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**ENVIRONMENTAL FORESTRY IN NAMIBIA:
Preliminary site descriptions of strategic forests**

FINAL REVISED REPORT

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Appendix 1 Section of Forest Act outlining management options for forest conservation areas

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ENVIRONMENTAL FORESTRY IN NAMIBIA: Conservation of strategic forests for the national benefit

1 THE CONCEPT OF ENVIRONMENTAL FORESTRY

Environmental forestry is a new concept in the global forestry sector. Environmental forestry refers, basically, to "satisfying national conservation¹ objectives through the management of certain forest areas that contribute to this end" (Tuomasjukka, 1999). Environmental forestry has two distinct levels of action:

- the national level for defining national conservation objectives, identifying conservation areas, co-coordinating and monitoring the conservation activities and
- the local level for the management of forest conservation areas.

National conservation objectives are generally political issues, derived from a political agenda aimed at improving the well-being of the nation. This agenda normally reflects issues such as the quality of the human environment, production capacity of ecosystems for maintaining the national economy and conservation of nature for its own sake, even if no particular use can be defined.

In addition, international commitments related to the global environment have strong effects on this agenda. This refers particularly to the Biodiversity Convention, Climatic Change Convention, Desertification Convention and the Ramsar Convention for conservation of wetlands. A global forest convention is being debated at this moment and if it can be brokered, it will definitely be reflected in the national conservation agenda of Namibia.

The national conservation objectives are often defined by the central government, although this may not be the best possible approach. On the other hand, it is partly justified, as a central government is often held responsible for taking care of the nation's needs and commitments. National conservation objectives extend their influence over forest ecosystems and give the impetus for the forest conservation and environmental forestry.

Fulfilling the national forest conservation objectives requires practical conservation activities in the field, particularly in forest areas that are considered of national importance. Once these forests of national importance are identified, a range of activities can be applied for putting the area under sustainable management and conservation. At one extreme we have those areas and activities that are entirely state controlled, which often excludes all other users and operates completely under central government control. This is normally called "state management".

At the other extreme there is the control of conservation or management areas by local stakeholders, the so called "community-based natural resource management", (CBNRM) initiatives. In between these two management systems fall a range of combinations, often referred to as "collaborative management" schemes. In

¹ In environmental forestry the word *conservation* is understood as a synonym of sustainable use. It is important to distinguish the earlier term *protection* from the modern concept of conservation. Protection of a natural resource reflects the desire to protect the resource *from use*, while conservation considers this relation in a more positive manner, as protecting the resource *for* its use.

collaborative management the responsibilities of conservation and management are divided between the state and the local community², and the benefits derived are also shared between the two parties. The benefits need not be only physical goods, but also environmental services which are generally difficult to account for.

The difference between CBNRM and collaborative management is not always clear and sometimes appears very subtle. In some cases, an area managed purely by a community for the its own benefit, may also benefit the nation by maintaining a certain natural ecosystem relatively intact and in this way enhancing biodiversity conservation. The important issue in the above classification is the difference between the exclusive state-run management interventions and those based on the involvement of local communities.

Community involvement is by far the most prominent and preferred strategy in natural resource management throughout the world. Exclusive state management has succeeded only in special cases and is often costly to implement. Thus, it is not difficult to understand why the actual tendency in a range of conservation activities is towards the involvement of local stakeholder groups.

This applies equally to environmental forestry field activities. In fact, at the field level, when local stakeholder groups are involved in and benefiting from the conservation activities, environmental forestry approaches community forestry. This is due to the fact that the techniques for working with the local forest stakeholder groups are basically the same in both cases. In community forestry, the use of a forest resource is aimed at satisfying the local community's³ needs. In other words the local groups using the forest resources directly define the overriding objectives for the management of forest resources. These objectives are quite often oriented towards the physical goods obtained from the forest ecosystem.

What distinguishes environmental forestry activities from traditional community forestry activities is that, in the latter, only local management objectives are promoted, in the former the national conservation objectives have to be taken into account. This is the great practical challenge of environmental forestry field activities: to consider both the local needs and the national needs and to accommodate them in such a way as to conserve resources in a particular forest without infringing on the rights of the local and national user-groups.

2 APPLICATION OF THE ENVIRONMENTAL FORESTRY CONCEPT IN NAMIBIA

2.1 Strategic forests

In 1996, the Namibian Government launched and adopted the Namibia Forestry Strategic Plan. This was the first document in which the concept of environmental

² In this text, the word "local community" refers to populations related to a particular forest or other natural resource. It is difficult to define the geographical limit of a local community, as this concept actually is derived from interests over the resource, the attribute of being a stakeholder.

³ In this text the terms "local community" and "stakeholder groups" always refer to human populations consisting of men and women, and recognize that the populations are not homogenous with respect to rights, interests and access to resources across different gender defined groups. Addressing these issues is, however, beyond the scope of this paper.

forestry was addressed in Namibia. Additionally, the Strategic Plan introduces the concept of strategic forests, also called environmental forests. The Strategic Plan states that:

"The management of these forests will mainly produce environmental public goods and external benefits that local people will not receive income compensation for their provision."

From the above it is apparent that the management of strategic forests is in the national interest and that they can be considered of national importance, but that local stakeholder involvement is a requirement. The Strategic Plan does not give a clear definition of these forests, but introduces some ideas and concepts to be associated with them. These are that strategic forests would be important in terms of:

- Watershed and riverine management zones
- Biodiversity conservation zones
- Nature conservation zones

The Strategic Plan also refers to the role of strategic forests in sequestering carbon and thus contributing to slowing climatic change. The Strategic Plan defines the conceptual framework of Environmental Forestry in Namibia and assigns the Directorate of Forestry (DoF) as the main agency responsible for its implementation.

Guided by the Strategic Plan, the Environmental Forestry Component of the Namibia-Finland Forestry Programme (NFFP) has further clarified the concept of strategic forests to refer to such forests that produce nationally important environmental benefits with respect to:

- ***Biodiversity conservation***
- ***Water catchment management***
- ***Carbon sequestration***

These three are called "focus themes".

The benefits of biodiversity conservation to nations is still largely being debated, but has in many instances, been accepted as a part of a nation's moral and ethical commitments. Management of strategic forests will clearly contribute towards the fulfillment of Namibia's commitment towards the Biodiversity Convention.

Being one of the most arid countries in the world, water catchment management is of crucial importance to Namibia. Management of strategic forests through environmental forestry may play a vital role in this sector in the future and will also enhance Namibia's efforts to fulfill its obligations under the Global Desertification Convention. Finally, combating the negative effects of the global warming through capturing and storing atmospheric CO₂ is part of Namibia's effort to comply with the Climatic Change Convention.

All the above global conventions have been signed and ratified by the Government of Namibia, and are therefore an international commitment to be fulfilled. However, it is also important to recognise that fulfilling the commitments expressed in global

conventions is not an objective itself, but rather a means of benefiting the people of Namibia. Environmental forestry is a vehicle to achieve this in the forest sector.

The benefits discussed above, are important at an international and national level. However, it was felt that in the Namibian context, there was little reference to what forests could provide in terms of socio-economic development at the national level. The importance of the goods and services provided by strategic forests are fundamental to the continuing success of environmental and community forestry initiatives in Namibia. *The socio-economic values of forests are, therefore, included here as a fourth focus theme at the national level.*

2.2 NFFP/EF – Main entry of Directorate of Forestry in environmental forestry

Overall strategy

The Environmental Forestry⁴ Component (EF) of the NFFP/DoF was designed to establish the basis of forest conservation and management for environmental purposes in Namibia. This is to be achieved with a three-step strategy, consisting of three phases, viz.:

1. Framework building at national level
2. Field work in pilot areas for the development of methodologies
3. Consolidation of methodologies and expansion of the conservation activities.

National framework building

The process of framework building at the national level was seen to be critical in the process of identifying nationally important strategic forests. Framework building led to clarification of the approach required to Environmental Forestry, the responsibilities of various agencies, organisations and individuals at national and local level and provided insight into the types of data that would be required to identify and manage strategic forests. Prior to the current programme of EF activities, discussion of this nature has been rather limited in Namibia.

The national framework building revealed that the role of the Directorate of Forestry is not specifically to implement *all* EF activities in Namibia. What was clear was that it would be more important for DoF to assume a co-ordination role, through which it could ensure that strategic forests are managed sustainably and that national conservation objectives are met. Who actually implements the conservation activities in specific strategic forests is of secondary concern to the DoF.

During this first step, the EF Component established a national Strategic Forests Criteria Task Force, which was composed of specialists of the four main focal areas (biodiversity, water, carbon sequestration and socio-economic values) and representatives of organisations working with these issues. The main function of the

⁴ Originally called "State Management of Environmental Forestry"

Task Force was to assist and guide the Directorate of Forestry in the process of definition of the criteria for identifying national strategic forests.

As one of its first tasks the Task Force adopted operational definitions for environmental forestry and strategic forests, which are:

Environmental forestry: Management of forests, particularly strategic forests, for maintaining the quality of environment at a desired level in the national and global contexts

Strategic forests: Those forests, which are considered most important for providing and maintaining forest services, which contribute to the national and global well-being.

In this initial phase of the framework development the basic idea was that the process of identifying nationally important forests would be based on a large integrated database of environmental data. This data base would be linked through spatial attribute data to a GIS system. Through a process of iteration and filtering important forest areas would be identified on the basis of species habitat requirements and specific conservation objectives for different species.

However, within the Namibian context, the data sets on which this type of objective categorisation is entirely dependent, are lacking. Additionally the criteria and species profiling for defining habitat requirements remains problematic as species specific information and data is lacking for most taxa. A critical flaw in this approach is that this process does not take into account (at any level) the socio-economic development aspects of environmental forestry. The details of this approach are given in Tuomasjukka (1999). As there were problems in deriving and defining the data sets, developing the search criteria and the lack of socio-economic data in the process it was decided that a simplified approach to strategic forest identification was required.

This process is more fully described in Section 3 below. It comprises a two stage approach where:

- Strategic forests are identified subjectively based on the collective knowledge of a range of expertise.
- The identified strategic forests are subsequently assessed objectively as to their "real" value in terms of the 4 focal themes at the national level.

Development of field methodologies

Within the context of the national framework for Environmental Forestry it was recognised that field work would provide the testing ground for integrating national and local forest management and conservation needs. The EF programme established some pilot areas in the Caprivi but no conclusions have been drawn regarding the effectivity of the methods employed here in evaluating the criteria for identifying and categorising strategic forests.

