodiversity through wild plant and forest utilisation, grazing and agricultural development. Local economic factors underlying these threats include widescale poverty, an insecure and limited livelihood base, poor access to alternatives to biodiversity-based sources of subsistence and income, significant climatic and seasonal variation, lack of sufficient water and a high dependence on a marginal and vulnerable natural resource base. These internal forces are further compounded by a range of exogenous factors, most notably the regular and unpredictable inflow from neighbouring countries of both settled refugee populations and pastoralist immigrants, both of whom increase pressure and competition over existing rural resources.

  The bulk of economic strategies and policies formulated by government have little impact on the on-the-ground activities of many rural communities because they are aimed at commercial and urban sectors of the economy and because levels of communication between the capital and outlying rural areas are generally poor. The major national policy decision which may have had some impact in terms of exacerbating local-level forces driving biodiversity loss is the provision of water points in rangeland areas. The

development and effectively free provision of permanent water sources has undoubtedly disrupted traditional patterns of transhumance, and may – in combination with the breakdown of customary land and resource management systems in some areas (Guedda 1998) – have led to higher pressure on woodland and grazing resources resulting from increased sedenterisation and concentration of livestock herds and human populations.

The main effects of urban and commercial sectors on biodiversity are related to the generation and disposal of wastes and effluents – especially those impacting on marine ecosystems, and trade in terrestrial and marine wildlife products. Two linked policy factors have contributed to this biodiversity degradation – the promotion of sectors of the economy which have the most potential to impact on biodiversity, and the accompanying absence of clearly defined and enforced provisions for the incorporation of environmental concerns into development planning and economic activity.

In addition to the main target of economic growth the service sector, agriculture, livestock and fisheries as well as infrastructure, industry and urban settlement have formed a focus of Djibouti's development strategy over the last decade. All these activities have the potential to impact on biodiversity. Strategies for their further development currently contain weak, or no, consideration of biodiversity concerns and well-defined or properly-enforced measures to minimise negative biodiversity impacts are largely absent.

A major policy and institutional gap, and underlying cause of urban and industrial threats to biodiversity, is the weakness of existing legislation relating to biodiversity. There is no single, co-ordinated law dealing with environmental matters in Djibouti and consideration of biodiversity issues is almost non-existent in existing statutes. Provisions touching on environmental concerns are spread between different laws, most of which have primary concerns other than environmental conservation. The legal backing for biodiversity conservation is accordingly fragmented, piecemeal and often mutually contradicting (CNE 1991, de Saint Sauveur 1991).

Even in the rare cases where clear statements in favour of biodiversity conservation exist – for example in legislation banning the hunting of wild animals, or in Djibouti's ratification of CITES – these tend to be poorly or not at all enforced in practice. A notable absence in existing policy and legislation is also the lack of any clear or binding guidelines on integration of biodiversity concerns and damage avoidance into the planning and implementation of urban, industrial and infrastructural development activities, all of which are leading to demonstrably negative impacts on biodiversity.

- ***Possible future support to biodiversity conservation – the role of biodiversity in macroeconomic and sectoral policy reforms***

  Economic consumption and production activities currently present only minor and scattered threats to the status and integrity of biodiversity in Djibouti. Over time the nature and level of these activities is however likely to change. Major sectors of the economy highlighted for development – including agriculture, fisheries, urban and industrial development – all have the potential to impact negatively on biodiversity.

Demands and pressures on biological resources and ecosystems are also growing as a result of a rapidly increasing rural population – many of whom are becoming more sedenterised as a result of agricultural development and water provision, and whose situation is likely be further weakened by exogenous factors such as insecurity in neighbouring countries and continuing drought.

These economic and policy factors need not impact negatively on Djibouti's biodiversity. To maintain Djibouti's current development and social equity goals at the same time as ensuring that biodiversity is conserved depends on action being taken at several levels of policy and economic activity. Of primary importance is the integration of biodiversity concerns at the macroeconomic and sectoral policy level, including the establishment of effective institutions, laws and guidelines governing the ways in which fisheries, urban and industrial developments are planned and carried out. It is also imperative that attention be given to presenting a supportive set of incentives for rural communities to conserve biodiversity in the course of their economic activity. Both these actions in turn depend upon adequate financial, legal and institutional support being provided to the government agencies mandated with biodiversity conservation.

On-going economic and policy changes provide a positive environment for effecting these actions. Djibouti is currently reforming its development planning and policy structure, at macroeconomic and sectoral levels. Present levels and types of economic activity in Djibouti do not, as yet, present major or irreversible threats to biodiversity. A broad range of economic tools and measures can be integrated into these new forms of economic and development planning and practice and used to ensure that biodiversity is conserved at the same time as economic growth and development take place in the future. Specific economic instruments and incentives are described in detail in Chapter 5, below.

3. THE ECONOMIC BENEFIT OF BIODIVERSITY

3.1 Overview of the total economic benefit of biodiversity in Djibouti

The total economic benefit of Djibouti includes a wide range of component values. As illustrated in Figure 4, the economic value of biodiversity far exceeds the ***direct uses*** made of biological resources – outputs that can be consumed directly such as fish, shells, woodfuel, pasture, fodder, wild foods, medicines, construction materials and the various other human uses supported by wild plant and animal products. It also includes ***indirect values*** – ecological services and ecosystem functions which protect natural resources and human economies through providing a sink for wastes and residues and maintaining essential life support functions, ***option values*** – the economic premium placed on maintaining a pool of resources and services for future possible uses and applications, and ***existence values*** – diverse sources of intrinsic aesthetic, cultural and heritage significance. All of these attributes of biodiversity yield value to human populations because they provide support to economic activities and permit human consumption, production and utility maximisation.

Figure 4: The total economic benefit of biodiversity

TOTAL ECONOMIC VALUE OF BIOLOGICAL RESOURCES AND THEIR DIVERSITY

- **USE VALUES**
  - **Direct values** — Outputs that can be consumed directly, such as timber, minerals, food, recreation,etc.
  - **Indirect values** — Ecological services, such as flood control, storm protection, carbon sequestration, climatic control, etc.
  - **Option values** — The premium placed on maintaining resources for future possible direct and indirect uses, some of which may not be known now.
- **NON-USE VALUES**
  - **Existence values** — The intrinsic value of resources, irrespective of their use such as cultural, aesthetic, bequest significance, etc.

In Djibouti the major economic values supported by biological resources, ecosystems and their diversity comprise:

- ***Biological resources which are used for economic production and consumption***

Rangeland, forest and woodland biological resources form the basis of rural pastoralist production in Djibouti, providing a wide range of products including wild foods, fuel, medicines, fibres, construction materials, fodder, forage and pasture. Their diversity also provides important fallback in dry-seasons and drought, when other sources of human and livestock foods fail. Fisheries constitutes an important, and growing, sector of the economy while the harvesting of other plant, animal and marine products generate income in both rural areas and urban centres. Although only a small proportion of these direct values can be quantified, fisheries, plant-based human foods and livestock fodder, and wood-based energy sources are together worth almost FD 76.5 billion, a value which would rise to over FD 83.7 billion a year if fisheries were developed to maximum sustainable yields.

- ***Ecosystem functions which support and maintain economic activities***

Ecosystem functions support and maintain economic production and consumption in Djibouti. Forest, woodland and bush cover provide an important service by protecting watersheds and water courses, minimising erosion, guarding against the on-site loss of soil fertility and preventing downstream sedimentation and siltation of water supplies. Both mangrove and coral reef areas, as well as playing an important role in fisheries production, protect coastal areas against storm and flood damage. Together reefs, mangroves and terrestrial vegetation act as a carbon sink, albeit at a low level, and contribute towards mitigating the effects of global warming. Although it is almost impossible to quantify these indirect values on the basis of available data, costs avoided by the presence of Djibouti's natural ecosystems in terms of land degradation and global climate change are estimated to be worth in excess of FD 100 million a year.

- ***Biodiversity which increases the strength, resilience and security of economic systems***

The diversity of wild plants, trees, fish and animals, and the different ecosystems which form a part of Djibouti, because of their variety, have the function of supporting economic choice. This is a very important set of benefits, given Djibouti's limited production and consumption base, and is especially significant in rural areas where the variability within and between species and ecosystems provides basic livelihood security and fallback in times of drought and stress. It is impossible to quantify the value of this diversity on the basis of available data.

- ***Potential and intrinsic values attached by humans to biological resources, ecosystems and their diversity***

Biological resources and their diversity may support a range of economic opportunities in the future, including planned developments in the fisheries and tourism sectors as well as potentially providing a range of as yet unknown pharmaceutical, agricultural and industrial applications. Djibouti's biodiversity also undoubtedly has some form of intrinsic significance by virtue of its mere existence, including local-level cultural values, national heritage and bequest values and global existence values. These option and existence values cannot be quantified on the basis of available data.

3.2 The value of biological resources in economic production and consumption

Although Djibouti's urban and commercial economy depends little on biological resources, they form the basis of rural livelihoods and also constitute the primary components of one major commercial economic sector – fisheries. They also provide, on a small scale, a range of plant and animal products for sale in urban centres including charcoal, handicrafts and souvenirs. The economic significance of these production and consumption activities is described in the paragraphs below.

3.2.1 Rangeland resources

Approximately a quarter of Djibouti's residents live in rural areas. Aside from a small but important minority of cultivators, the vast majority of this population – some 24,000 households or 135,000 people – depend on pastoralist livestock production for their livelihoods[9]. Rangeland biodiversity forms an extremely important part of these livelihoods, because it provides pasture and fodder for animals and also yields a range of plant-based subsistence items for humans. The economic importance of plant-based subsistence goods are discussed below, Section 3.2.2. This section deals with the economic value of rangeland biodiversity for livestock production.

There are over 200,000 ha of permanent pastures in Djibouti (CNE 1991). The distribution and status of grazing areas determines pastoralist transhumance patterns. Seasonal movements of both humans and livestock are determined by rainfall and the availability of pasture and water. In the hot season (June to October) herds move with the rains towards western parts of Djibouti, over the western border with Ethiopia and the south western border with Somalia. In the cold season (November to May) herds move to the highlands and pastures towards the coast, when rain falls in these places.

Although it is certain that the livestock population has grown significantly over time, as illustrated in Table 2, it is extremely difficult to estimate current numbers as a national census has not been carried out since 1978, or detailed survey since 1987.

Table 2: Livestock numbers 1947-87

	1947	1964	1978	1987
Cattle	3,000	14,000	40,000	51,000
Camels	2,000	19,000	50,000	56,000
Sheep	50,000	85,000	350,000	410,000
Goats	100,000	500,000	500,000	500,000
Total	**155,000**	**618,000**	**940,000**	**1,017,000**

(*From CNE 1991*)

Today's livestock population can be estimated either by applying an annual growth rate based on the known herd increase between 1978-87, or by calculating the average numbers of different types of animals per household based on 1987 figures and extrapolating these to the current pastoralist population. As illustrated in Table 3 both of these methods yield remarkably similar results – between 1.1 and 1.3 million animals in total. In this report a mid-point of these two estimates, expressed as number of animals and Tropical Livestock Units (TLUs)[10] and rounded to the nearest thousand, has been taken. The 1998 livestock population for Djibouti is therefore estimated at 1.213 million animals or 323,000 TLUs, mainly comprised of smallstock, as illustrated in Table 3.