Expansion of forest conservation

The third phase, consolidation of methods and expansion of conservation activities will concentrate on evaluating the pilot area experiences, developing practical methodologies and training of DoF personnel to identifying and categorise strategic forests. At this stage, it will be important to be sensitive to the highly variable conditions of Namibia, and construct the model approaches in such a way that they allow for adaptations and modifications, when applied in different conditions

3 IDENTIFICATION OF STRATEGIC FORESTS BY EF/DoF

3.1 Strategic forests criteria

As discussed above, strategic forests (or nationally important forest areas) are those forests, which provide important national and international benefits in terms of biodiversity conservation, socio-economic development, water catchment management and carbon sequestration. Within the framework of Environmental Forestry in Namibia, it was decided that it was important to reflect local, regional and national level socio-economic factors as a selection criteria.

In this program the operational definition of forests according to the FAO was taken as the basis for the discussion (see Table 1). This definition is generally applicable around the globe but it was felt that the 5 m minimum height cutoff was too high for areas of concern in Namibia. For this reason the minimum height for trees was modified to 3 m thus including the Short class in the recently developed descriptive system of vegetation classification for Namibia (Hines, 2001).

Table 1: Definition of Forests according to FAO.

Land with tree crown cover (or equivalent stocking level) of more than 10 % and area of more than 0.5 hectares (ha). The tree should be able to reach a minimum height of 5 meters (m) at maturity in situ. May consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground; or open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 percent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10% or tree height of 5 m are included under forest, as are areas normally forming part of the forest areas which are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest.

Includes: forest nurseries and seed orchards that constitute an integral part of the forest; forest roads, cleared tracts, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest; windbreaks and shelterbelts of trees with an area of more than 0.5 ha and width of more than 20 m; plantations primarily used for forestry purposes, including rubberwood plantations and cork oak stands.

Excludes: Land predominantly used for agricultural practices.

The process of identifying nationally important forests was done in 2 phases:

- Phase 1: The **SUBJECTIVE** identification of sites based on the experience and understanding of fieldworkers, local and regional experts in forestry and conservation both inside and outside the Directorate of Forestry. The purpose of the subjective identification process was to compile a coarse overview (long list) of those areas that interested parties felt merited consideration as strategic forests. This document is the product of two meetings, one held in Windhoek (November 1999) and one held in Ongwediva (February 2000) Participants were asked to say WHICH areas they considered important, WHERE these areas were (extent), WHAT was important in each area and whether there were any known THREATS to the area. These areas were assessed in terms of values related to the 4 principle areas of interest (criteria) discussed above. The definition of values under these criteria is given in Section 4 below.
- Phase 2: The **OBJECTIVE** evaluation of the sites identified in Phase 1. The evaluation will be based on the field assessment of sites and an in depth analysis of published data and information. The evaluation is a crucial part of the whole environmental forestry programme in that it will allow for an objective categorisation of priority (in terms of resource allocation) and at the same time providing the framework on which to base the correct management decisions required for fulfilling national conservation goals.

This report gives the findings of Phase 1 – the subjective identification of sites and provides some background information on these sites. These findings are presented here to provide some background for the evaluation (Phase 2) of the sites. It should be noted that what is presented here is a *rapid and subjective* synthesis of what was presented at the meetings and is not a comprehensive statement of the criteria and values relating to specific sites.

4 CRITERIA AND VALUES

The four principle criteria for site selection and the values used to describe the sites are given below. The list of values and the definitions given here are not regarded as comprehensive or final and the information given here is entirely descriptive. Comment and inputs are welcomed, especially in the provision of additional details and information given, but also regarding the definition of some of the values outlined here.

Please note that this report is designed to provide some basic interpreted background to each of the sites identified by a group of individuals during the course of two relatively informal meetings. These descriptions are in no way comprehensive, nor can they be regarded as providing sufficient information to make rational decisions regarding the allocation of funds and setting conservation priorities. That is the process required during the second phase of this study - the objective evaluation of each site.

Within each site description the principal criteria are rated on a three star scale, where those criteria thought to be most important in site selection are given 3 stars and those criteria thought to be least important are given a single star. This was done subjectively during the meetings and does not reflect any "real" values. These ratings are likely to change markedly during the Phase 2 objective evaluations of the sites.

4.1 BIODIVERSITY CONSERVATION

The values listed below were developed in consultation with a number of people and groups. An aspect, which is not clearly stated in the values below, is that of conserving biodiversity for its own sake, even though there is no particular direct use or function within a particular area. Other aspects, which should be considered, are the functional and economic aspects of biodiversity conservation. With all the values below the systems can be broadly rated in terms of comparative value in that the higher the diversity, number of endemic species, etc., the more important the area may be assumed to be.

In the discussion of the specific sites given in Section 9 below, lists are given of those endemic and Red Data species thought to occur within the described forest site. These lists are derived from the following sources:

- Amphibians – list provided to Tuomasjukka (1999) by M. Griffin (Vertebrate - Mammology & Herpetology - Biodiversity Specialist, Ministry of Environment and Tourism).
- Reptiles – list provided to Tuomasjukka (1999) by M. Griffin (Vertebrate - Mammology & Herpetology - Biodiversity Specialist, Ministry of Environment and Tourism).
- Birds - list provided to Tuomasjukka (1999) by Dr. R. Simmons (Ornithologist, Ministry of Environment and Tourism).
- Mammals – list provided to Tuomasjukka (1999) by M. Griffin (Vertebrate - Mammology & Herpetology - Biodiversity Specialist, Ministry of Environment and Tourism).

These lists *are not* comprehensive lists of all endemic and Red Data species for these taxonomic groups in Namibia. They reflect the authors view of those species in Namibia that are dependent (to a greater or lesser extent) on forest and woodland habitats. In listing these species in the site descriptions below we have made no attempt to discuss the importance of a particular site for any one species unless that information is known. Phase 2 should address this in more detail.

A major gap in information relates to the species diversity, occurrence of Red Data and endemic plant species within each site. A study in this regard was commissioned by the NFFP during 1999 but the assigned consultants withdrew from the project and no product was ever delivered. The lack of detailed information relating to plants will need to be carefully addressed during the objective evaluation of each site during Phase 2 of this project.

It should also be noted that the species listed under the Red Data Species listings are not specifically Red Data Species (*sensu stricto*). We use this as a convenient

heading to reflect Red Data Species (as listed by experts in each taxonomic group), species of conservation concern and those species of indeterminate status but which are thought to be important in biodiversity conservation in Namibia. There seems to be a wide and lenient application of the IUCN categories of Red Data Species between different taxonomic experts. As this is a descriptive account of sites and not the basis for objective categorisation of the sites, it was felt that it would be more meaningful to reflect which species are thought to be important at each site rather than discuss the systems of classification and their merits in detail.

Environmental/Ecological function

This refers to the value of the forested area in terms of maintaining or providing certain ecological or environmental functions. For example, the riparian woodlands along the west-flowing ephemeral rivers provide mesic corridors along which species normally found further east are able to move within very arid environments.

Habitat diversity

This value refers to the diversity of plant-soil-topography based habitats (also called land units) within an area. In these habitats the soil, topography and plant growth is relatively uniform. The diversity of these units is the *habitat diversity*. It does not refer to the structural habitat diversity afforded by canopy, stem and rooting environments within different plant communities.

Species diversity

This value refers to the species richness of an area. This should be assessed by taxonomic group.

Endemism

This value refers to the number of endemic or near-endemic species (within defined taxonomic groups), which occur within or are associated with a given forest of national importance. A list of endemic species is available for a range of taxonomic groups within Namibia. A plant list has been produced by the NBR but no analysis of this list has been done in terms of forest resources.

The species listed within this criterion are species known to be endemic or near-endemic to Namibia, not endemic to a specific forest site or area.

Red Data Species

This value refers to the number of red listed species (within defined taxonomic groups) including all species considered to be of conservation concern, which occur within or are associated with a given strategic forest. Red Data Species have been defined for a range of taxonomic groups, but a list of RD plant species associated with wooded habitats is lacking. Different taxa are defined differently with regard to such classes as endangered, vulnerable etc., and these classifications have not been included in the lists given below.

Genetic Diversity

This refers to the diversity of genetic make-up between species, among populations, within populations and within individuals. Within Namibia there is little capacity to provide quantitative assessment of genetic diversity. This value is included here in

case an assessment of genetic diversity is made and can be used in the site selection process.

Scientific Interest

This value refers to the uniqueness and/or naturalness of a particular forest area, the presence of an exceptional population of a particular species, the importance of the area for scientific monitoring etc. This value is by definition subjective and comparative.

4.2 SOCIO-ECONOMIC CRITERIA

The values given below refer to the functional value of forest resources to household livelihood strategies and development in a national context. Many of these values were poorly defined within the working groups and their definition needs to be strengthened before the process of objective evaluation of sites is attempted.

Wood resources

This value refers to the woody plant resources within a forest area, which are important in providing construction materials, fuelwood and timber. These resources tend to be valued in terms of local economic demand in the initial site selection process. Care should be taken to value these resources at the regional and national levels.

Non-wood resources

This value refers to the goods and services provided by all plant resources within a forest area, excluding those given above. This may include the value of the forest area for grazing resources, thatching, medicinal plants, fruit products and other ethnobiological resources. These resources tend to be valued in terms of local economic demand in the initial site selection process. Care should be taken to value these resources at the regional and national levels.

Economic

This value was introduced into the site selection process as a catch-all for those forests where it was difficult to define human-use resource values. Some participants felt that non-wood resource values did not adequately encompass the importance of some forest areas in rural subsistence farming systems, because of the multitude of goods and services provided by forests in these systems. This would include the intrinsic value of forest areas as a resource within the drought-coping mechanisms of rural households. This value needs further careful definition.

Cultural/Traditional

This refers to the importance of a forest area in terms of cultural and traditional uses or perceived values. Many sites will initially be selected in terms of local cultural and traditional values. While this is important and may provide a management option in terms of forest conservation, care should be taken to value these resources at the regional and national levels.

Tourism/Recreation

This refers to the value of a forest area in terms of attracting and/or maintaining tourism and recreational activities in an area, as tourism is increasingly being viewed

as an important economic asset in many rural areas of Namibia.

Aesthetics

This is entirely a subjective assessment of an area based on the personal judgement of the observer. This value is linked strongly with the Tourism/Recreation value above. It refers, broadly, to how "good" the forest area looks to the observer. Objective evaluation is not possible and this value should not be used as a principal selection value.

Education/Scientific

This value refers to the importance of the area in terms of providing educational opportunities (environmental education, as well as supplementary input into high school geography, biology and history). Scientific values refer to the site in terms of anthropological interest or importance and/or the archaeological importance of the site.

4.3 WATER CATCHMENT MANAGEMENT

This concept is well developed in global forestry especially in areas of high rainfall and important riparian industries. However, this is poorly developed in Namibian forestry literature and water catchment management is currently not a focus of management systems in forestry in Namibia. The values listed below refer to those sites, which are important in maintaining or enhancing riparian and downstream ecosystem goods and services. An important issue to consider when assessing forestry areas for these goods and services, is that the accrual of these goods and services is primarily "off-site", i.e. the services provided improve the system many kilometers away. The values given below are difficult (in terms of time and money) to measure objectively.

Prevention of soil erosion and/or reduction of siltation

This value refers to the importance of riparian and catchment vegetation in preventing soil erosion and in reducing siltation within rivers. Vegetation reduces flow rates thus cutting down on sheet and gulley erosion. Siltation has been recognised as a major factor in negatively changing groundwater recharge rates in fluvial aquifers in western Namibia.

Flood attenuation

This value refers to the importance of riparian and catchment vegetation in reducing run-off rates both outside and within river channels. Within the stream channel heavy flooding leads to scouring of the fluvial deposits in which the groundwater is found.

Groundwater recharge

This value refers to the importance of riparian and catchment vegetation in recharging groundwater. Where there is a good cover of vegetation runoff rates are reduced, thereby increasing infiltration rates of water into the groundwater aquifers.

4.4 CARBON SEQUESTRATION

The concept of carbon sequestration and its applicability to forest management in Namibia is poorly developed in DoF documentation. Sequestration has been proposed as being significant in bush encroached areas of Namibia relative to industrial and urban carbon production in the country. However, given the low standing biomass of woody plants and the low growth increments within the arid and semi-arid systems prevailing here, carbon sequestration is likely to be unimportant within a global context. In exceptional circumstances the following values may be found to be important in site selection.

Onsite woody biomass

This value refers to those sites with an exceptionally high standing biomass of woody plants.

Annual growth increments

This value is closely linked with onsite woody biomass and refers to those sites where growth increments are significant.

5 THREATS

Threats are included in the discussion of each site as information on which to base some sort of prioritisation of site evaluations. Those sites with the highest threats related to high values should be assessed as a matter of urgency. Threats are *not*, however, a selection criteria.

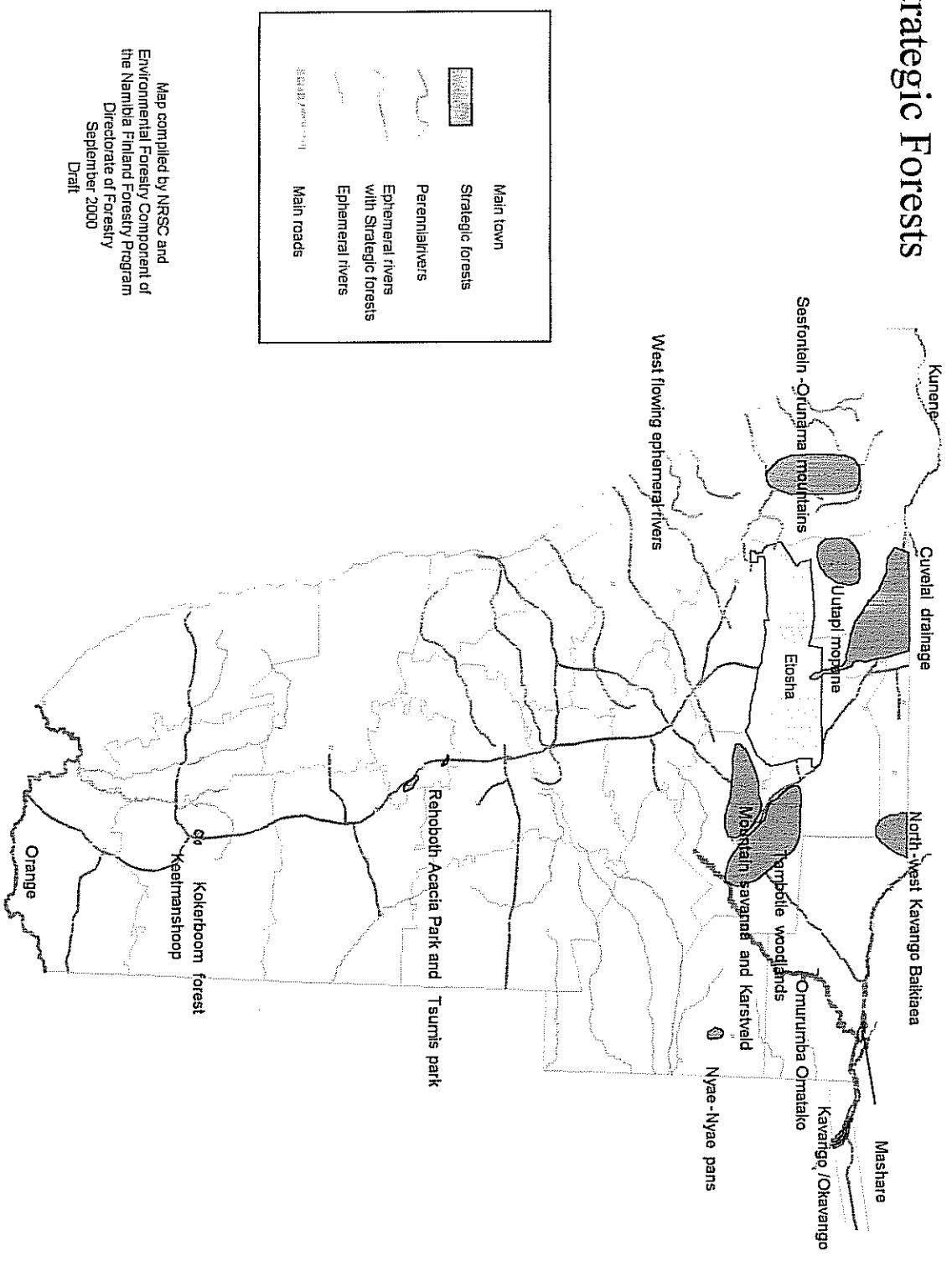
6 MANAGEMENT OPTIONS

Management categories are listed for each site. These are based on the conservation and management categories contained in the Forest Act and the Parks and Wildlife Management Bill. The management categories given in the Forest Act are, however, vague and permissible activities are not stipulated. The range of permissible activities and the restrictions on development need to be clearly stated such that management options will be relevant and practical. The categories given under each of the site descriptions below are all outlined in the relevant piece of legislation.

The relevant sections of each Act/Bill are given in Appendix 1 (Forest Act) and Appendix 2 (Parks & Wildlife Management Bill).

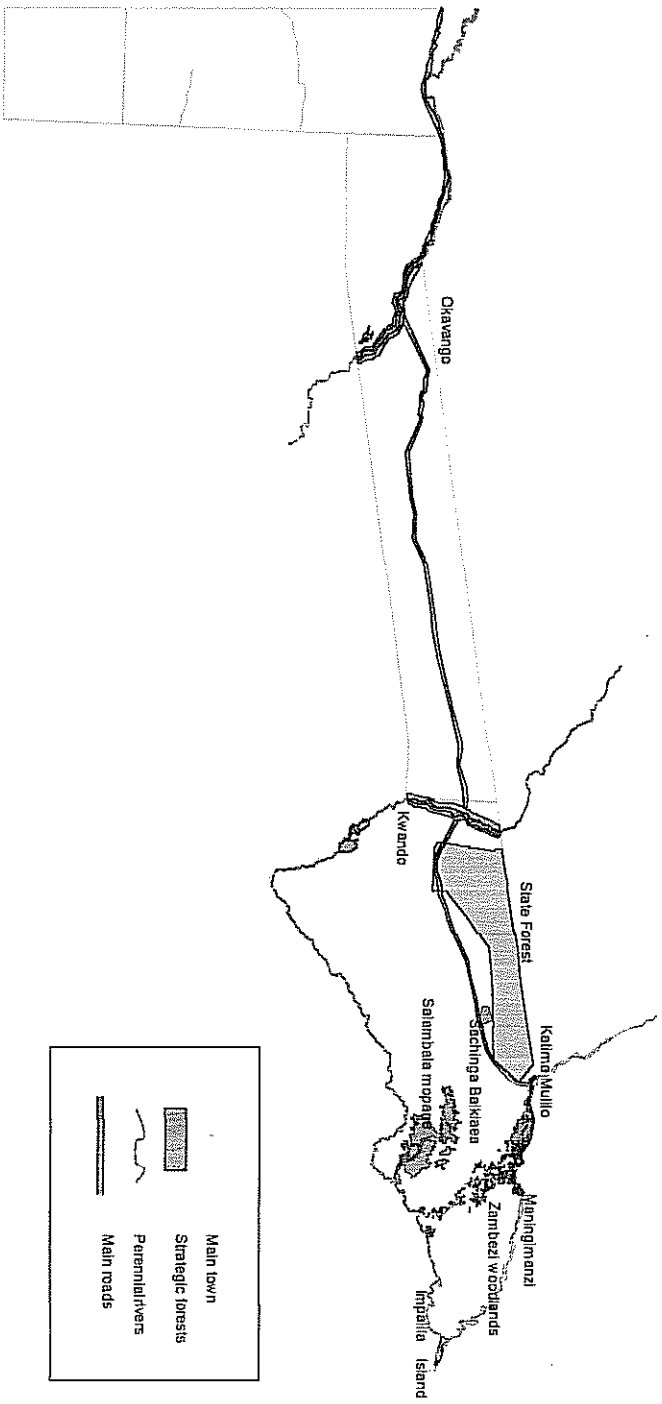
7 MAP OF STRATEGIC FORESTS

Strategic Forests



Map compiled by NRSC and Environmental Forestry Component of the Namibia Finland Forestry Program
 Directorate of Forestry
 September 2000
 Draft

8 MAP OF STRATEGIC FORESTS IN CAPRIVI REGION



Map compiled by NRSC and
 Environmental Forestry Component of
 the Namibia-Finland Forestry Program
 Directorate of Forestry
 September 2000
 Draft

9 LIST OF SELECTED FOREST AREAS

Kunene River Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Kunene River forms the north-western border of Namibia with Angola. The river rises in the central highlands of Angola. The Namibian section, from Ruacana to the mouth of the river, is some 300km long. The actual extent and location of the forests of national importance have yet to be determined. The wooded habitats that lie between Ruacana and the Epupa Falls are thought to be of the greatest importance. Down stream of the Epupa Falls the river course is largely confined to a narrow gorge with limited tree growth.

GENERAL SITE DESCRIPTION:

The Kunene River system is relatively well studied in terms of its hydrology and fish populations but few studies have been published on the vegetation of the system. Water flow is driven largely by rainfall in Angola with very little runoff in Namibia contributing to the flow regime. The functioning of the river has changed drastically since the construction of the Ruacana Hydropower Scheme. Water flow is controlled and the seasonal flood regime has been markedly altered to one where there is little or no apparent seasonal flooding. This has had important effects on the resident fish populations and the functioning of the mouth of the river.