[9] This figure may underestimate the overall dependence of pastoralists on Djibouti's rangeland resources, as regional grazing patterns cross-cut national boundaries (Guedda 1998). It is therefore likely that populations living close to the border in Ethiopian and Somali populations rely on rangeland resources in Djibouti, and that conversely Djiboutian pastoralists move into these neighbouring countries at particular times.

[10] One TLU represents 250 kg standing weight, where a bovine = 1 TLU, camel = 1.4 TLU and shoat = 0.15 TLU.

Table 3: Estimates of livestock population 1998

	Calculated by growth rate		Calculated by herd size[11]		(Animals)	(TLUs)
	Annual growth 1978-87 (%)[12]	1998 livestock estimate	Animals/ household	1998 livestock estimate	1998 livestock	1998 livestock
Cattle	2.75	68,817	2.70	65,013	67,000	67,000
Camels	1.25	64,102	2.96	71,386	68,000	95,000
Sheep	1.75	495,172	21.68	522,651	509,000	76,000
Goats	-	500,000	26.44	637,379	569,000	85,000
Total	**0.88**	**1,128,091**	**53.78**	**1,296,429**	**1,213,000**	**323,000**

Pastoralist livestock production is entirely dependent on the wild fodder, forage and pasture provided from rangeland, grassland, woodland and forest biodiversity. It is impossible to calculate the direct market value of this biodiversity because these products are neither bought nor sold in rural areas. The value of rangeland biodiversity in terms of livestock production can however be at least partially estimated by looking at the replacement cost of naturally-occurring fodder, forage and pasture species – this represents a minimum value in terms of expenditure saved by the presence of rangeland biodiversity. Fodder requirements in Djibouti are in the region of 6.25 kg dry grass/TLU/day (CNE 1991) and grass retails in urban markets for some FD 100/kg, meaning that in total the 739,000 tonnes of naturally-occurring fodder, forage and pasture consumed by pastoralist livestock herds is worth in the region of FD 74 billion a year as illustrated in Table 4.

Table 4: Value of rangeland biodiversity for livestock production

	Consumption requirement (kg fodder/mature animal/day)	Total consumption ('000 tonnes fodder/yr)	Replacement value (FD mill/yr)
Cattle	6.25	153	15,284
Camels	8.75	217	21,718
Smallstock	0.94	369	36,888
Total	**-**	**739**	**73,890**[13]

3.2.2 Forest and woodland resources

It is estimated that there are 2,000 ha of forests and 68,000 ha of open woodlands in Djibouti (CNE 1991). These include rare and localised *Juniperus* forests only found on the Goda and Mabla Massifs (Guedda 1998) as well as *Terminalia* and *Buxus* forests found in highland areas, isolated stands of Doum Palm in riverine areas of central and western parts of the country, steppe *Acacia nilotica* woodland around Magdoul, d'Andaba and Guinibad and open *Acacia* woodlands and bushlands across interior arid and semi-arid lands of Djibouti (CNE 1991).

[11] Taking into account pastoralists, approximately 24,000 households, only.

[12] The total herd increase, from 940,000 to 1,017,000 animals, over the entire 9 year period was 8% including a large increase in cattle numbers by a factor of more than one and a quarter, and no change in goats.

[13] It is worth noting that the high costs of purchased grass and fodder mean that, under current management systems, pastoralist production would not be profitable if all feed had to be purchased (see section 3.3.1 for estimated gross annual production values). This further increases the value attached to wild sources of fodder.

These forests and woodlands support virtually no commercial exploitation. They are however widely used by surrounding human populations for firewood and charcoal production, the collection of fibres and woody materials for housing, fencing, rope and mat production, wild honey, gums, resins and medicines harvesting and as dry season fodder and grazing areas (CNE 1991, Guedda 1998). For the majority of the rural population in Djibouti alternative sources of these basic household subsistence items are unavailable or unaffordable – people rely almost entirely on sourcing them from locally-occurring tree and plant species.

Despite their widespread use and importance in household economies, no estimates of the species, levels or nature of non-wood forest products utilisation exist for Djibouti. Some data are however available on the consumption of wood for domestic energy and building poles. It was estimated in 1984 that national firewood consumption was in the region of 25,811 tonnes, charcoal consumption 2,137 tonnes and that household polewood demand was some 1.2 tonnes/household/year (CNE 1991). Such a figure for polewood consumption appears to be unrealistically high[14], and therefore has not been used in this report. It is also worth noting that although charcoal consumption seems realistic at some 1.5 kg per capita per day[15], the resulting figure of 0.8 kg firewood/per capita/day[16] for firewood is very low when compared to similar populations, livelihood systems and agro-ecological conditions in other parts of the region[17]. For this reason these per capita rural firewood consumption figures are adjusted slightly upwards in this report to a minimum estimate of 1.0 kg/capita/day.

These data permit the level and value of domestic woodfuel use to be quantified. At 1998 population levels some 143,000 rural households and 6,800 urban dwellers depend on wood-based energy sources – the former cooking almost exclusively with firewood, and the latter using charcoal. This equates to a total demand of over 52,000 tonnes of firewood and nearly 4,000 tonnes of charcoal, equivalent to some 176,000 m^3 of roundwood a year[18]. As illustrated in Table 5, the equivalent market value of this wood use is FD 1.3 billion a year, which represents the effective value of forest and woodland biodiversity in woodfuel terms.

[14] Most estimates of polewood consumption in other sub-Saharan countries are less than one tenth of this amount, and even lower for pastoralist households.

[15] Approximately 1% of the permanently housed urban population were recorded as using charcoal as their primary domestic energy source in 1995 (World Bank 1998). Taking into account other urban groups, including homeless and insecurely-housed persons – these are the poorest urban groups, and therefore those most likely to rely on woodfuel energy sources – the total proportion of urban households cooking on charcoal is likely to be higher than this. This report assumes that 1.5% of urban households, or 6,849 persons, cook exclusively on charcoal.

[16] The entire rural population, or 143,396 persons, are assumed in this report to rely on firewood as their primary energy source.

[17] For example in rural areas of Eritrea which border Djibouti, firewood consumption is estimated to be in the region of 1.5 kg/capita/day (Emerton 1998a). For Somali refugee populations living close to the Djibouti border in Ethiopia, daily firewood consumption has been estimated to be 1.2 kg/capita/day (Emerton 1998b).

[18] 1 m3 roundwood yields 600 kg of green firewood, which converts to dry firewood at a weight ratio of 1:0.65. 1 m^3 of roundwood yields 90 kg of finished charcoal.

Table 5: Value of woodfuel utilisation

	Number of users	Consumption (kg/capita/day)	Consumption (Tonnes/yr)	Equivalent roundwood (m^3)	Rural market price (FD/kg)	Value (FD mill /yr)
Charcoal	6,849	1.5	3,760	41,779	67[19]	251
Firewood	143,396	1.0	52,340	134,204	20[20]	1,047
Total	**-**	**-**	**56,100**	**175,983**	**-**	**1,297**

Although it is impossible to make any estimate of the – undoubtedly high – economic value of most non-wood tree products to households, an approximation of the value of wild foods to rural pastoralists may be made. In similar livelihood systems in southern Sudan, an average household in a 'normal' year obtain 15% of their annual nutritional requirements from plant wild foods (Emerton 1998c). If similar figures hold for pastoralists in Djibouti – and is actually likely that this dependence is higher in Djibouti, due to the more marginal nature of pastoralist livelihoods, the smaller variety of available foods and more frequent drought conditions – then the nutritional value of wild foods may account for an intake of 104,025 Kcal/capita/year. In terms of grain equivalent – the most realistic replacement – this consumption has a value of some FD 2,500 per capita per year or FD 357 million for all pastoralist households, as illustrated in Table 6[21]. It is worth noting that this figure will be much higher for poorer households, and in times of drought and stress.

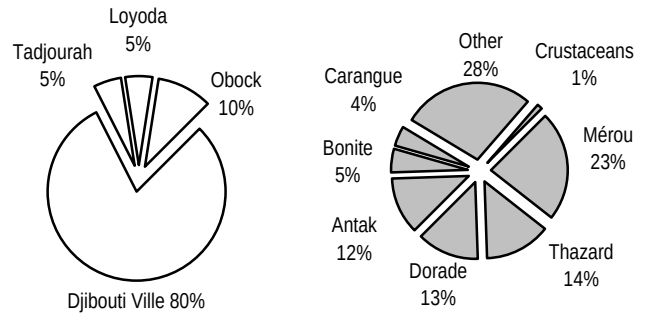
Table 6: The value of wild foods consumption by humans

	Value
Nutritional value of wild foods consumption (Kcal/capita/yr)	104,025
Household wild foods consumption in grain equivalent (kg/year)	21
Price of grain (FD/kg)	120
Equivalent value of wild foods (FD/capita/yr)	**2,497**
Equivalent value of wild foods (FD million, all pastoralists)	**357**

3.2.3 Marine resources

Fisheries represent an expanding sector of the Djibouti economy in both consumption and production terms. The current national catch is estimated at 600 tonnes of fish and crustaceans[22] (Djibril 1998), of which just under 50% or 260 tonnes is sold through the main retailer and wholesaler in

Figure 5: Composition of fish catch by area and type



(*From DINAS 1990, Djibril 1998*)

[19] This is the urban retail value of charcoal (1,000 FD for a 15 kg sack). Rural producers of charcoal realise about half of this total.

[20] This is the rural price of firewood (a bundle of between 5-10 kg of firewood retails for an average price of FD 150). The urban price of firewood is approximately 3 times higher than this

[21] Daily nutritional requirements are some 1,900 Kcal/capita. Total annual nutritional requirements, some 693,500 Kcal per capita, are equivalent to approximately 140 kg grain, meaning that grain has a nutritional value of around 5,000 Kcal/kg.

[22] For Djiboutian fishermen, in Djibouti waters. Djibouti waters are also fished by Yemeni and Somali fishermen (World Bank 1998).

Djibouti Ville, Sarl de Mer Rouge Pêche[23]. The fishery is predominantly artisanal, with over 85% of the fishing fleet comprising small (6-8 metres) and medium sized (10-14 metres) boats, primarily using line and net fishing and labour-intensive techniques (Künzel *et al* 1996).

At an average annual catch of 4.5 tonnes/year/boat (from data in World Bank 1998) and with between 3-4 fishermen using each boat (Djibril 1998), current fisheries production may involve some 135 boats and over 450 fishermen. It is also estimated that the fisheries sector generates additional related employment – for example in retailing and packaging, and in boat and net construction and maintenance – equivalent to 6 workers for every fisherman employed (from data in World Bank 1998), meaning that an additional 2,800 non-fishing job opportunities may be generated by the fisheries sector in Djibouti.

As illustrated in Table 7 existing fisheries activities in Djibouti may generate a direct income of FD 179 million and total income in excess of FD 872 million a year. About 8% of this value accrues directly to fishermen[24] while the majority – 80% – is received as broad employment benefits.