Large game has largely been eradicated along the length of the river, with the exception of Nile Crocodiles, which are abundant, particularly in the section downstream of the Epupa Falls. The biodiversity of the river and its catchment is seen as being high in a regional and international context, with a number of species in various taxa being largely associated with wetter habitats to the North. The riparian woodlands are characterised by few species and are generally dominated by *Colophospermum mopane*, *Faidherbia albida*, *Diospyros mespiliformis* and *Hyphaene petersiana*.

The riverine woodlands are important in the subsistence farming systems established here. The large, dense stands of *Faidherbia albida* provide important dry season forage resources for domestic livestock. Some subsistence gardening is done on the fluvial silts lining the river. Changing patterns of settlement and the fencing of large sections of the riparian woodlands is leading to changes in resource use along the river. These changes may lead to a decline in the quality of these riparian woodlands.

The river has no protected status with the exception of the lowest 40 km (East of the mouth), which falls, within the Skeleton Coast Park. Numerous tourism operations are established along the river and are important in the regional economy.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★★ ★

Ecological Function:

The riparian woodlands are important in that they provide a mesic corridor along the river in an otherwise extremely dry landscape. Species such as Rufous-tailed Palm Thrush (a tropical West African species) is entirely restricted to the *Hyphaene* palm stands along the river and its tributaries.

Species Diversity:

Detailed studies of the biodiversity of the riparian woodlands are lacking, but recent work on the potential impacts of a hydropower scheme at the Epupa Falls provides an indication that biodiversity within a number of taxa is high. Large game populations have been severely depleted through hunting and habitat loss, but there are small numbers of Black-faced Impala *Aepyceros (melampus) petersii* present in isolated populations. Close

to 300 bird species have been recorded in the river valley with many being restricted to the riparian strip. This would include species such as Rufous-tailed Palm Thrush *Cichladusa ruficauda*, Grey Kestrel *Falco ardosiaceus*, Grey-headed Bush Shrike *Malaconotus blanchotii*, Long-tailed Starling *Lamprotornis mevesii*, African Mourning Dove *Streptopelia decipiens* and Black Cuckoo-Shrike *Campephaga flava*. Other species such as Olive Bee Eater *Merops madagascariensis* and Cinderella Waxbill *Estrilda thomensis* are not restricted to the riparian woodlands but are common there. The diversity of reptiles and amphibians is not known but is thought to be high in a regional context. The floral diversity of the riparian woodlands is generally low.

Endemism:

Several species of near-endemic mammals, birds and reptiles are known from the Kunene River Valley area. The dependence of most of these species on the riparian woodlands is likely to be low. This would include:

<i>Fringilla monticola</i>	Hartlaub's Francolin
<i>Poicephalus rueppellii</i>	Ruppell's Parrot
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Phoeniculus damarensis</i>	Violet Wood-Hoopoe
<i>Tockus monteiri</i>	Monteiro's Hornbill
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Achaetops damarensis</i>	Damara Rockrunner
<i>Lanioturdus torquatus</i>	White-tailed Shrike
<i>Aepyceros (melampus) petersii</i>	Black-faced Impala

Red Data Species:

A number of Red Data Species are known to occur within the Kunene River valley, but the dependence of these species on the riparian woodlands is not known, but the following species are thought to be at least partially dependent.

<i>Stellio atricollis</i>	Tree agama
<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Kerivoula argentata</i>	Damara woolly bat
<i>Galago mohol</i>	Lesser bushbaby
<i>Aepyceros (melampus) petersii</i>	Black-faced impala
<i>Thallomys phaedulcus</i>	Tree rat
<i>Gorsachius leuconotus</i>	White-backed Night Heron
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Accipiter tachiro</i>	African Goshawk
<i>Cichladusa ruficauda</i>	Rufous-tailed Palm Thrush
<i>Malaconotus blanchoti</i>	Grey-headed Bushshrike
<i>Estrilda thomensis</i>	Cinderella Waxbill
<i>Macheirampus alcinus</i>	Bat Hawk
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle
<i>Fringilla monticola</i>	Red-necked Francolin
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Tockus monteiri</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★ ★ ★

The Kunene River valley supports two distinct social groups. These are the traditionally pastoral Himba people and a more recent population of settlers, largely from the Oshana, Ohangwena, Otjikoto and Omusati Regions. Most settlement has taken place along the river and changes in agricultural practices, from being largely pastoral in the past to more arable based currently, has resulted in a marked decline in the area covered by riparian woodlands.

Wood Resources:

The importance of wood resources in the area is not known but much wood is used in the construction of homesteads, fencing and livestock pens. The volumes of wood used have not been studied.

Non-wood Resources:

The pods of *Faidherbia albida* are very important in the maintenance of the domestic livestock herds along the river during the dry season. Other non-wood resource values are not known.

Tourism/Recreation:

At least 5 small to medium sized tourism operations are currently functioning along the section of the Kunene River between Swartboois Drift and Ruacana, including a community-based operation at the Hippo Pools near Ruacana. There are a number of tourism operations at Epupa Falls.

Aesthetics:

The riparian woodlands along the Kunene River have a high aesthetic value and are integral to the continued success and development of the tourism industry in the area.

WATER CATCHMENT MANAGEMENT

RATING: ★ ★ ★

The riparian woodlands of the Kunene River are all important in:

Reduction of soil erosion and siltation

Flood attenuation

Maintenance of downstream hydrological function

Groundwater recharge

THREATS

Uncontrolled and poorly planned settlement along the river is the greatest threat to the riparian woodlands. Increasingly people are cutting out large tracts of riparian trees for millet fields. The riparian silts are generally poorly suited to these crops and are highly erodable.

MANAGEMENT OPTIONS:

The settlement and the utilisation of the riparian woodlands for a variety of activities will result in a mosaic of management options being instituted in this area.

Forest Act: Regional Forest Reserves, Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Okavango Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Okavango River forms a 470km long border with Angola in the North-east of Namibia. The extent and location of forest sites of national importance have not been determined. Patterns of human settlement, war and an expanding population have contributed toward a rapidly declining riparian woodland resource and the area is a priority for conservation and management in Namibia.

GENERAL SITE DESCRIPTION:

The Okavango River rises in the highlands of Angola and by the time it reaches Namibia it is a low gradient system, which meanders across a broad area of Kalahari sand. The Okavango is joined by the Cuito, which provides an even greater runoff than the "parent" river. The Okavango River and its associated biota have been relatively well studied and these are summarised in Bethune (1991).

Large stretches of the riverbank still support some dense riparian vegetation. Many of the trees and shrubs are important in terms of human uses. Characteristic trees include *Garcinia livingstonei*, *Ficus sycamorus*, *Diospyros mespiliformis*, *Friesodielsia obovata*, *Sclerocarya birrea*, *Acacia hebeclada* and a number of *Combretum* spp. These riparian forests and thickets are being degraded through clearing for arable agriculture and the demand for fuelwood. Protection of the woodlands is minimal with only those sites at Popa Falls and within the Mahango Game Reserve having any sort of conservation status. These riparian woodlands support a diverse and productive biota including several endangered and Red Data species. These riparian woodlands are also important in the subsistence economy of the very large rural population here.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★★ ★

Ecological Function

The riparian woodlands of the Okavango River perform much the same function as the ephemeral west-flowing rivers do in the dry west of the country. The Okavango traverses a large area of Kalahari sands where no surface water is available. The riparian forests provide a habitat not available to many species away from the river and the riparian strip serves as a corridor of mesic habitats for those species more adapted to tropical environments (e.g. Western Banded Snake Eagle).

Habitat Diversity

Habitat diversity is thought to be high. There are a variety of landforms and flooding regimes within the system and these determine a complex set of woody and non-woody habitats. Heavier soils, which are not regularly inundated, have characteristic vegetation dominated by species such as *Diospyros mespiliformis*, *Acacia nigrescens* and *Friesodielsia obovata*. Wetter habitats may be characterised by species such as *Rhus quartiniana*, *Phoenix reclinata* and *Syzigium guineense*. The quartzitic islands at Mukwe and Andara have diverse vegetation, which is different to the surrounding areas.

Species Diversity

Species diversity is high. Twenty-nine species of frogs are known from the Okavango some of which are forest dependent. Some 63 species of reptiles are known from this area and many of these are undoubtedly dependent on woodland habitats. Birds are by far the most diverse group with over 450 species recorded along the length of the river, many being species of more tropical origin (e.g. Natal Robin) with limited distributions in Namibia.

Endemism

No endemic species dependent on woodland habitats are known to occur along the

Okavango.

Red Data Species

A large number of Red Data Species occur along the length of the Okavango River. Many of these are, however, species that reach the southern or western limits of their distributions here and are quite common elsewhere in the southern African sub-region.

<i>Stellio atricollis</i>	Tree Agama
<i>Pipistrellus rueppeli</i>	Riverine pipistrelle
<i>Kerivoula lanosa</i>	Lesser woolly bat
<i>Galago mohol</i>	Lesser bushbaby
<i>Loxodonta africana</i>	African elephant
<i>Giraffa camelopardalis</i>	Giraffe
<i>Damaliscus lunatus</i>	Tsessebe
<i>Aepyceros melampus</i>	Common impala
<i>Hippotragus equinus</i>	Roan
<i>Syncerus caffer</i>	Buffalo
<i>Taurotragus oryx</i>	Eland
<i>Thallomys phaedulcus</i>	Tree rat
<i>Gorsachius leuconotus</i>	White-backed Night Heron
<i>Circaetus cinerascens</i>	Western Banded Snake Eagle
<i>Scotopelia peli</i>	Pel's Fishing Owl
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Accipiter melanoleucus</i>	Black Sparrowhawk
<i>Accipiter tachiro</i>	African Goshawk
<i>Poicephalus robustus</i>	Grey-headed Parrot
<i>Bucorvus leadbeateri</i>	Ground Hornbill
<i>Malaconotus blanchoti</i>	Grey-headed Bushshrike
<i>Bostrychia hagedash</i>	Hadedda Ibis
<i>Necrosyrtes monachus</i>	Hooded Vulture
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aviceda cuculoides</i>	Cuckoo Hawk
<i>Macheiramphus alcinus</i>	Bat Hawk
<i>Aquila rapax</i>	Tawny Eagle
<i>Hieraetus ayresii</i>	Ayre's Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle
<i>Chrysococcyx cupreus</i>	Emerald Cuckoo
<i>Strix woodfordii</i>	Wood Owl
<i>Apaloderma narina</i>	Narina Trogon
<i>Ispidina picta</i>	Pygmy Kingfisher
<i>Cossypha natalensis</i>	Natal Robin
<i>Lanius souzae</i>	Sousa's Shrike

SOCIO-ECONOMIC

RATING: ★★★

The Okavango River valley and adjacent land supports a population in the region of 200 000 people. Of these about 80 % live within 5 km of the river and most are dependent (to a greater or lesser extent) on the riparian resources. The demand for natural resources has increased as the population has expanded and in some areas these resources are severely degraded or destroyed.

Wood Resources

The demand for wood resources along the Okavango River is known to be high. Wood is used for the construction of homesteads, livestock pens and other buildings. Large trees

<i>Hippotragus equinus</i>	Roan
<i>Syncerus caffer</i>	Buffalo
<i>Taurotragus oryx</i>	Eland
<i>Gorsachius leuconotus</i>	White-backed Night Heron
<i>Circaetus cinerascens</i>	Western Banded Snake Eagle
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Accipiter melanoleucus</i>	Black Sparrowhawk
<i>Accipiter tachiro</i>	African Goshawk
<i>Poicephalus robustus</i>	Grey-headed Parrot
<i>Bucorvus leadbeateri</i>	Ground Hornbill
<i>Malaconotus blanchoti</i>	Grey-headed Bushshrike
<i>Bostrychia hagedash</i>	Hadedda Ibis
<i>Necrosyrtes monachus</i>	Hooded Vulture
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aviceda cuculoides</i>	Cuckoo Hawk
<i>Macheirampus alcinus</i>	Bat Hawk
<i>Aquila rapax</i>	Tawny Eagle
<i>Hieraetus ayresii</i>	Ayre's Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle
<i>Guttera pucherani</i>	Crested Guineafowl
<i>Chrysococcyx cupreus</i>	Emerald Cuckoo
<i>Strix woodfordii</i>	Wood Owl
<i>Apaloderma narina</i>	Narina Trogon
<i>Ispidina picta</i>	Pygmy Kingfisher
<i>Bycanister bucinator</i>	Trumpeter Hornbill
<i>Smithornis capensis</i>	African Broadbill
<i>Thamnolaea arnoti</i>	Arnot's Chat
<i>Cossypha natalensis</i>	Natal Robin
<i>Lanius souzae</i>	Sousa's Shrike
<i>Vidua obtusa</i>	Broad-tailed Paradise Whydah

SOCIO-ECONOMIC

RATING: ★★

Wood Resources

Certain wood resources in the riparian forests are known to be important as construction materials and in the building of dug-out canoes. However, the utilisation of wood resources has not been studied in any depth.

Non-wood Resources

The importance of non-wood resources related to the forested habitats is not known.

Cultural/Traditional

The importance of the Kwando River riparian woodlands in traditional and cultural practices is not known.

Tourism/Recreation

The importance of the riparian forested habitats is of high value to the tourism industry in the area. Currently undergoing a slump because of the Angolan security situation, there are a number of lodges situated along the Kwando, all of which utilise riparian woodlands as part of their aesthetic appeal. The area is regarded as having a high potential for tourism development and this is dependent to an extent on the conservation of the riparian woodlands.

Aesthetics

The aesthetic appeal of the riparian forested habitats can be regarded as high.

WATER CATCHMENT MANAGEMENT

RATING: ★ ★ ★

The riparian woodlands and forests of the Kwando River valley are important in the:

Reduction of soil erosion and siltation

Attenuation of floods

Groundwater recharge

THREATS

Threats to the system are largely centered on the overutilisation and poor management of woodlands outside the state conservation areas. A number of conservancies have been established in the area and this may provide the framework for establishing better management practices in the future.

MANAGEMENT OPTIONS

The western bank of the Kwando is already under the administration of the MET and proclamation of the area as a National Park is already under discussion. The eastern bank of the river falls within both communal area and state controlled game reserves.

Forest Act: Regional Forest Reserves, Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Zambezi River Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The woodlands referred to here are those that lie along the margin of the Zambezi from about Katima Mulilo to Schuckmansberg. Further east the Zambezi margin floods for prolonged periods and the development of wooded habitats is rare. The location and extent of the forests of national importance have not been determined. Hippo Island, near Katima Mulilo, is one site that has been determined to be of importance by the DoF

GENERAL SITE DESCRIPTION:

The forested and woodland habitats of the Zambezi riparian strip tend to be distributed in patches along the margin of the river. They form discreet units and vary in species composition depending on the length of inundation during flooding and soil types. Wetter habitats tend to be dominated by *Syzigium guineense*, *Rhus quartiniana* and *Diospyros mespiliformis*. Drier habitats have a diversity of species but *Parinari curatellifolia*, *Kigelia africana*, *Diospyros mespiliformis*, *Acacia sieberana*, *Acacia erioloba*, *Acacia nigrescens*, *Trichilia emetica*, *Lonchocarpus capassa* and *Albizia versicolor* are all characteristic. The shrub layer can be dense and is characterised by *Phyllanthus reticulatus*, *Grewia spp.*, *Diospyros lycioides* and *Euclea divinorum*. These woodlands have a high diversity of habitats and species and are often surrounded by floodplain grasslands, which are generally uniform and have low diversity. As such the woodlands have high value in terms of conservation of biodiversity.

No sites are formally conserved.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★★ ★

Habitat Diversity

Habitat diversity is thought to be high. The flooding regime, soils and topographic position vary greatly along the margins of the river leading to marked changes in the species composition of wooded habitats.

Species Diversity

The diversity of species in the Zambezi riparian woodlands is thought to be high. No studies have been made of the vegetation in these woodlands. More than 300 species of birds have been recorded along the Zambezi and many of these are totally dependent on riparian forests. This includes species such as Eastern Bearded Robin *Erythropygia quadrivirgatai*, Eastern Nicator *Nicator gularis* and Trumpeter Hornbill *Bycanistes bucinator*. The diversity of mammals, reptiles and amphibians is also presumed to be high.

Endemism

No endemic or near-endemic species occur here.

Red Data Species

No studies have been made regarding the occurrence of Red Data plant species but a number of orchids occur here as do several species with limited distributions in Namibia. Other species include:

<i>Stellio atricollis</i>	Tree agama
<i>Epomophorus angolensis</i>	Angolan epauletted fruit bat
<i>Mops condylurus</i>	Angolan free-tailed bat
<i>Chaerephon bivittata</i>	Spotted free-tailed bat
<i>Pipistrellus rueppeli</i>	Riverine pipistrelle
<i>Eptesicus rendalli</i>	Rendall's serotine bat

<i>Kerivoula lanosa</i>	Lesser woolly bat
<i>Nycteris hispida</i>	Hairy slit-faced bat
<i>Galago mohol</i>	Lesser bushbaby
<i>Loxodonta africana</i>	African elephant
<i>Aepyceros melampus</i>	Common impala
<i>Syncerus caffer</i>	Buffalo
<i>Thallomys phaeulcus</i>	Tree rat
<i>Petrodromus tetradactylus</i>	Four-toed tree rat
<i>Gorsachius leuconotus</i>	White-backed Night Heron
<i>Circaetus cinerascens</i>	Western Banded Snake Eagle
<i>Podica senegalensis</i>	African Finfoot
<i>Scotopelia peli</i>	Pel's Fishing Owl
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Accipiter melanoleucus</i>	Black Sparrowhawk
<i>Accipiter tachiro</i>	African Goshawk
<i>Poicephalus robustus</i>	Grey-headed Parrot
<i>Bucorvus leadbeateri</i>	Ground Hornbill
<i>Malaconotus blanchoti</i>	Grey-headed Bushshrike
<i>Bostrychia hagedash</i>	Hadedda Ibis
<i>Necrosyrtes monachus</i>	Hooded Vulture
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aviceda cuculoides</i>	Cuckoo Hawk
<i>Macheirampus alcinus</i>	Bat Hawk
<i>Aquila rapax</i>	Tawny Eagle
<i>Hieraetus ayresii</i>	Ayre's Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle
<i>Guttera pucherani</i>	Crested Guineafowl
<i>Tauraco schalowi</i>	Schalow's Lourie
<i>Chrysococcyx cupreus</i>	Emerald Cuckoo
<i>Strix woodfordii</i>	Wood Owl
<i>Apaloderma narina</i>	Narina Trogon
<i>Ispidina picta</i>	Pygmy Kingfisher
<i>Bycanister bucinator</i>	Trumpeter Hornbill
<i>Cossypha natalensis</i>	Natal Robin
<i>Lanius souzae</i>	Sousa's Shrike

SOCIO-ECONOMIC

RATING: ★★ ★

Wood Resources

The utilisation of wood resources in these riparian woodlands has not been studied. A number of species are used for the construction of dug-out canoes and several species are regarded as good construction wood for houses.

Non-wood Resources

The importance of non-wood resources derived from riparian woodlands here is not known. Several fruit bearing species and species known to be used as medicinals are found in these woodlands.

Cultural/Traditional

The cultural and traditional importance of these woodlands is not known.

WATER CATCHMENT MANAGEMENT

RATING: ★★ ★

The riparian woodlands and forests of the Zambezi River are important in the:

Reduction of soil erosion and siltation

Attenuation of floods

Groundwater recharge

THREATS

Threats to the system are largely centered on the overutilisation and poor management of woodlands. None of these woodlands are formally protected. There are plans to establish conservancies to the East of Katima Mulilo, which may provide the framework for establishing better management practices in the future.

MANAGEMENT OPTIONS

None of the riparian woodlands along the Zambezi River are currently protected. There is discussion within the DoF regarding the management of Hippo Island, near Katima Mulilo, but the management category has not been defined. Given the demand for resources along this river, the management will be determined as a complex of options in different areas.

Forest Act: State Forest Reserve, Regional Forest Reserves, Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Orange River Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Orange River forms the southern border of Namibia with South Africa. Riparian woodlands are restricted to the narrow river valley, which traverses a generally arid area. The extent and location of the woodlands of interest has not been established.

GENERAL SITE DESCRIPTION:

Little information is available. The riparian woodland fringe tends to be patchy and is made up of species such as *Acacia karoo* and *Rhus pendulina*. These woodlands are often heavily encroached by *Nicotiana glauca* and *Prosopis* sp.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★ ★ ★

Ecological Function

The riparian woodland fringe is important in that it contributes to maintaining the functioning of important Ramsar wetlands at the Orange River mouth. Additionally, it provides habitat for a number of species which normally only occur further south. This includes Malachite Sunbird *Nectarinia famosa*, Lesser Double Collared Sunbird *Cynniris chalebea* and Cape Robin *Cossypha capensis*. These species have their distributions largely centred on the Orange River in Namibia.

Habitat Diversity

Habitat diversity is thought to be high and is comparable to the ephemeral western flowing rivers. Little information is available.

Species Diversity

The diversity of species dependent on the riparian woodlands is not known, but it is thought that it will be moderate to high for most taxonomic groups.

Endemism

It is not known whether any endemic or near endemic species are associated with the riparian woodlands of the Orange River, but the Orange River valley itself is a known centre of endemism for plants.

Red Data Species

The following Red Data Species are thought to occur along the Orange River.