Table 7: Economic value of existing fisheries production

	Value
Fish catch (tonnes/yr)	600
% retailed[25]	75
% home consumed	25
Gross value of catch (FD million)	**179**
Of which:[26]	
Retailers (FD million)	108
Fishermen (FD million)	72
Non-fishing employment (FD million)[27]	700
Total fisheries related value (FD million)	**879**

Current fisheries production is well under the maximum sustainable yield in Djibouti. Estimates of the fisheries potential of Djibouti's waters differ greatly, varying between 4,500-9,000 tonnes (composed of 1,500-5,000 tonnes of demersal and 3,000-5,000 tonnes of pelagic fish, CNE 1991, Djibril 1998, El Gharbi 1987, FAO 1983, Künzel *et al* 1996) and in excess of 48,000 tonnes (composed of over 15,200 tonnes of demersal and 32,500 tonnes of pelagic

[23] The rest of the catch is disposed of through own consumption, sales in other urban centres and informal sales in Djibouti Ville. It is surprising that such a low proportion of total national catch is sold at Sarl de Mer Rouge Pêche due to the fact that Djibouti Ville landings comprise some 80% of total catch (Djibril 1998, see Figure 5), and because Sarl de Mer Rouge Pêche hold a monopoly on fish retail in the capital. Other markets might have been expected to be much smaller than half of total consumption because fish forms such a small part of most people's diet in Djibouti (World Bank 1998).

[24] The actual proportion may be larger than this, as it is likely that a proportion of catch is retained by fishermen for home consumption and informal sales.

[25] Including all urban centres and towns in Djibouti.

[26] Calculated from the proportion of total value accounted for by retail/wholesale trade, and payments made to fishermen, extrapolated from data provided by Sarl de Mer Rouge Pêche.

[27] Median income is FD 250,000 (World Bank 1998).

fish, World Bank 1998) [28]. The most recent and detailed calculations, used in this report, give a maximum sustainable yield of some 8,200 tonnes of fish (Künzel *et al* 1996). As illustrated in Table 8, calculations suggest that, if it were expanded, the direct value of fishing activities could increase by a factor of more than twenty, and the fisheries sector could overall generate a gross income of some FD 5.4 billion a year[29].

Table 8: Potential economic value of fisheries production

	Catch (tonnes/yr)	Average price (FD/tonne)[30]	Total value (FD mill/yr)
Demersal fish	5,000	425,000	2,125
Pelagic fish	3,200	550,000	1,760
Crustaceans	65[31]	2,000,000	130
Gross value of catch (FD million)			4,015
Of which:			
Retailers (FD million)			2,409
Fishermen (FD million)			1,606
Non-fishing employment (FD million)[32]			1,400
Total fisheries-related value (FD million)	**8,263**		**5,415**

Although fishing is at present the most developed activity, a range of other direct economic values also accrue from Djibouti's marine biodiversity. No data are available about the level of use or value of these other economic activities. Marine tourism – which is at least partially dependent on biodiversity – is generally poorly developed, but some coastal tourist facilities do exist such as the 60 bed "Beach Club" of the Djibouti Sheraton Hotel in Parc Territorial de Musha. A variety of non-fish marine products are harvested and sold in Djibouti Ville souvenir shops (as described below in Section 3.2.4), as well as being exported to other countries. It is reported that sharkfin obtained from Djibouti waters is exported to the Gulf states and Asia, mainly by Yemeni fishermen (Djibril 1998). Turtles are also an important source of food for coastal dwellers (Djibril 1998) and generate local income from the sale of eggs, meat and shells. Mangroves provide various products to rural households – mostly at the subsistence level – including camel fodder, construction poles, firewood and charcoal (CNE 1991). At least some of the economic value of this utilisation is accounted for in calculations made above of livestock fodder and woodfuel.

[28] The higher estimates (appearing in World Bank 1998) cannot be applied to actual offtake, because they refer to *all* fish species, including ones which have no commercial value.

[29] It is worth noting that these calculations hold other factors equal, for example that fisheries remain predominantly artisanal, prices remain stable and that although a large proportion of catch is likely to be exported, no major fish processing or value-added industries are developed in Djibouti. If additional value-added and industrial-level activities are developed in the fisheries sector, gross value may prove to be signficantly higher than this figure.

[30] From data provided by Sarl de Mer Rouge Pêche.

[31] There are no estimates of maximum sustainable yield for crustaceans (mainly langouste and crab – although prawn are consumed in Djibouti they are imported from Yemen). The catch of crustaceans is therefore assumed to have the potential to increase by the same factor as fish production.

[32] It is unlikely that the number of people employed in secondary fisheries activities will increase at a rate proportional to increased production. Thus the number of employment oportunities is assumed to double under a scenario of increased fisheries production.

3.2.4 Wildlife resources

As illustrated in Table 9 a wide range of animal products are available in small souvenir shops and markets around Djibouti. There does not however appear to be any large-scale commercial trade or export of wildlife artefacts. Most shells, corals and animal products are sold to tourists and foreign residents, while live animals are reputedly exported to the Gulf States. No data exists as to the origin[33], amount or value of these goods sold.

Table 9: Stocks of wildlife products in souvenir shops, Djibouti Ville, 1990

Product	Number on sale	Product	Number on sale
Unworked animal products:		Warthog tusks	>3
Ostrich eggs	>286	Various horns and teeth	Several shops
Turtle shells	>200		
Cheetah skins	>12	**Worked animal products:**	
Leopard skins	>5	Stuffed birds	2 species
Caracal skin	1	Stuffed cobra	>20
Dik dik skins	>6	Dik dik bags	>6
Snake skins	>20	Colobus rug	1
Sharks' teeth and jaws	Several shops	Crocodile skin bags	>6
Sawfishes saws	Several shops	Worked horn and ivory	Most shops
Dried sea horses	3-4 shops		
Shells and corals	2 shops	**Live animals**	
Gazelle horns	5	Young cheetah	3
Unworked ivory	6 tusks	Young kite	1

(*From CNE 1991*)

3.3 The economic benefit of ecosystem services

Despite the limited nature of Djibouti's biodiversity, ecosystems provide several vital areas of support to rural and urban economic activities. The most important of these ecosystems services are the erosion control functions of natural vegetation, the storm control and flood protection functions of coral reefs and mangroves and the carbon sequestration functions of forest, woodland and reefs. These are described in detail below.

3.3.1 Erosion control functions of vegetative cover

Rangelands in Djibouti are highly susceptible to degradation – they are marginal and infertile areas, often with highly erodible soils, little ground cover and poor water supplies, and are subject to uncertain climatic conditions. This vulnerability is further exacerbated by cyclical drought and on-going processes of desertification. The dependence of a large pastoralist population and growing livestock numbers on limited and poor quality pasture land, and an increasing trend towards sedenterisation in rural areas, can soon lead to over-grazing, localised pressure on forest and woodland resources and bush clearance. As illustrated in Table 10, grazing activities exceed carrying capacity in many parts of the country. Deforestation and loss of vegetative cover are repeatedly cited as the most immediate threats to Djibouti's biodiversity, and plains areas in many parts of the country are becoming observably degraded and eroded (CNE 1991, Guedda 1998, de Saint Sauveur 1991).

[33] It is likely that some of these products originate in neighbouring countries – for example ivory, as Djibouti has no known elephant population.

Table 10: Grazing capacity and actual livestock densities

	Livestock carrying capacity (TLU/ha)	Actual livestock usage (TLU/ha)
Forest		
Summer	0.09-0.36	**0.41**
Winter	0.18-0.71	**1.66**
Steppe		
Summer	0.09-0.36	**0.14**
Winter	0.09-0.36	**0.27**

(*From CNE 1991*)

As a direct result of vegetation loss, several parts of Djibouti are subject to wind and rain erosion, topsoil loss and excessive runoff (de Saint Sauveur 1991). In turn, this has had a range of downstream impacts including siltation of watercourses and dams, and impaired water quality and flow in both terrestrial watercourses and marine areas. For example sedimentation is cited as a major threat to coral reefs off the Djibouti coast (Djibril 1991), and it is judged that sediment yields are excessive in much of the Gulf of Tadjourah and have adversely affected 90% of the coral reef in the Réserve Intégrale de Maskali Sud (CNE 1991). Although these off-site impacts have major economic implications – for example in terms of declining fish yields, and expenditures necessary to offset the human effects of poor water quality and sedimentation of watercourses – no data exists which permit them to be quantified. Their economic value is, however, likely to be immense given the scarcity and uncertainty of water supplies in Djibouti and the fragile nature of marine ecosystems.

Loss of natural vegetation also has on-site impacts in terms of decreased soil fertility and land productivity. Of particular economic importance in Djibouti is the impact of rangeland degradation and erosion on livestock productivity and – to a lesser extent – agricultural production. This loss of productivity – and by implication the economic benefit of maintaining rangeland and forest biodiversity as groundcover – can be at least partially quantified.

Annual rates of soil loss resulting from loss of natural vegetation has been estimated for agro-ecologically and socio-economically similar areas of the Horn of Africa to be in the region of 15/tonnes/ha/year for rangeland areas, leading to a decline in on-site livestock productivity of up to 0.1%; and an average of 12 tonnes/ha/year for arable areas, leasing to a decline in crop yields of up to 0.6% (Emerton 1998a). If – as is likely – similar rates of soil and productivity losses hold for Djibouti, this is equivalent to a cost to pastoralist production of up to FD 7.74 million a year and to arable production of up to FD 5.28 million a year as illustrated in Table 11. The total figure of FD 13.02 million represents a minimum estimate of the annual economic value associated with erosion control functions of natural vegetation in terms of costs avoided. Over time, vegetation loss and land degradation will lead to increasing economic costs as the soil base becomes progressively more eroded and production declines still further.

Table 11: Agricultural productivity losses resulting from soil erosion

	Affected herd size/ farm area	Gross value of production[34] (FD mill/year)	Erosion-related productivity losses (FD mill/yr)
Cattle	67,000 TLUs	1,861.34	1.86
Camels	95,000 TLUs	778.60	0.78
Sheep	76,000 TLUs	2,410.43	2.41
Goats	85,000 TLUs	2,694.57	2.69
Total livestock:	**323,000 TLUs**	**7,744.95**	**7.74**
Crops:	**600 ha**	**879.80**	**5.28**
Total all agriculture		**8,624.75**	**13.02**

3.3.2 Coral reef and mangrove ecosystem services

Although unquantifiable on the basis of available data, it is important to emphasise the high economic value to Djibouti associated with coral reef and mangrove ecosystem services. Much of Djibouti's mainland and island coastline is protected by coral reefs, including larger reef systems at Musha and Maskali and continuous fringing reefs from Arta Plage to Khor Dorale as well as isolated patch reefs around Moidubis Kebir, Moidubis Sanghir and the Sept Frères island complex (Barratt and Medley 1989). Relatively intact mangrove areas are found on the northern coast of Djibouti at Ras Syan, Godoria and Khor-Angar and around the island complex of Musha and Maskali, and relics of mangroves still exist on the south coast between Djibouti and Loyada (Audru *et al* 1987).

These coral reefs and mangrove areas provide shoreline protection, yielding economic benefits in terms of forming natural sea defences and saving expenditure on mitigating or guarding against damage to coastlines and to coastal infrastructure and settlements which might otherwise be caused by the erosive and destructive impacts of waves and storm surges. They also provide breeding grounds and nurseries for coastal and pelagic fish species – for example 60% of commercially exploited fish species in Djibouti depend on mangrove ecosystems at some time in their life cycle, directly contributing to the economic output of fisheries. This value of coral reefs and mangroves is at least partially reflected in estimates of fisheries output described above, Section 3.2.3. Mangroves also act as sediment traps, filter pollutants from water and prevent salt water intrusion, and thus have indirect benefits in terms of guarding mainland water supplies against salinity, protecting coral reefs from sedimentation and maintaining coastal water quality.

3.3.3 Carbon sequestration functions of forest and marine ecosystems

Both coral reefs and terrestrial vegetation in Djibouti act as carbon sinks. By absorbing carbon they help to mitigate the effects of global warming. It is estimated that at least half of the 1.2×10^{13} mol of calcium carbonate delivered to the sea each year is precipitated by coral reefs, which are estimated to have a net primary productivity in excess of 2,500 g carbon/m^2/year (Spurgeon and Aylward 1992). Natural vegetation is estimated to sequester an average of between 10 (for wooded grassland and bush) and 125 (for secondary closed forest) tonnes of carbon/ha (Myers 1997, Sala and Paruelo 1997).

[34] Meat, milk and sales. While the vast majority of meat and milk is consumed within the household, some sales are made to towns and urban centres. Under these calculations, average meat consumption is low at under 2 kg/capita/month and milk consumption averages 1 litre/capita/day.

As illustrated in Table 12 Djibouti's coral reefs can be estimated to have a surface area of at least 6.105 million $m^{2(35)}$, and forests (2,000 ha) and woodland (68,000 ha) together cover some 70,000 ha (CNE 1991). This equates to some 15,200 tonnes of carbon/year sequestered by Djibouti's reefs and 930,000 tonnes in total[36] from natural vegetation. With the economic value[37] of carbon sequestration estimated at between US$ 1-100/tonne (Alexander *et al* 1997) and on average US$ 20/tonne (Myers 1997), forest and marine ecosystems in Djibouti may together generate economic benefits of over FD 87 million a year.

Table 12: Carbon sequestration by reefs, forests, woodlands and grasslands

	Reefs	Forests, woodlands and grasslands
Surface area	6.105 million m^2	70,000 ha
Net primary productivity carbon	2,500 g/m^2	10-125 tonnes/ha
Carbon sequestration	15,263 tonnes/year	930,000 tonnes in total
Value of sequestration (FD mill/year)	**54.25**	**33.09**

3.4 The economic importance of biodiversity

Biodiversity – the variability between and within wild species and habitats – has an economic premium over and above the direct use values associated with the use of biological resources and the indirect economic values supported by ecosystem functions and services. In Djibouti the primary economic significance of biological and ecological diversity is that it permits choice and allows a range of alternative production and consumption opportunities for humans who live in otherwise limited rural and urban economies, and that it contributes to the stability, resistance and resilience of natural and human systems to stress, shock and changes in an uncertain and marginal physical and economic environment.

At the rural level, biodiversity strengthens livelihood security and ensures human survival under difficult natural and socio-economic conditions. The variability between wild plant and animal species which permits different foods, medicines, pasture areas and fodder types to be utilised contributes to food security, resistance to drought, disease and pest attack for both human and livestock populations. As illustrated in Table 13 a wide range of plant biodiversity supports human consumption and livestock production, and is especially important when other sources of foods and fodder are unavailable. This diversity comprises a very important

[35] It is assumed that 75% of Djibouti's coastline is protected by reef. As the depth of reef rarely is in general between 10-15 metres (Barrat and Medley 1989, CNE 1991), a figure of 12 metres has been used in these claculations. The width of the reef is on average 10m (Barrat and Medley 1989). The total surface area comprises the sum of the surface areas of upwards-facing and outwards-facing planes of the reef.

[36] Carbon is mainly sequestered by growing trees, and locked up in mature trees. When a tree is felled this carbon is released, at a rate depending on the subsequent treatment of the tree. For this reason, annual values and amounts for carbon sequestration have been calculated by using an inverse discount rate of:

$$\frac{1}{T}\sum_{t=1}^{t=T}\frac{V}{T}(1+r^{(T-t)}),$$

where T = overall period (100 years), V = overall value/amount of carbon sequestered, r = discount rate (10%), t = year. It is worth noting that calculations also allow for carbon fixation rates of subsequent land uses in forest, woodland and bush areas (primarily pasture).

[37] Mainly avoidance of the economic costs of damage associated with global warming.

set of economic benefits given the marginal and uncertain nature of pastoralist activities, and the limited rural production and consumption base, in Djibouti. In the absence of plant and animal biodiversity, rural economies in Djibouti would undoubtedly be severely weakened and, under extreme conditions, might fail altogether.

Table 13: Human and livestock consumption of plant biodiversity

Grasses:	**Trees:**	
Chloris pyncnothrix (L)	*Acacia asak* (L)	*Grewia tenax* (H)
Chrysopogon plumulosus (L)	*Acacia ehrenbergiama* (L)	*Hyphaena thebaica* (H, L)
Cymbopogon schoenanthus (L)	*Acacia etbaica** (L)	*Maerua spp.* (L)
Cynodon dactylon (L)	*Acacia mellifera** (L)	*Olea africana* (L)
Dactyloctenium scindicum (L)	*Acacia nilotica** (L)	*Prosopis juliflora*+ (L)
Lasiurus scindicus (L)	*Acacia seyal** (L)	*Rhigozum somalense* (L)
Ochtochloa (L)	*Acacia tortilis** (L)	*Tamarindus indica*+ (L)
Panicum turgidum (L)	*Balanites spp.** (H, L)	*Tarchonanthus camphoratus* (L)
Pennisetum ciliare (L)	*Cadaba spp.* (L)	*Terminalia brownii* (L)
	Cypreus laevigatus (L)	*Ximenia americana* (H)
	Dobera glabra (H)	*Zizyphus spp.** (H, L)

(From Audru et al *1987, various* pers. comm.)

** of particular importance in dry-season/drought; + introduced species;* L: *livestock fodder/forage;* H: *human consumption)*

Variability between and within biological resources and ecosystems also supports the national economy, which likewise depends on a very limited and uncertain production and consumption base. Much of the potential to diversify national economic production in Djibouti depends on the development of various different biodiversity-dependent sectors such as agriculture, livestock and fisheries. All of these sectors already make an important contribution to national food security, employment, income and – potentially – exports.

3.5 Intrinsic and potential biodiversity economic values

Although unquantifiable, Djibouti's biodiversity support a range of other economic values in addition to their current contributions to production and consumption. Conserving biodiversity allows for the possibility of carrying out economic activities in the future. As well as permitting existing activities to be maintained and expanded – for example agriculture, fisheries and livestock production, biodiversity conservation also ensures that a pool of genetic resources are available for new types of use and development, some of which may not be known now.

Many marine and terrestrial plant and animal species may have agricultural, industrial and pharmaceutical applications – for example possible drug developments from forest plants and species, the domestication of wild plant species as food, gum, incense or oil crops, or potential for cross-breeding or gene transfer into other varieties from indigenous livestock agrobiodiversity so as to increase herds' natural tolerance to stress, drought, pests and disease. Other species and ecosystems in Djibouti have the potential for new or further commercial activities, including already identified developments in the aquarium fish trade (Barratt and Medley 1989), eco-tourism sector (Welch and Welch 1985) or desert cultivation of plant extracts (World Bank 1991).

The continued existence of biological resources, ecosystems and their diversity in Djibouti also has an intrinsic value, regardless of current or possible future utilisation opportunities. This includes local and national cultural, heritage and bequest significance accruing from wild species, natural habitats and areas considered to be of outstanding natural beauty, historical or traditional importance as well as the global existence values attached to conserving biological diversity in Djibouti.

4. THE DISTRIBUTION OF BIODIVERSITY BENEFITS AND COSTS

4.1 Overview of the distribution of biodiversity benefits and costs in Djibouti

Biodiversity conservation, through the implementation of Djibouti's Biodiversity Strategy and Action Plan (BSAP), will incur a range of economic costs including ***direct expenditures*** on the staffing, equipment, infrastructure and other inputs required by its projects and programmes; the ***opportunity costs*** of the alternative land, labour and resource uses and investment opportunities foregone by allocating funds and labour to biodiversity conservation; and ***interference with other economic activities*** through the impacts of biodiversity which is harmful to humans, and required investments in new technologies and production processes and various.

The fact that these costs arise from biodiversity conservation, and the unequal distribution of biodiversity benefits and costs between different socio-economic groups, results in economic inefficiency and inequity. It can undermine attempts at biodiversity conservation through giving rise to a situation where people have few incentives to conserve biodiversity because they do not gain from conservation in financial and economic terms. There is, accordingly, a clear need to set in place adequate economic incentives and financing measures for biodiversity conservation in Djibouti as part of the BSAP.

4.2 The economic costs of biodiversity conservation

Few if any formal on-the-ground biodiversity management or protection strategies are currently practised in Djibouti. The development of a BSAP will involve setting in place various conservation structures and activities. Effecting these structures and activities will in turn give rise to a range of economic costs. Although neither the exact nature of biodiversity conservation nor its associated costs cannot be predicted – no BSAP yet exists for Djibouti and there has never been any kind of environmental investment plan for the country, costs incurred once the BSAP is developed and implemented will include at least three elements:

- ***Direct project and programme costs***
  At the moment the only direct costs associated with biodiversity conservation in Djibouti are the central running costs of the Direction de l'Environnement. These are not known. No programmes or projects directly concerned with biodiversity conservation are currently implemented by other government departments or non-governmental organisations in Djibouti.

  Once operationalised, BSAP projects and programmes will give rise to a range of direct costs including expenditures on staffing, equipment, infrastructure, running costs and other inputs. Other related expenditures by government, non-government, educational and multilateral agencies mandated with different aspects of biodiversity conservation are also likely to be incurred.

- ***Opportunity costs***
  Financial, physical and manpower resources are scarce in Djibouti. The labour, time, land, money and other resources used for BSAP programmes and projects all have alternative productive uses because they could be allocated elsewhere, to other activities or to other sectors of the economy. The opportunity costs of biodiversity conservation in Djibouti are the income and profits that these alternative uses of resources could have generated, and which are effectively foregone by the decision to allocate them to biodiversity conservation.

  The main opportunity costs likely to arise from the BSAP are restrictions in land and resource utilisation in threatened and degraded biodiversity areas. Decreased land and resource uses may for example be implied by gazetting new protected areas, or increasing the on-the-ground protection of existing protected areas. Both will inevitably involve some decrease in extractive activities or active enforcement of restrictions, constituting a loss of potentially productive land and resources for users.

  All three of the existing protected areas in Djibouti already limit extractive utilisation, in theory at least. Around the Forêt du Day[38], although there are negligible on-the-ground protection activities, resource harvesting is informally banned in some places (for example restrictions on grazing and polewood collection are enforced by at least one landowner). The two marine and coastal protected areas – Musha and Maskali Sud – both forbid the collection of coral and shells, although restricted small-scale line fishing is permitted in Maskali and artisanal fishing is allowed in some zones of Musha.

- ***Costs to other economic activities***
  Not all elements of biodiversity are positive or benign from a socio-economic perspective. The presence of biodiversity can incur costs through interfering with or damaging economic systems. For example biodiversity-related human disease and injury, crop and livestock damage by wild animals and pests, and competition over habitat and resources from wild species all incur economic costs on human populations.