<i>Mabuya spilogaster</i>	Namibian Tree Skink
<i>Lygodactylus bradfieldi</i>	Namibian Dwarf Gecko
<i>Eptesicus melckorum</i>	Melck's serotine bat
<i>Thallomys shortridgei</i>	Black tailed tree rat
<i>Gorsachius leuconotus</i>	White-backed Night Heron
<i>Bostrychia hagedash</i>	Hadedda Ibis
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle

SOCIO-ECONOMIC

RATING: ★ ★ ★

The socio-economic importance of the riparian woodlands of the Orange River is not known. There is some settlement along the river and small scale agriculture has developed in places since Independence. Small scale diamond mining takes place all along the river.

Wood Resources

Extensively used by local communities for fuel wood and construction materials.

Non-wood Resources

The extensive reedbeds along the river provide important construction materials for local communities and fodder for livestock.

Cultural/Traditional

The importance of the riparian woodlands in terms of cultural and traditional uses is not known, but the area has a long history of human settlement and there are a number of known archaeological sites along the river.

Tourism/Recreation

The tourism industry along the Orange River is continually expanding. Current activities include canoe safaris, 4x4 routes, some hiking and limited accommodation facilities.

WATER CATCHMENT MANAGEMENT

RATING: ★ ★ ★

The riparian woodlands of the Orange River and its tributaries are all important in:

- Prevention of soil erosion and the reduction of siltation*
- Flood attenuation*
- Maintenance of the downstream hydrological environment*
- Groundwater recharge*

THREATS

The greatest threats to the riparian woodlands along the Orange River would be from overexploitation for fuel and construction wood, uncontrolled clearing and competition from alien invasive species. The uncontrolled use of agricultural chemicals in the catchments is also an important threat.

MANAGEMENT OPTIONS

The riparian woodlands of the Orange River fall mostly within a narrow river valley. Parts of this are protected formally (Huns Mountain Reserve) and informally (Sperrgebiet). Practical management options would need to be carefully considered.

Forest Act: Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Khumib Catchment and Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

This small catchment (2 200 km²) is situated in the far north-west of Namibia and contains the small settlement of Orupembe and the former mine of Sarusas. It is not known whether this small catchment and short river (80 km) contain any woodland habitats of national importance.

GENERAL SITE DESCRIPTION:

The Khumib River has a very small catchment in north-western Namibia. No information is available as to the types of vegetation associated with this river and catchment. The area is very dry and it is likely that the vegetation will be dominated by mopane *Colophospermum mopane* and some *Acacia* species.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★★

Very little information is available regarding the diversity of the Khumib River and its catchment. It is included here as it was clear during that discussions that participants felt that the riparian woodlands of *all* west flowing ephemeral rivers should be investigated.

Endemism

The following endemics and near-endemic species may occur in the catchment.

<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Parus carpi</i>	Carp's Black Tit
<i>Lanioturdus torquatus</i>	White-tailed Shrike

Red Data Species

The following Red Data Species are thought to occur in the catchment and along the river.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
<i>Lygodactylus lawrenceii</i>	Kaokoveld dwarf gecko
<i>Mabuya spilogasterr</i>	Namibian tree skink
<i>Loxodonta africana</i>	African elephant
<i>Giraffa camelopardalis</i>	Giraffe
<i>Thallomys phaedulcus</i>	Tree rat
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★

Little information could be found on the socio-economic conditions pertaining in the Khumib River catchment. Less than 100 people live in this arid catchment and the village of Orupembe is the only formal settlement in the area. The use of wood and non-wood resources is not known.

WATER CATCHMENT MANAGEMENT

RATING: ★★

The riparian woodlands of the Khumib and its tributaries may contribute towards:

Prevention of soil erosion and the reduction of siltation
Flood attenuation

THREATS

None known.

MANAGEMENT OPTIONS

The Khumib catchment is of limited extent and falls mainly within a communal area. A small section falls within the Skeleton Coast Park. Management will need to be oriented towards the community in this catchment.

Forest Act: Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Hoarusib Catchment and Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Hoarusib River is about 300km long and has a catchment of some 15000 km². The Hoarusib flows virtually every year and contains some extensive patches of riparian woodlands. The extent and location of these woodlands has not been determined.

GENERAL SITE DESCRIPTION:

The Hoarusib is one of the most active of the west-flowing ephemeral rivers, flowing to the sea nearly every year. As a result it supports fairly large areas of riparian forest along its margin. These forests comprise species such as *Combretum imberbe*, *Acacia erioloba*, *Faidherbia albida*, *Euclea pseudebenis* and *Hyphaene* palms. A number of large wetlands are found along the river.

The combination of wetlands and woodlands supports a fairly large population of nomadic herders as well as significant populations of wildlife.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★ ★ ★

Ecological Function

All the west flowing rivers are important in that they provide important mesic corridors in very arid landscapes. Species normally associated with wetter habitats to the east are therefore able to intrude into the Namib, where they would not normally survive.

Habitat Diversity

Habitat diversity is thought to be relatively high with the river and its tributaries rising at altitudes of up to 1960 m and draining to the sea. Upper catchment areas tend to be rocky with shallower soils, in the middle reaches of the river the river valley broadens out into a flat plain of fluvial silt and sandy soils and the vegetation is characterised by large stands of tall tree species such as *Faidherbia albida*, *Acacia tortilis*, *Acacia erioloba*, *Combretum imberbe* and mopane. The lower reaches of the river tend to be dominated by species such as *Tamarix usneoides*, *Salvadora persica* and *Euclea pseudebenis*.

Species Diversity

Detailed studies of the fauna and flora of the Hoarusib river and catchment are lacking. Species diversity along the river is thought to be high relative to the surrounding areas, which are arid and uniform. There are important populations of large game within the catchment, including African Elephant *Loxodonta africana*, Black Rhino *Diceros bicornis* and Giraffe *Giraffa camelopardus*. About 250 bird species have been recorded in this area including species more commonly associated with wetter habitats.

Endemism

All the west flowing ephemeral rivers are thought to be important in terms of endemic and near-endemic species. The occurrence of endemic and near-endemic plant species warrants further attention. The following species are thought to occur in the area.

<i>Francolinus hartlaubi</i>	Hartlaub's Francolin
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Namibornis herero</i>	Herero Chat
<i>Achaetops pycnopygius</i>	Rockrunner

<i>Lanioturdus torquatus</i>	White-tailed Shrike
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Red Data Species

The following species are thought to occur within the Hoarusib catchment and be at least partially dependent on wooded habitats in this area.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
<i>Lygodactylus lawrencei</i>	Kaokoveld dwarf gecko
<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Loxodonta africana</i>	African elephant
<i>Giraffa camelopardalis</i>	Giraffe
<i>Thallomys phaedulcus</i>	Tree rat
<i>Gyps africanus</i>	White-backed vulture
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★★ ★

Over 12 000 people are resident in the Hoarusib catchment with the town of Opuwo forming the most important settlement in the area. Resource demands are high for both wood and non-wood goods and services.

Wood Resources

The importance of wood resources has not been quantified in any studies. Wood is heavily used in the construction of homesteads, livestock pens and for fencing. Most of the wood used here is mopane.

Non-wood Resources

The use of non-wood resources has not been studied in this area. However, the pods of species such as *Faidherbia albida* are important in the maintenance of domestic livestock and wildlife populations in the area.

Cultural/Traditional

The importance of the riparian woodlands in terms of cultural and traditional uses is not known.

Tourism/Recreation

The lower Hoarusib falls within the Skeleton Coast Park and a tourism concession operates along the river in this section. Community tourism initiatives have developed in the Purros area and form an important part of the local economy.

WATER CATCHMENT MANAGEMENT

RATING: ★★ ★

The riparian woodlands of the Hoarusib catchment are all important in:

- The reduction of soil erosion and siltation*
- Flood attenuation*

Groundwater recharge

THREATS

A rapidly expanding population at Opuwo and changing settlement patterns places increasing pressure on the woody resources of the river and its catchment. Riparian woodland losses will be significant if the proposed dam at Purros is to be built.

MANAGEMENT OPTIONS

This river catchment system is heavily settled in parts and management options need to take into account subsistence farming systems, existing and proposed conservancies, tourism operations and the Skeleton Coast Park.

Forest Act: State Forest Reserve, Regional Forest Reserves, Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Hoanib River Catchment and Riparian woodlands

GEOGRAPHIC LOCATION AND EXTENT:

The Hoanib River and its catchment covers some 17 000 square kilometers in north-western Namibia. The actual extent and the location of the forests of national importance have yet to be determined. The wooded habitats downstream of the Khowarib area to about the confluence of the Hoanib and the Ganamub Rivers are thought to be of the greatest importance. The woodlands associated with the upper catchments of the Ombonde and the Aap Rivers are not well known.

GENERAL SITE DESCRIPTION:

The Hoanib River is approximately 270 km long. The upper catchment lies within commercial farmlands in the Kamanjab District, but the major part of the river and its catchment lies within communal land. Historically this river formed the boundary between Damaraland and Kaokoland.

The Hoanib is regarded as one of the most important of the ephemeral west-flowing rivers as it supports important populations of wildlife, as well as being an important support element in the subsistence farming systems practiced in the area. The biodiversity of this river and its catchment is seen as being high in a regional context as the river forms a mesic corridor in an arid landscape, which is especially important for species normally only associated with wetter habitats further east. Significant populations of large game still exist along much of the river, with important populations of African Elephant, Black Rhino and Lion being the focus of much conservation effort in the area.

The riverine woodlands are extremely important in the subsistence farming systems established here. Certain species, such as the Ana Tree *Faidherbia albida*, provide dry season forage for domestic livestock. The fluvial silts along the river are used for subsistence gardens near major settlements. The river drains through two proclaimed conservation areas, a conservancy, three tourism concessions and contains several lodges, hotels and campgrounds. This gives an indication of the importance of this river and its catchment in terms of regional tourism and conservation and as such is an important economic asset in the Kunene Region.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★ ★ ★

Habitat Diversity:

Habitat diversity is thought to be relatively high with the river and its tributaries rising at altitudes of up to 1800 m and draining to the sea. Upper catchment areas tend to be rocky with shallower soils and often dominated by mopane *Colophospermum mopane*, even in the riparian fringe. In the middle reaches of the river, the river valley broadens out into a flat plain of fluvial silt and sandy soils, where the vegetation is characterised by large stands of tall tree species such as *Faidherbia albida*, *Acacia tortilis*, *Acacia erioloba*, *Combretum imberbe* and mopane. The lower reaches of the river are narrow and as flooding is very irregular this far down the river, the vegetation tends to be dominated by species such as *Tamarix usneoides*, *Salvadora persica*, *Euclea pseudebenis* and numerous woody shrubs.