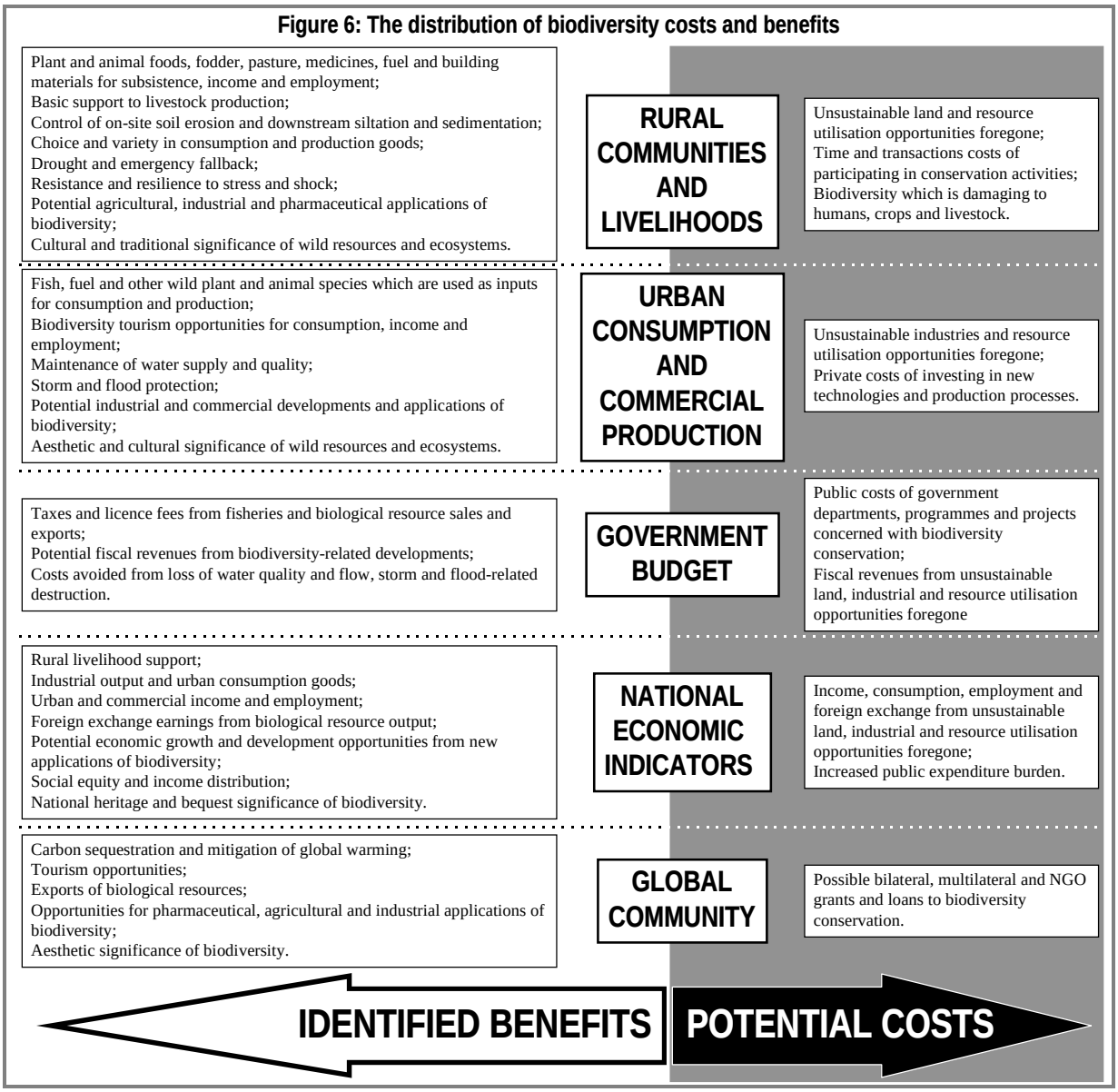
  Conservation may also require some change in industrial and commercial production processes where these are harmful to, or impact negatively on, biodiversity. The BSAP may for example require the limitation of destructive fishing methods such as poisoning and dynamiting, investment in new production technologies in the manufacturing sector, the proper treatment and disposal of wastes and effluents or the implementation of environmental impact assessment procedures as part of infrastructural and industrial development. As well as possible opportunity costs – when certain types of production or output are foregone or diminished – all these changes in production processes imply direct expenditures, including investment in new technologies, production methods and training.

[38] The current protected area status of the Forêt du Day is very unclear. Although references are made to the Parc National du Day, and a legal instrument enabling this gazettment exists (CNE 1991), it is not known if this is still in operation.

4.3 The distribution of biodiversity economic benefits and costs within and outside Djibouti

Although the benefits associated with biodiversity are demonstrably high in economic terms – as illustrated in Chapter 3, they must be weighed against the economic costs of biodiversity conservation described above. As no BSAP has yet been formulated for Djibouti, and no conservation activities defined, it is impossible to determine exactly which biodiversity costs and benefits will arise from conservation, or to whom they will accrue. It is however possible to provide some indicative examples and guides of the likely distribution of biodiversity benefits and costs between different economic groups.

Figure 6: The distribution of biodiversity costs and benefits



As illustrated in Figure 6, different identified benefits and potential costs associated with Djibouti's biodiversity accrue to various groups, inside and outside the country, including:

- ***Rural communities and livelihood systems***

Rural livelihood systems in Djibouti depend almost wholly on the presence of biodiversity and natural ecosystems. The utilisation of wild plant and animal species for fuel, fodder, pasture, construction, food and medicines provides for the majority of households' basic needs. Their diversity allows choice in rural production and consumption, and strengthens livelihoods by making them more secure and resilient to shock and stress. On-site benefits associated with ecosystem services, including the maintenance of soil fertility, water quality and flow, also supports basic human survival and agricultural production. Together, these on-site benefits are estimated to have a quantified value in excess of some ***FD 3.1 million per rural household per year or FD 75.3 billion overall***. Potential developments and applications of biological resources may, in the future, have the possibility to diversify and further strengthen rural production and consumption opportunities. In contrast, biodiversity degradation and loss implies a weakening of livelihoods, and would lead to significant and widespread economic losses at the local level. The main costs associated with biodiversity conservation for rural communities relate to unsustainable land and resource utilisation opportunities foregone – for example limiting livestock grazing in degraded rangeland areas, or diminishing tree felling for fuel and construction materials in forest areas, and to the wild plant and animal pests which interfere with crop and livestock production.

- ***Urban consumption and commercial production processes***

Certain biological resources support urban consumption and commercial production processes in Djibouti, including the those used in the fisheries, energy and tourism sectors as well as sales of plant and animal products. Together fisheries and woodfuel production are estimated to have a quantified value in excess of ***FD 1.1 billion a year*** and would be worth over ***FD 8.5 billion a year*** if fisheries activities were fully developed. Possibilities for further development of biodiversity goods and commercial processes may also generate other as yet unknown economic opportunities in the future. Ecosystem services and functions play a particularly important role in urban consumption and commercial production, for example by ensuring waterflow and quality and protecting coastal areas against storms and floods. The major economic costs associated with biodiversity conservation for urban and commercial groups are those relating to limitations on unsustainable levels and methods of biological resource use, and replacement of production technologies and processes which are harmful to biodiversity.

- ***Government budget***

The Djibouti Government's budget gains fiscal revenues from a range of taxes and license fees on biological resources. These include license fees and export taxes on fisheries and livestock production activities, and taxes raised from tourism. Ecosystem goods and functions also allow significant savings to the government budget by reducing expenditures on the provision of basic services such as ensuring adequate water supply and quality, and saving expenditures necessary to offset the costs associated with biodiversity loss such as flood and storm-related reconstruction or investment in storm barriers. The government is however simultaneously likely to be the main financier for the

BSAP, covering the capital and recurrent costs of government departments and of national biodiversity conservation programmes and projects.

- ***National economic indicators***

Biodiversity contributes to the Djiboutian economy in a number of ways. Biological resource utilisation forms a direct component of national income, employment and foreign exchange earnings. Biodiversity also supports basic components of the national economy, including rural livelihoods, urban consumption and industrial output. The goods and services associated with biodiversity – and their potential future applications – make a significant contribution to economic diversification, growth and development, as well as helping to achieve social equity and income distribution goals. In turn biodiversity degradation and loss implies a loss of productive biological resources and supportive ecosystem functions, and is likely to erode national economic indicators over the long-term.

- ***Global community***

The global community receive a range of economic benefits from the presence of Djibouti's biodiversity. These include the environmental benefits associated with carbon sequestration as well as various option and existence values. They however bear few – if any – of the costs associated with biodiversity conservation in Djibouti aside from possible contributions to biodiversity programmes and projects from donors and international financing agencies.

4.4 The need for biodiversity finance and incentives

The presence of biodiversity costs, and their unequal distribution relative to biodiversity benefits between different groups, has implications for conservation. A situation where some people gain disproportionately from biodiversity and others lose out in economic terms can lead to or exacerbate processes of biodiversity degradation and loss. There is a clear need to at least partially redress any imbalance between of biodiversity benefits and costs and to provide, as part of the BSAP, adequate incentives and finance for biodiversity conservation.

4.4.1 Policy and market failures as economic disincentives to biodiversity conservation

The unequal distribution of biodiversity benefits and costs is inefficient in both economic and conservation terms. It does not encourage the sustainable use of biological resources and ecosystems, and does not maximise biodiversity economic values. There exist a range of disincentives to biodiversity conservation in Djibouti which arise because it often makes more economic sense for producers and consumers to degrade biodiversity in the course of their economic activity than to actively conserve it.

When groups have the potential to benefit from biodiversity without directly bearing the costs associated with its consumption or degradation they are likely to deplete biodiversity. For example, in Djibouti, industrial producers can freely dispose of untreated wastes and effluents into the land and sea. They neither pay for the use of terrestrial and marine ecosystems as a dump nor bear the direct costs associated with the resulting pollution, such as declining fish

yields or loss of utilisable plant and tree species. It thus makes little economic sense for them to spend money on waste treatment or disposal technologies, or to incur economic losses by reducing their production and consumption. Likewise, consumers pay the same price – or may even pay a lower price – for fish which have been harvested sustainably as those which have been caught using destructive fishing methods. It makes no economic sense either for fishermen to ensure that their fishing methods are non-destructive or for consumers to ensure that the products they buy have been obtained in a sustainable way, and may even make economic sense to do the opposite.

Conversely, when groups bear many of the costs associated with biodiversity conservation without gaining commensurate benefits, they have little incentive to support conservation. For example, in Djibouti, restrictions on protected area land and resource utilisation – such as in the Forêt du Day or around Maskali and Musha marine parks – may make little economic sense to agricultural communities or artisanal fishermen. Conserving biodiversity by curtailing utilisation means, for both of these groups, foregoing completely any economic gains. This makes no economic sense, especially when few alternative sources of income and subsistence are available to them.

The net effect of the imbalance of biodiversity costs and benefits in Djibouti is to present economic disincentives to conservation, because it is more profitable for people to degrade biodiversity than to conserve it. The private profits and expenditures of groups who consume biological resources unsustainably or carry out economic activities which contribute to their degradation and loss do not reflect the costs associated with this consumption and degradation. They have incentives to over-exploit and degrade biodiversity because it is cheap, or free, for them to do so and because they do not have to pay the costs arising from the damage that their activities causes. Conversely, people who are in a position to conserve biodiversity have no economic incentive to do so when they gain no personal benefit from conservation. Their private profits remain the same whether or not they conserve biodiversity as they consume and produce goods and services. In the course of their economic activities, people are presented with incentives to under-value, over-consume and under-conserve biodiversity.

Attempts at biodiversity conservation in Djibouti are unlikely to succeed unless they at the same time provide economic incentives – and overcome economic disincentives – to the groups whose activities impact on biodiversity. This requires action both at the market level – where biodiversity goods and services are free or underpriced and biodiversity values do not accrue to the people who conserve biodiversity in the course of their economic activity, and at the policy level – where policies encourage or increase the relative profitability of biodiversity-degrading economic activities and discourage or decrease the relative profitability of biodiversity-conserving economic activities. A range of economic instruments can be used to overcome these market and policy failures and to provide people with incentives to conserve biodiversity in the course of their economic activity. These instruments, and their role in Djibouti's BSAP, are described below Section 5.4.2.

4.4.2 Inadequate finance for biodiversity conservation

As well as being in inefficient, the disparity in the distribution of biodiversity benefits and costs is inequitable and unsustainable because it places an undue cost burden on particular economic groups, while unfairly benefiting others. Even where people have incentives and are willing to conserve biodiversity, they may lack the necessary funds or economic security to do so. Biodiversity conservation is unlikely to succeed over the long-term if people are unable to bear its associated costs.

Available sources of finance are extremely limited in Djibouti. Both government budgets and donor funds are low and under severe pressure from other sectors of the economy such as defence, health and education, all of which are often seen as having a more urgent need, and priority claim, on public finance than biodiversity conservation. Sources of private and commercial investment funds are also limited and under heavy competition from activities which may be able more easily to demonstrate themselves to be profitable and secure investment opportunities than biodiversity. Many of the opportunity costs associated with biodiversity conservation are felt by poorer rural groups who depend more on biodiversity and cannot always afford to limit their consumption of biological resources or switch to alternative modes of production and consumption.

The BSAP is unlikely to succeed unless its funding can be assured. The Djibouti government cannot absorb the additional cost implications of biodiversity conservation within its existing budget. New ways of raising funds for biodiversity and making the BSAP financially sustainable need to be identified. There is a clear need to generate sufficient funds for biodiversity conservation, and to channel them in a suitable form to the groups who are ultimately responsible for bearing its costs. A range of financing mechanisms and instruments can be used to raise and distribute finance for biodiversity conservation. These mechanisms, and their role in Djibouti's BSAP, are described below Section 5.4.3.

5. CONCLUSIONS AND RECOMMENDATIONS: ECONOMIC TOOLS AND MEASURES FOR THE BIODIVERSITY STRATEGY AND ACTION PLAN

5.1 Overview of economic tools and measures for biodiversity conservation in Djibouti

The economic assessment of Djibouti's biodiversity generates a variety of information which can be used in the BSAP. This includes:

- An ***economic justification for biodiversity conservation***, demonstrating that many sectors of Djibouti's rural and urban economies depend heavily on biological resources, ecosystems and their diversity, and cannot afford to bear the long-term economic costs associated with their degradation and loss.

- Analysis of the direct ***economic activities which lead to biodiversity degradation***, and of the ***underlying root economic causes of biodiversity loss*** including a wide range of policy and market factors which lead to economic activities taking place in ways or at levels which harm biodiversity.

- Identification of ***economic measures which can be integrated into the BSAP*** to overcome the economic forces driving biodiversity degradation and loss, through providing incentives and finance for people to conserve biodiversity in the course of their economic activity.

5.2 Economic justification for biodiversity conservation in Djibouti

It will be necessary for the BSAP to be able to justify biodiversity conservation to other sectors of the Djibouti government, as well as to donors, private firms and rural communities. Unless it can be demonstrated that activities in other sectors of the economy depend on the continued conservation of biodiversity, and that biodiversity in turn supports broader national development, economic growth and social equity goals, the BSAP stands little chance of success or acceptance. Economics provides a strong and convincing set of arguments for conserving Djibouti's biodiversity. As outlined in Chapters 3 and 4 of this report, a range of economic factors justify biodiversity conservation in Djibouti, including:

- ***Rural livelihoods are based almost wholly on biological resources and their diversity.*** At the same time as pastoralist livestock production relies on wild sources of pasture, fodder and forage, human survival depends to a large extent on plant biodiversity. Rural households have few other accessible or affordable sources of domestic energy, construction materials, medicines or wild foods. Biological resources provide a ready supply of these basic consumption goods, while their diversity ensures that human populations have choice and a source of fallback in times of emergency or drought. In a marginal and uncertain physical environment, where poverty is widespread, little human production or consumption would be possible without biodiversity.

- ***Biodiversity makes an important contribution to national income, employment, output and foreign exchange earnings.***
  As well as forming the basis of rural livelihoods, biodiversity provides for urban consumption, income and employment through the supply of fuel and other raw materials as well as through activities in the fisheries and tourism sectors. Together, these biodiversity economic values contribute to national economic indicators and development goals such as income, employment, output and foreign exchange earnings.

- ***Maintaining a pool of genetic resources supports opportunities for future economic diversification, growth and development.***
  Djibouti has an extremely small production base, and limited options for future economic expansion. Biodiversity comprises a pool of resources which have great potential, if developed, to contribute to economic diversification, growth and development in the future. As well as already identified projects in the fisheries, aquarium trade, agriculture and tourism sectors, various as yet unknown opportunities for pharmaceutical, industrial and agricultural applications of genetic resources may exist.

- ***Neither the government nor the people of Djibouti can afford to bear the economic costs and risks associated with biodiversity loss.***
  The depletion or exhaustion of biological resources will impose severe losses on rural livelihoods and may significantly constrain future urban and industrial development. Ecosystem degradation will lead to the loss of various natural functions which are vital to human survival and economic production, such as maintenance of waterflow and quality, support of soil fertility and land productivity and protection of coastal areas against storms and floods. These services are especially important because they relate to at least two of the major constraints to economic development in Djibouti – marginal and infertile lands, and poor water availability.

  Many of the losses associated with biodiversity and ecosystem degradation will impact most on the poorest sections of the population, including rural households who have few other economic opportunities open to them. They will also accrue to Djibouti's national economy, which is already vulnerable and limited in scope. The costs of biodiversity loss will weigh heavily on government, who are responsible for providing or replacing basic services and maintaining a basic standard of living for the population. Neither the Djiboutian government, national economy nor urban and rural households can afford to bear the costs associated with biodiversity loss, or the risks to economic security and well-being that they imply, over the long-term.

5.3 Economic root causes of biodiversity degradation and loss in Djibouti

The BSAP needs not just to address the immediate factors which give rise to biodiversity degradation – such as destructive fishing methods, industrial and urban pollution and unsustainable exploitation of wild plant and animal resources – but to deal with the underlying root economic causes which encourage these activities to occur in the first place.

As outlined in Chapter 2 of this report, direct economic factors driving biodiversity loss in Djibouti include:

- ***Unsustainable exploitation of biological resources***
  Although existing pressure on biological resources is generally low in Djibouti, the demands of a rapidly expanding population and diversifying economy may in the future make biodiversity exploitation increasingly unsustainable. Several biodiversity production and consumption activities are already giving rise to concern including tree felling for woodfuel and polewood and the resulting clearance of mangroves and forest areas, the harvesting of rare and endangered animal and marine species for sale and the growing trade in aquarium fish.

- ***Destructive harvesting and utilisation methods***

At least two major economic activities are carried out in ways which harm biodiversity. Activities in the fisheries sector utilise destructive methods, such as poison, spearfishing and dynamiting, which harm both fish populations and the marine and coastal environment. Over-grazing has already become a major problem in rural areas of Djibouti, where herd pressure exceeds the natural carrying capacity of rangelands and is leading to severe land degradation.

- ***Disposal of wastes and effluents into the terrestrial and marine environment.***
  Although most urban and industrial production processes make little direct use of biological resources as primary inputs, they can have devastating knock-on effects on biodiversity. Disposal of untreated waste into the natural environment, including domestic, manufacturing and shipping effluents, constitute a serious threat to terrestrial and marine biodiversity in Djibouti.

In turn, as outlined in Sections 2.4 and 4.4 of this report, these economic activities are encouraged or caused to take place by a range of broader and more pervasive factors which constitute the underlying economic root causes of biodiversity degradation and loss. Together, these root causes result in a situation where people have few incentives to conserve biodiversity because it makes no economic sense for them to do so, and include in Djibouti:

- ***Market failures***

The prices that people face, and markets which are available to them, reflect neither the economic benefits associated with biodiversity conservation nor the costs arising from its degradation and loss. There are few incentives, and inadequate finance, for people to conserve biodiversity in the course of their economic activity because the effects of their production and consumption on biodiversity are not reflected in the prices they face or the profits they receive.

- ***Policy failures***

Emerging economic policy in Djibouti is not geared towards conserving biodiversity. Although existing economic and development strategies generally have no intrinsically negative effects on biodiversity, the past policy of free water provision in agricultural

areas – while of undoubted social and economic benefit – may present disincentives to biodiversity conservation by encouraging habitat conversion and sedenterisation. Industrial development strategies, in both biodiversity and non-biodiversity dependent sectors of the economy, may in the absence of adequate controls and checks lead to biodiversity degradation and loss.

- ***Legal failures***

There is omission in existing legislation of any clear and binding guidelines, or penalties, for economic activities which contribute to biodiversity loss. Laws relating to environmental conservation generally, and biodiversity conservation in particular, are largely lacking in Djibouti; where they do exist they tend to be scattered, often contradictory and poorly enforced.

- ***Physical and economic situation***

  Severe physical constraints to production and consumption, and the limited economic base of Djibouti, mean both that biodiversity is vulnerable and that people often have few alternatives to engaging in economic activities which harm biodiversity. Djibouti's biodiversity, and the economic activities which depend on it, are also highly susceptible to changes in exogenous economic and political factors over which the Djibouti government and people have little control.

5.4 Use of economic tools and measures in the strategy and action plan

A range of economic tools have potential for use within Djibouti's BSAP. These include measures which attempt to decrease immediately unsustainable economic activities as well as those addressing the more pervasive policy and market failures which comprise the root economic causes of biodiversity degradation and loss. Although it will be impossible to identify specific economic tools for biodiversity in Djibouti until the BSAP is formulated and conservation activities chosen, a number of general recommendations may be made as to the nature and available choice of economic measures. These are outlined below.

5.4.1 Available economic instruments for biodiversity conservation

Economic instruments are already used by government as tools for broad macroeconomic management and to pursue major sectoral economic strategies in Djibouti. They aim to influence people's economic behaviour and promote particular sectors of the economy by making it more or less profitable for them to produce or consume particular goods. They can also provide incentives for biodiversity conservation. A range of economic instruments have potential for use in Djibouti's BSAP to provide incentives for biodiversity conservation, including:

- ***Property rights***

  Property rights deal with the fact that market failure is due in part to the absence of well-defined, secure and transferable rights over land and biological resources. If property rights are established, biodiversity markets and scarcity prices should emerge, and permit the users and owners of biological resources to benefit from conservation or be forced to

bear the on-site implications of degradation. Examples of property rights include the allocation of legal rights and tenure over the ownership, management and use of biological resources or biodiversity areas to particular groups or communities.

There is currently only limited potential for the application of property rights in Djibouti because of the relatively small number of well-defined, high-biodiversity areas in the country, the undeveloped nature of private property in rural areas and the difficulty of creating any kind of private right over marine areas. One use of property rights as a tool for biodiversity conservation might however be to strengthen and reinforce already-existing pastoralist customary resource rights and management systems over areas of rangeland biodiversity.

- ***Market creation and charge systems***
  Market creation and charge systems entail trading in biodiversity goods and services and giving them a price which reflects their relative scarcity, costs and benefits. Creating markets ensures that biological resources are allocated efficiently and put to their best use according to people's willingness to pay. Creating the ability to buy, sell and trade in biodiversity, or to exchange biodiversity-damaging economic activities between sites, can encourage biodiversity conservation and discourage activities which result in biodiversity loss. Assigning charges or prices to biodiversity goods and services is also a means of generating revenues.