Species diversity:

Detailed studies of the fauna and flora of the whole catchment are lacking, but recent work by DRFN on the catchment may have addressed some of the gaps in current knowledge. Species diversity along the river is thought to be high relative to the surrounding areas, which are both arid and relatively uniform in terms of habitats. Significant populations of large mammals are present along the length of the river. African Elephant *Loxodonta africana*, Black Rhino *Diceros bicornis*, Lion *Panthera leo* and Giraffe *Giraffa camelopardus* all occur here. More common herbivores include Hartmann's Mountain Zebra *Equus zebra hartmannae*, Oryx *Oryx gazella* and Springbok *Antidorcas*

marsupialis. Reasonably good data exists on bird populations within the catchment and at least 270 species have been recorded. The riparian woodlands are important corridors for species more commonly associated with mesic habitats in the East of Namibia, such as Long-tailed Starling *Lamprotornis mevesii*, Africa Mourning Dove *Streptopelia decipiens* and Black Cuckoo-Shrike *Campephaga flava*. The species diversity of lower vertebrates populations has been investigated at isolated disjunction sites, but no comprehensive assessment has been done. The floral diversity of the area warrants further investigation.

Endemism:

All the west-flowing rivers of northern Namibia are thought to be important in terms of endemic and near endemic taxa. Hartmann's Mountain Zebra *Equus zebra hartmannae* is a near-endemic species/sub-species, which occurs commonly within the Hoanib catchment. Several near-endemic species of birds also occur here. The occurrence of endemic reptiles, amphibians, insects and plants warrants further investigation.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
<i>Lygodactylus lawrencei</i>	Kaokoveld dwarf gecko
<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Petromus typicus</i>	Dassie Rat
<i>Francolinus hartlaubii</i>	Hartlaub's Francolin
<i>Poicephalus rueppellii</i>	Ruppell's Parrot
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Phoeniculus damarensis</i>	Violet Wood-Hoopoe
<i>Tockus Monteiroi</i>	Monteiro's Hornbill
<i>Parus carpii</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Namibornis herero</i>	Herero Chat
<i>Achaetops damarensis</i>	Damara Rockrunner
<i>Lanioturdus torquatus</i>	White-tailed Shrike

Red Data Species:

A number of Red Data Species are known to occur within the Hoanib catchment. It is unclear as to whether some of these species are closely associated with the riparian woodlands. The following species are known to occur in association with the riparian woodland habitats of the Hoanib and its major tributaries.

<i>Kerivoula argentata</i>	Damara woolly bat
<i>Galago mohol</i>	Lesser bushbaby
<i>Loxodonta africana</i>	African Elephant
<i>Giraffa camelopardus</i>	Giraffe
<i>Thallomys phaedulcus</i>	Tree Rat
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle

SOCIO-ECONOMIC

RATING: ★★

The catchment as a whole supports over 7 500 people, with most settlement taking place along the course of the river.

Wood Resources:

The importance of the wood resources in the area is not known but much wood is used in the construction of homesteads, livestock pens and other buildings. Most of this wood is

mopane.

Non-wood resources:

Non-wood resources, particularly the pods of *Faidherbia albida* are critical in the maintenance of subsistence farming livelihoods.

Tourism:

The Hoanib catchment contains some of the most visited tourism sites in the North-west of Namibia. This includes Sesfontein, a number of concession areas, the Khowarib Schlucht, the Hoanib population of Elephant down-stream of Sesfontein and a number of lodges, hotels and campsites.

WATERSHED MANAGEMENT

RATING: ★★ ★

The riparian woodlands of the Hoanib and its tributaries are all important in:

Prevention of soil erosion and the reduction of siltation

Flood attenuation

Maintenance of the downstream hydrological environment

Groundwater recharge

THREATS

Overexploitation of riparian resources is probably the greatest threat to this system. There are proposals for the increased development of agricultural projects, mining and tourism in the area, some of which are conflicting. The management of riparian resources is critical to the long-term success or failure of these projected developments as well as maintaining the current systems of subsistence agriculture, conservation and tourism.

MANAGEMENT OPTIONS

Forest Act: Regional Forest Reserves, Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Uniab River Catchment and Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Uniab River catchment lies to the west of the Etendeka mountains near Palmwag in the North-west of Namibia. The river is fairly short (110 km) and has a small catchment of about 4 500 km². The extent and location of riparian woodlands within this catchment is not known.

GENERAL SITE DESCRIPTION:

The Uniab catchment has very low rainfall and does not support large dense stands of riparian woodlands. Mopane *Colophospermum mopane* dominates the riverine vegetation as well as the drier parts of the catchment.

The Uniab supports significant populations of wildlife. Human habitation is sparse with fewer than 100 people resident within the catchment. Most of the catchment falls within two tourism concessions and the Skeleton Coast Park.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★ ★ ★

Habitat Diversity

Habitat diversity may be moderate to low. The river does not have a significant floodplain or margin except for a limited area in its middle reaches.

Species Diversity

The species diversity of the Uniab River and catchment are thought to be low to moderate although no detailed studies have been made of this area. The diversity of plant species in the catchment warrants further study. Significant populations of large mammals are present along the length of the river including, African Elephant *Loxodonta africana*, Black Rhino *Diceros bicornis*, Lion *Panthera leo* and Giraffe *Giraffa camelopardus*. These are a major attraction for tourists visiting the area.

Endemism

No information on plant endemism was found for the Uniab River catchment. The occurrence of endemic reptiles, amphibians, insects and plants warrants further investigation.

<i>Francolinus hartlaubi</i>	Hartlaub's Francolin
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Namibornis herero</i>	Herero Chat
<i>Achaetops pycnopygius</i>	Rockrunner
<i>Lanioturdus torquatus</i>	White-tailed Shrike

Red Data Species

The list below gives those Red Data Species thought to occur within the catchment. The degree of dependency of some species on riparian woodlands is not clear.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
<i>Lygodactylus lawrenceii</i>	Kaokoveld dwarf gecko

<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Loxodonta africana</i>	African elephant
<i>Giraffa camelopardalis</i>	Giraffe
<i>Aepyceros petersii</i>	Black-faced impala
<i>Thallomys phaedulus</i>	Tree rat
<i>Gyps africanus</i>	White-backed Vulture
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aviceda cuculoides</i>	Cuckoo Hawk
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppelii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★★

Given the fact that so few people reside within this catchment most of the woodland resources are unlikely to be of significance in terms of the socio-economic development of the area.

Tourism/Recreation

The Uniab catchment falls almost entirely within the Palmwag and Etendeka Mountain tourism concessions. The lower reaches fall within the Skeleton Coast Park. These two concessions attract a significant number of tourists to this area and tourism forms a significant part of the local economy. The success of these tourism operations is dependent on maintaining the relatively pristine environment here.

WATER CATCHMENT MANAGEMENT

RATING: ★★

Although the vegetation along the river is relatively sparse, riparian woodlands are important in:
Reduction of soil erosion and siltation
Flood attenuation
Groundwater recharge

THREATS

None known.

MANAGEMENT OPTIONS

The Uniab catchment is relatively small and very few people live in this area. Wildlife management is the principle focus in this area.

Forest Act: Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Huab River Catchment and Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Huab River is some 300km long and has a catchment of about 15 000 km². The extent and location of the forests of national importance have not been determined.

GENERAL SITE DESCRIPTION:

The Huab is one of the major rivers in the North-west of Namibia and some 15000 people are resident within its catchment. The vegetation along its course is diverse with mopane *Colophospermum mopane* savanna dominating most of the area. Riverine woodlands are also dominated by mopane but species such as *Faidherbia albida*, *Acacia erioloba*, *Salvadora persica* and *Combretum imberbe* are all characteristic, either forming dense almost mono-specific stands or scattered along the course of the river.

The river traverses private farmlands and communal farmlands, as well as the Skeleton Coast Park. Land use is varied but the riparian woodlands are particularly important in supporting the subsistence livestock industry in the communal areas along its course.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★ ★ ★

Ecological Function

All the west flowing rivers are important in that they provide important mesic corridors in very arid landscapes. Species normally associated with wetter habitats to the east are therefore able to intrude into the Namib, where they would not normally survive.

Habitat Diversity

The habitat diversity along this river is thought to be high. The upper catchment areas fall within the calcrete based habitats west of Kamanjab dominated by short scrub mopane. The river broadens out near Eersbegin and supports large stands of trees and wetlands. The lower reaches are dominated by scrubby vegetation which important in supporting significant populations of large game.

Species Diversity

The Huab catchment has been the subject of a detailed study by the DRFN. Details of the study were not available but species diversity is considered to be high, especially relative to the surrounding areas. There are important populations of large game species along the river, including the majority of African Elephants *Loxodonta africana* occurring in the West of Namibia. About 250 species of birds have been recorded in the Huab catchment. The diversity of plants, invertebrates, amphibians and reptiles warrants further study.

Endemism

The Huab River catchment supports a number of endemic and near-endemic species of plants and animals. Many of these, e.g. Hartmann's Mountain Zebra *Equus zebra hartmannae* are not dependant on riparian vegetation. However, several near-endemic bird species dependent on woodland habitats occur commonly here. The occurrence of endemic reptiles, amphibians and plants warrants further investigation.

<i>Francolinus hartlaubi</i>	Hartlaub's Francolin
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Parus carpi</i>	Carp's Black Tit

<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Namibornis herero</i>	Herero Chat
<i>Achaetops pycnopygius</i>	Rockrunner
<i>Lanioturdus torquatus</i>	White-tailed Shrike
<i>Aepyceros (melampus) petersii</i>	Black-faced Impala

Red Data Species

The following species are thought to be closely associated with the riparian woodlands within the Huab River catchment.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Loxodonta africana</i>	African elephant
<i>Giraffa camelopardalis</i>	Giraffe
<i>Thallomys phaedulcus</i>	Tree rat
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopus ecaudatus</i>	Bateleur
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppelii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★★★

The Huab River catchment is large and more than 15 000 people are resident here. Most people are centred around the towns of Khorixas, Fransfontein and Kamanjab. Demand for fuel wood resources in these towns is likely to be high.

Wood Resources

The importance of wood resources is not known, but it is assumed that fuel wood demand at the main urban centers will be high. Wood use for construction purposes is largely for homesteads, livestock pens and fencing.

Non-wood Resources

The value of non-wood resources, particularly the pods of *Faidherbia albida*, is high. The riparian vegetation resources form a crucial part of the dry season grazing/fodder supply for most domestic livestock in the area.

Cultural/Traditional

The importance of riparian woodlands and resources in cultural and traditional practices is not known.

Tourism/Recreation

There are a number of tourism developments along the Huab River and its tributaries. These range from small scale community based operations to high priced concessionary camps on communal land and also upmarket lodges on private lands. These tourism operations are dependent to a greater or lesser extent on the riparian woodlands, which

support the game populations on which the industry is based.

WATER CATCHMENT MANAGEMENT

RATING: ★ ★ ★

The riparian woodlands of the Hoanib and its tributaries are important in:

Reducing soil erosion and siltation

Flood attenuation

Groundwater recharge

THREATS

The greatest threats to the system are the continued construction of dams in the upper catchment (reduction of downstream runoff severely impacts the riparian woodlands), uncontrolled settlement, overutilisation of woody plant resources, and overgrazing of upland sites leading to increased siltation of the river.