  Examples of market creation and charge systems include the direct creation of markets – such as by instituting the purchase and sale of biodiversity goods and services and value-added products where there is a demand and willingness to pay on the part of consumers; the establishment of tradeable rights, shares and quotas in biological resources and environmental quality – such as fishing quotas, pollution permits or development rights; setting new charges or rationalising existing charges – such as park entry fees, biological resource utilisation licences, environmental pollution and waste clean up charges; and initiating charges for biodiversity goods and services which are currently received free – such as downstream water catchment benefits, storm protection or consumptive and non-consumptive biological resource utilisation activities.

  The is potential for creating or strengthening various biodiversity markets in Djibouti, at both larger-scale and local commercial levels. Fishing rights and quotas are currently ill-defined, and incursion into Djiboutian waters by Somali and Yemeni fishermen is perceived to be a problem. With the expansion and further commercialisation of the fisheries sector there may be possibilities for introducing some form of quota in fish or fishing areas to individual fishermen or groups, or permitting auction and trade in fisheries quotas. Waste and pollution clean up charges form another market instrument to minimise marine ecosystem degradation, with potential application to shipping, industrial and manufacturing developments in Djibouti Ville. At the local level, there is potential for the development of small-scale biodiversity enterprises and cottage industries, for example the sustainable harvesting and sale of plant products with commercial value such as gum arabic, doum palm leaves, frankincense and myrrh.

- ***Fiscal instruments***
  Fiscal instruments include various types of taxes and subsidies. They can be used to raise the relative price of biodiversity-degrading products and technologies in line with the costs of the damage they cause and discourage people from using them, and to decrease the relative price of biodiversity-conserving products in line with the benefits of conservation and encourage people to use them. Fiscal instruments can also be used as a budgetary tool to raise revenues. Examples of fiscal instruments include differential tax rates – such as relatively higher taxes on biodiversity depleting land uses, equipment, inputs and products, or subsidies to biodiversity-neutral or biodiversity conserving technologies, land uses and enterprises.

  Although there are arguments against increasing tax rates on basic consumption goods and increasing the government spending burden by increasing subsidies in Djibouti, it may be feasible to make intra-government transfers returning a proportion of existing fiscal revenues from biodiversity-dependent sectors of the economy, such as fisheries and water, to biodiversity conservation. A range of selective differential tax and subsidy systems – including differential import taxes, or import tax relief – could also be applied as mutually-financing mechanisms to encourage investment in, and use of, biodiversity-friendly production technologies such as non-destructive fishing equipment or improved industrial technologies.

- ***Financial instruments***
  Financial instruments are a way of mobilising and channelling funds to biodiversity conservation. They include funds, loans, grants and investment activities specially earmarked for biodiversity conservation. Examples of financial instruments include green funds, trust funds and preferential loans to biodiversity-conserving activities and technologies.

  In Djibouti credit is readily available in the capital and its provision on easy terms is used by government as an incentive for industrial investment. These arrangements could be extended to rural areas and to biodiversity-based enterprise or biodiversity-friendly production development, so as to encourage investment in technologies and start-up of rural enterprises, which would reduce pressure on biodiversity.

- ***Bonds and deposits***
  Bonds and deposits are product surcharges which shift the responsibility for biodiversity depletion to individual producers and consumers. They are levied on activities which run the risk of harming biodiversity, and require the person carrying out these activities to pay a bond or deposit before they start against the possibility of this damage occurring. By charging in advance for possible biodiversity damage, bonds and deposits provide funds for covering the costs of this damage and ensure that producers or consumers cover the cost themselves, and also presents an incentive to avoid biodiversity damage and reclaim the deposit or bond. Examples of bonds and deposits include those set on land restoration,

disposal of dangerous or hazardous chemicals, waste clean up and proper harvesting of biological resources.

The major potential for bonds and deposits in Djibouti is in the infrastructural, industrial and shipping sectors. Refundable bonds could be imposed on new urban and industrial developments, shipping of dangerous or hazardous wastes, the use of proper impact assessment procedures or damage caused to biodiversity.

5.4.2 Available financing measures for biodiversity conservation

The development of a BSAP will involve defining a set of projects and programmes which are required to achieve biodiversity conservation goals. All these activities will incur some level of costs, and all will therefore require financing. A wide range of mechanisms can be used to fund Djibouti's BSAP, once activities and their costs have been identified. Four main sets of funding methods are available to Djibouti, including conventional sources of finance, domestic economic instruments, private domestic finance and innovative international financing mechanisms:

- Three major categories of ***conventional financing instruments*** are already used to raise finance by the Djiboutian government, and can potentially be used to fund the BSAP. These include borrowing from banks and other commercial lending institutions; multilateral, bilateral and NGO grants and loans; and public sector investments and budgetary allocations. The potential for raising funds from these sources for biodiversity conservation activities should be assessed.

  Djibouti already depends heavily on foreign aid and external financial assistance. Although donor funds will undoubtedly form an important means of implementing BSAP activities, care should be taken that this neither increases unduly the country's foreign debt burden or leads to a loss of national sovereignty over biodiversity-related decisions and actions.

- Although the primary goal of ***economic instruments*** is to change incentive structures and to encourage people to conserve biodiversity in the course of their economic activities, some however have the additional advantage that they simultaneously can generate and allocate funds for biodiversity conservation. For example, fiscal instruments, markets, charge systems, bonds and deposits all generate revenues; property rights and financial instruments provide a means of ensuring that funds accrue to particular economic sectors or social groups. Economic instruments are particularly effective ways of making sure that the private sector and communities both generate and receive biodiversity finance, and channelling revenues to the small-scale, community or site-specific level.

- ***Private sector sources of finance*** should also be considered as potential means of financing the Djibouti BSAP. There is no reason why the state should have a monopoly on funding or managing biodiversity conservation – Djibouti has an efficient and rapidly expanding private sector, including large-scale commercial concerns as well as small-

scale and community-level groups. There is great potential for encouraging private and community sector investment in biodiversity. This can not only generate funds, it can increase public participation in biodiversity conservation and transfer some of the cost burden of the BSAP away from government.

In Djibouti encouraging private participation and management in biodiversity-based sectors of the economy which have already been targeted for future growth – such as biodiversity tourism and protected area establishment activities – would provide a means of devolving some (although not all) of the responsibility and costs of biodiversity management away from the state to private and non-governmental agencies. At the small-scale rural level encouraging investment in, and development of, value-added biodiversity enterprises and cottage industries may also have potential to increase private and community participation in biodiversity management and cost-sharing.

For the private sector to be more fully engaged, biodiversity must be made into an attractive and accessible investment opportunity. There are a range of ways in which the private sector can be encouraged to invest in biodiversity conservation. Most importantly opportunities must be created for private engagement, both in terms of ownership and control of biological resources and biodiversity areas as well as in support to sustainable biodiversity-based enterprises such as the extraction and processing of biological resources or biodiversity tourism. Support can be provided to the entry of the private sector into biodiversity conservation in various other ways, including research and development into new biodiversity products and markets, the elimination of barriers to trade and business, the allocation of concessions, franchises, sponsorship and advertising deals in biodiversity areas or enterprises, the provision of credit on favourable terms and other inducements to investment. Many of these forms of support can be made under joint arrangements and partnerships between the public, commercial and community sectors.

The private sector can also be encouraged to invest in biodiversity aside from direct participation in biological-resource based enterprises and management of biodiversity areas and species. Efforts can be made to attract charitable contributions and donations through such mechanisms as trusts, foundations and endowments. Such contributions can be made more attractive to the private sector by providing incentives such as tax relief or publicity to contributors, and may be particularly attractive to foreign-owned firms operating in Djibouti. Economic instruments can also be used as a means of raising revenues from the private sector and allocating them to various types of biodiversity funds – for example from subsidies saved, charges made or taxes levied.

- Donor arrangements are not the only means of funding biodiversity conservation from international sources. Multiple possibilities exist for attracting ***international finance*** to biodiversity conservation, including those which encourage the transfer of private financial resources as well as the more innovative use of donor funds.

- A range of ***international funds*** can be used to finance biodiversity conservation. These include trust funds, foundations, endowments, revolving funds, green funds and other grant or loan-making entities. These funds can both be used as a means of raising money from international sources as well as channelling money to biodiversity conservation.

  International funds have some potential for financing conservation for Djibouti's biodiversity areas, or species, which have a high global profile and perceived value. For example areas such as coral reefs, marine parks and the Forêt du Day, and species such as the Djibouti Francolin or Bankoualé Palm, may all be able to successfully raise international finance for conservation.

- Various approaches to ***debt relief*** such as debt rescheduling, debt forgiveness, debt-for-equity and debt-for-nature swaps can be used as a means of simultaneously generating funds, increasing private and NGO participation in biodiversity conservation and reducing national indebtedness.

  Some kind of debt relief arrangement may be a way of reducing Djibouti's large external debt and providing targeted funds for biodiversity conservation.

- ***Offsets and credits*** can generate flows of funds from international industries to biodiversity conservation. For example under carbon offset and credit arrangements, developed country power utilities finance the operations of a developing country Forest Department, in exchange for credit for the amount of carbon saved or sequestered.

  As Djibouti has few resources or ecosystems of a large enough area or sufficient uniqueness to be of significant global importance, the potential for offset and credit arrangements as a mechanism for biodiversity financing is likely to be extremely limited.

- ***International compacts*** are voluntary agreements made by developing countries to engage in policy reforms and biodiversity conservation in exchange for the transfer of financial or technological resources from international sources to support these reforms.

  As Djibouti is in the process of major policy reform and is for the first time operationalising a national environmental and biodiversity conservation plan, it is possible that these on-going processes could be used to bargain some kind of international compact agreement.

- ***Concessions or prospecting rights*** can be offered in biodiversity areas and species to companies interested in their possible future uses – for example agricultural, industrial and pharmaceutical applications – of biodiversity and genetic resources.

Djibouti is not a country with high or extensive biodiversity, and does not contain a large number of endemic or rare species. The potential for instigating biodiversity prospecting arrangements is therefore likely to be limited.

5.4.3 Choice of appropriate economic measures

Only some of the available economic measures for biodiversity conservation described above will be suitable for inclusion in the BSAP. The unique physical characteristics and economic situation of Djibouti influence the choice of economic instruments and their appropriateness for achieving biodiversity conservation goals. It is also crucial that any economic tools applied to biodiversity conservation are politically acceptable, and consistent with goals in other sectors of the economy. The choice of economic measures to be included in the BSAP should be influenced by the following considerations:

- Djibouti is characterised by extreme ***economic duality***, and is comprised of two distinct sub-economies within which very different economic conditions pertain. It is likely that two sets of economic instruments will have to be formulated in order to deal with this heterogeneity. It will be important to set in place economic measures for biodiversity conservation which target both the commercial, market-based urban sector and the subsistence-based rural sector. It cannot be assumed that one set of biodiversity economic measures will simultaneously have relevance to both these sub-economies.

- ***Consumer prices*** are already extremely high in Djibouti. Any economic instrument for biodiversity conservation should not increase commodity prices, even those of biodiversity-depleting goods. Rather, economic measures which present positive incentives for biodiversity conservation by saving money, increasing production efficiency or contributing to consumer choice will be far more effective than those which use the price mechanism to penalise directly for biodiversity loss.

- Both urban and rural ***poverty*** is widespread in Djibouti, with extreme inequities in the distribution of income between a small élite and a large, poorer population. Economic instruments which balance more equitably the costs and benefits of biodiversity conservation, and redistribute income, will provide a means to help overcome these inequities. Conversely, there is little potential for using economic instruments which will further widen disparities in socio-economic status.

- In both of Djibouti's sub-economies ***production and consumption opportunities are limited*** and focused on a small number of commodities. Rather than increasing the reliance of the Djiboutian economy on these limited economic activities, instruments for biodiversity conservation should aim to strengthen the diversity, and sustainability, of different economic opportunities at national and local levels.

- Djibouti is in the process of ***policy development and reform***, major aims of which are to strengthen and diversify the economy, to increase liberalisation and to decrease the role of the public sector. Economic instruments for biodiversity conservation should from the

start be integrated with, and consistent with the goals of, these new macroeconomic and sectoral policies. In particular biodiversity economic measures should support new policy by aiming to minimise the costs of conservation to government, increase decentralisation, privatisation and liberalisation and to contribute to national economic growth and development goals.

- The Djibouti economy is already ***dependent on external financial assistance*** and is ***highly vulnerable to exogenous shocks***. Economic instruments for biodiversity conservation, if they are to be sustainable over the long-term, should decrease rather than exacerbate this dependence and vulnerability.

5.4.4 Indicative economic tools for inclusion in the Djibouti BSAP

Until the BSAP is formulated it is impossible to identify the specific economic incentives and financing mechanism which will support its activities. It is however possible to predict certain broad areas which may be covered by BSAP activities, and to make general recommendations as to supportive economic tools and measures. These are outlined in Table 14 below.

Table 14: Indicative economic measures for incentives and financing in the BSAP

Economic tools and measures ▶ / Examples of BSAP activities ▼	Specific economics components	Supportive incentive measures	Supportive financing mechanisms
Strengthening biodiversity institutions in government	• Inclusion of economists in biodiversity agency • Integration of biodiversity agency with economic planning and development agencies • Financing plan for biodiversity programme		• Cross-finance from other biodiversity-dependent public revenues • Donor funding
Formulating biodiversity policy and legislation	• Integration of economic instruments and financing mechanisms into biodiversity, economic and other sectoral policy and legislation		• International compacts
Biodiversity monitoring	• Monitoring of economic value of biodiversity • Monitoring of economic effects of biodiversity loss	• All aim to identify and provide incentives for biodiversity conservation	• International funding from interested NGOs • International research funds • Private sector sponsorship
Biodiversity surveys and inventories	• Data collection on levels and value of biodiversity utilisation		• Partnerships with international agencies and research institutes
Biodiversity education and awareness	• Dissemination of biodiversity economics information		
Establishing or extending protected area network	• Development of business plan for management • Development of economic strategy for utilisation • Assessment of opportunity costs of PA establishment	• Private and community property rights • Joint management • Sustainable utilisation • Provision of alternatives to biodiversity goods, income and employment	• Trust fund mechanisms • Debt exchange • Development of utilisation and return of revenues • Private sponsorship and advertising • Benefit and cost-sharing
Strengthening the role of communities and private sector in biodiversity conservation	• Formulation of cost and benefit sharing plans for community and private sector participation	• Development of utilisation and value-added activities • Property rights and joint management mechanisms • Cost and benefit-sharing mechanisms	• Cost-sharing and joint management • Revolving funds and credit • Donor seed money • Private sponsorship
Development of sustainable biodiversity utilisation activities	• Market and business analysis of opportunities and niches	• Property rights • Joint venture • Revolving funds and credit • Development of new markets • Rational pricing of biodiversity goods and services • Selective/differential taxes and subsidies • Revolving funds and credit	• Commercialisation • Private sector participation • Donor seed money • Private sponsorship
Enforcing penalties against illegal and destructive biodiversity utilisation	• Setting and enforcement of realistic fines and penalties	• Selective/differential taxes and subsidies • Fines • Quotas and permits • Supportive policy and legislation	• Return of fines, etc. to finance operations

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7. DATA ANNEX

Population

Table 15: Djibouti population 1998

			Persons			Households		
	Area(km2)	Density	Urban	Rural	Total	Urban	Rural	Total
Djibouti Ville			388,567	-	388,567	55,636	-	55,636
Rest of Djibouti District	600	676	8,233	8,986	17,219	1,430	1,895	3,325
Ali-Sabieh District	2,400	23	19,377	34,804	54,181	2,865	5,470	8,334
Dikhil District	7,200	9	24,163	38,223	62,387	3,393	6,744	10,137
Tadjourah District	7,300	7	8,623	44,626	53,250	1,097	8,334	9,432
Obock District	5,700	4	7,641	16,756	24,397	1,041	2,862	3,903
TOTAL	**23,200**	**26**	**456,604**	**143,396**	**600,000**	**65,461**	**25,305**	**90,767**

(From District areas, household size and density from DINAS 1990 extrapolated to total population)

Agriculture

Table 16: National agricultural output 1978-88

Year	Agricultural output (tonnes)
1978/9	50
1979/80	100
1980/1	300
1981/2	500
1982/3	727
1983/4	1,069
1984/5	1,292
1985/6	1,700
1986/7	1,815
1987/8	1,767
1988/9	1,572

(*From CNE 1991*)

Table 17: Agricultural revenues 1998

	'000 FD/farm/year				
	Ali Sabieh District	Dikhil District	Tadjourah District	Obock District	Djibouti District
Gross production	593	572	567	385	1,141
Intermediate inputs	142	110	100	40	150
Depreciation	30	30	30	30	30
Labour	120	120	120	120	240
Net revenue	**298**	**312**	**314**	**195**	**721**

(*From Habib 1998; assumed average 0.5 ha cultivated area per farm*)

Fisheries

Table 18: Estimates of national fisheries production 1979-95

Year	Catch (tonnes)	Source
1979	250	*El Gharbi 1987*
1980	200	*Djibril 1998*
	310	*El Gharbi 1987*
1981	390	*El Gharbi 1987*
1982	400	*El Gharbi 1987*
1983	500	*World Bank 1991*
	460	*El Gharbi 1987*
1984	400	*Djibril 1998*
	290	*DINAS 1990*
	480	*El Gharbi 1987*
1985	270	*DINAS 1990*
	420	*El Gharbi 1987*
1986	410	*DINAS 1990*
	620	*El Gharbi 1987*
1987	430	*DINAS 1990*
1988	700	*Djibril 1998*
	450	*DINAS 1990*
1989	390	*DINAS 1990*
1990	800	*CNE 1991*
	360	*DINAS 1990*
1991	200	*Djibril 1998*
1995	500	*Djibril 1998*
	400	*World Bank 1991*

Table 19: Total maximum annual fisheries yield

Type of fish	MSY (tonnes)
Demersal	
Small demersal (excluding *Leiogathidae spp.*)	1,872
*Leiogathidae spp. (*slipmouth)	8,625
Large demersal (excluding *Balistadae spp.*)	1,760
Balistadae spp. (trigger fish)	1,862
Other demersal	1,095
Total demersal	**15,214**
Pelagic	
Small pelagic	24,800
Large pelagic	3,200
Total pelagic	**32,625**
All fish	**47,839**

(*From World Bank 1998*)

Table 20: Maximum sustainable commercial fisheries catch

	Catch (tonnes)
Demersal fish catch	5,000.00
Pelagic fish catch	3,200.00
Crustaceans catch	65.24
Total fisheries production	**8,265.24**

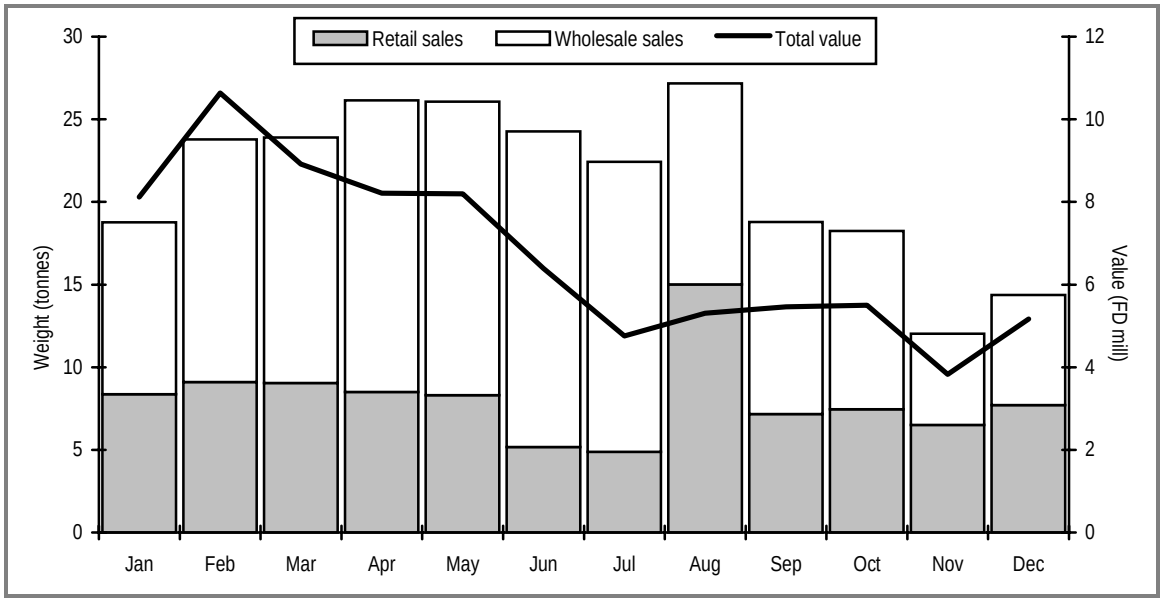
(*From Künzel* et al *1996*)

Table 21: Fish prices 1998

	FD/kg whole fish	
	Retail price	**Price paid to fishermen**
Barracuda	425	180-250
Bonite	425	180-250
Carangue	400	180-250
Coryphene	425	180-250
Dorade	700	180-250
Maille maille	475	180-250
Merou	450	180-250
Rouget	500	180-250
Thazard	500	180-250
Thon	500	180-250
Sardines/mackerel	600	250
Crabe	700	400
Langouste vivante (period chaude)	2,800	2,100
Langouste vivante (period froide)	2,800	2,100
Palourde	600	325
Queue de langouste fraiche	4,075	3,500

(*From Sarl de Mer Rouge Pêche* pers comm.)

Figure 7: Retail and wholesale fish trade, Djibouti Ville 1997



(*From Sarl de Mer Rouge Pêche* pers comm.)

Livestock

Table 22: Livestock productivity estimates

	Calving interval (yrs)	Lactation period (days)	Milk yield (lt/day)	Meat+sales offtake (%)
Cow	3	180	3.5	12.5
Camel	2	360	6.5	10
Smallstock	1	90	1.0	25

(*From Habib* pers comm.*, Emerton 1998a*)

Table 23: Price of animals and livestock products 1998

	Rural meat price (FD/kg)	Djibouti Ville meat price (FD/kg)	Rural milk price (FD/lt)	Live sales price (FD/mature animal)
Camel	300			70,000
Smallstock	600	500	100	3,000-5,000
Cattle		500	150	4,000

(*From Habib* pers comm.)