MANAGEMENT OPTIONS

The Huab catchment contains Khorixas and a number of other settlements. Tenure systems include private land holdings, communal lands and state controlled lands.

Forest Act: Regional Forest Reserves, Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Ugab River Catchment and Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Ugab River is about 450 km long, its catchment covers an area of some 28 000 km² and spans three administrative regions. The location and extent of the forested areas of national importance have not been determined.

GENERAL SITE DESCRIPTION:

The Ugab River rises in the hills North of Otjiwarongo and drains a relatively narrow catchment. The upper sections of the river are characterised by dense stands of *Acacia* species, which can be quite extensive in parts. Where the river enters the bare rocky areas of the Mitten Fold woody forested habitats are rare. From about the Khorixas-Uis road bridge the river course is much wider and the riparian strip is characterised by extensive stands of large *Faidherbia albida*, *Acacia erioloba* and mopane *Colophospermum mopane*. Where the fluvial silts have become salinised through water percolation the vegetation is dominated by dense stands of *Tamarix usneoides*. West of Brandberg West the river enters a narrow stretch and again wooded habitats are limited in their occurrence. The lower reaches of the river within the Skeleton Coast Park are dominated by scrubby vegetation comprising species such as *Tamarix usneoides*, *Salvadora persica* and succulent species.

The riverine woodlands from the Khorixas-Uis road, westwards, are extremely important in terms of the subsistence farming systems there as well as wildlife, especially the *Faidherbia albida* stands which produce large quantities of pods which are used as fodder during the dry season.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★★ ★

Ecological Function

All the west flowing rivers are important in that they provide important mesic corridors in very arid landscapes. Species normally associated with wetter habitats to the east are therefore able to intrude into the Namib, where they would not normally survive.

Habitat Diversity

Given the length of the river and the variety of geological systems the river passes through the habitat diversity along the river is thought to be high.

Species Diversity

Species diversity is thought to be high, especially compared to the surrounding areas in the lower reaches. Important populations of African Elephant *Loxodonta africana*, Black Rhino *Diceros bicornis* and Oryx *Oryx gazella* occur along the river, particularly West of Anichab. The species diversity of the upper catchment is not well documented. About 300 species of birds have been recorded along the river. The floral diversity of the catchment warrants further attention.

Endemism

All the west-flowing rivers of northern Namibia are thought to be important in terms of endemic and near-endemic taxa. The Ugab River is no exception and as it passes very close to the Brandberg many of the localised Brandberg endemics may occur within the catchment. Considerable further work is required in the Ugab River itself, but the following species are known to occur here.

<i>Fringilla monticola</i>	Hartlaub's Fringilla
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe

<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Namibornis herero</i>	Herero Chat
<i>Achaetops pycnopygius</i>	Rockrunner
<i>Lanioturdus torquatus</i>	White-tailed Shrike

Red Data Species

The following Red Data Species are known to occur in or near the Ugab River. No data on plants could be found.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Kerivoula argentata</i>	Damara woolly bat
<i>Loxodonta africana</i>	African elephant
<i>Giraffa camelopardalis</i>	Giraffe
<i>Thallomys phaedulcus</i>	Tree rat
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Macheirampus alcinus</i>	Bat Hawk
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★ ★ ★

The catchment supports over 35 000 people, the majority of whom live in Otjiwarongo, Outjo and Kalkfeld. Settlement in the private farm lands to the East of the Mitten Fold is at low densities, but between the Khorixas-Uis Road bridge and the eastern boundary of the Skeleton Coast Park settlement along the river is dense. Resource demands in this section of the river are high.

Wood Resources

The importance of wood resources in the area is not known. In the communal area in the lower reaches of the river, wood is used for building construction, making livestock pens, lining wells and as fuel wood.

Non-wood Resources

The most important non-wood resources in the area are the pods of *Faidherbia albida*, which are an important source of fodder for domestic livestock and wildlife.

Tourism/Recreation

The current tourism and recreation levels along the Ugab are low, but there are currently plans to construct community campsites near Anichab and to expand the campsite at Brandberg West.

WATER CATCHMENT MANAGEMENT

RATING: ★ ★ ★

The riparian woodlands of the Ugab and its tributaries all contribute towards :
Reduction of soil erosion and siltation
Flood attenuation
Groundwater recharge

THREATS

The greatest threat to riparian woodlands in the Ugab River catchment is the proposed construction of a large dam at Sebraskop to supply water to Khorixas. The unplanned construction of small farm dams in the upper catchments also interferes with downstream waterflows, reducing the vigour of some of the stands of large trees.

MANAGEMENT OPTIONS

The Ugab catchment is one of the largest of the west flowing rivers and land use includes mining, tourism, agriculture and nature conservation. Land tenure includes private land, communal land and state land. Management options would need to be structured in a way to reflect the needs of all these uses and users.

Forest Act: State Forest Reserve, Regional Forest Reserves, Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Omaruru River Catchment and Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Omaruru River comprises a catchment of about 13 000 km² and is about 300 km long. It traverses commercial and communal farmland, entering the sea at Hentiesbay. The location and extent of the riparian woodlands of national importance have not been identified.

GENERAL SITE DESCRIPTION:

The Omaruru River has a relatively long narrow catchment rising just to the west of the Etjo Mountains and draining a broader area to the west of Omaruru. The river is heavily utilised for water supplies for Omaruru and other settlements along its course, including the supply to Henties Bay from the Omdel Dam. Settlements in the commercial farmlands are relatively sparsely distributed. The density of human settlements along the river from Okambahe to about Nei-Neis is considerably higher, with most people being dependent on the river for stock fodder and water.

The vegetation is patchy but is dominated by stands of large *Faidherbia albida* and *Acacia erioloba*. Some areas have been heavily encroached with mesquite *Prosopis sp.*

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★ ★ ★

Ecological Function

All the west flowing rivers are important in that they provide important mesic corridors in very arid landscapes. Species normally associated with wetter habitats to the east are therefore able to intrude into the Namib, where they would not normally survive

Species Diversity

Species diversity is thought to be high, especially compared to the surrounding areas in the lower reaches. However there are no important populations of African Elephant *Loxodonta africana* and Black Rhino *Diceros bicornis* along the river. The species diversity of the upper catchment is not well documented. About 300 species of birds have been recorded along the river. The floral diversity of the catchment warrants further attention.

Endemism

The following endemic and near-endemic species have been recorded within the Omaruru River and its catchment.

<i>Fringilla monticola</i>	Hartlaub's Francolin
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Tockus Monteiroi</i>	Monteiro's Hornbill
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Namibornis herero</i>	Herero Chat
<i>Achaetops pycnopygius</i>	Rockrunner
<i>Lanioturdus torquatus</i>	White-tailed Shrike

Red Data Species

The following Red Data Species have been recorded or are thought to occur within the Omaruru River and its catchment.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
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<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Galago mohol</i>	Lesser bushbaby
<i>Loxodonta africana</i>	African elephant
<i>Giraffa camelopardalis</i>	Giraffe
<i>Thallomys phaedulcus</i>	Tree rat
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Macheirampus alcinus</i>	Bat Hawk
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppelii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★★★

The Omaruru River catchment supports some 12000 people, with most people being resident in the towns of Omaruru and Henties Bay, and the village of Okambahe.

Wood Resources

The dependence of the local population on wood resources associated with the Omaruru River is not documented. Wood is used in the construction of homesteads and for fuelwood.

Non-wood Resources

The pods of *Faidherbia albida* are important in the subsistence farming systems practiced in the middle and lower reaches of the river.

WATER CATCHMENT MANAGEMENT

RATING: ★★★

The riparian woodlands and forests of the Omaruru river and its catchment are all important in:

Reduction of soil erosion and siltation

Flood attenuation

Groundwater recharge

THREATS

The continued increase in the number of upper catchment dams threatens the functioning of the river in terms of flooding. These floods are essential in maintaining the forests along the margin of the river.

MANAGEMENT OPTIONS

This catchment drains an area of private farmland in the east and an extensive area of communal lands in the west. Tourism, agriculture and mining all take place in this area.

Forest Act: Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Swakop River Catchment and Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Swakop River has a huge catchment of over 30 000 km² and extends for about 460 km from the mountains to the west of Windhoek and the east of Okahandja to the coast. The location and extent of the woodlands of national importance have not been determined.

GENERAL SITE DESCRIPTION:

The Swakop River is one of the most important rivers in Namibia. Two large dams (Swakoppoort and Von Bach) supply most of the towns in the central part of Namibia with water as well as water to Rossing Mine and other industries. Most of the catchment of the river lies within commercial farmlands, but it also passes through the Otjimbingwe communal area and through the Namib Naukluft Park in its lower reaches.

The geology of the Swakop River catchment is diverse and hence, there is a great variability in the woodlands and forests associated with the river. Where there are wider benches of deep soils the woody habitats are dominated by stands of large *Acacias* and *Faidherbia albida*. These have been severely encroached by mesquite *Prosopis sp.* in many areas. In other areas woody vegetation tends to be fragmented and patchy.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★ ★ ★

Habitat Diversity

The habitat diversity is assumed to be relatively high given the size of the catchment and the length of the river. However, no assessment of the diversity has been made.

Species Diversity

The species diversity of the Swakop River and its catchment are presumed to be relatively high, especially in comparison with the surrounding areas in its lower reaches. However there are no important populations of African Elephant *Loxodonta africana* and Black Rhino *Diceros bicornis* along the river although they occurred historically. The species diversity of the upper catchment is not well documented. About 250 species of birds have been recorded along the river. The floral diversity of the catchment warrants further attention.

Endemism

The following endemic and near-endemic species have been recorded within the Swakop River catchment. A number of these species are only partially dependent on woody habitats or use them intermittently.

<i>Francolinus hartlaubi</i>	Hartlaub's Francolin
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Parus carpi</i>	Carp's Black Tit
<i>Turdoides gymnogenys</i>	Bare-cheeked Babbler
<i>Namibornis herero</i>	Herero Chat
<i>Achaetops pycnopygius</i>	Rockrunner
<i>Lanioturdus torquatus</i>	White-tailed Shrike

Red Data Species

The following Namibian Red Data Species have been recorded within the Swakop River catchment.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Thallomys phaedulcus</i>	Tree rat
<i>Gyps africanus</i>	White-backed Vulture
<i>Terathopius ecaudatus</i>	Bateleur
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Macheiramphus alcinus</i>	Bat Hawk
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppelii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Tockus monteiroi</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★ ★ ★

Most of the Swakop River and its catchment lie within commercial farmlands and the Namib Naukluft Lodge, with the exception of a short section, which runs through the Otjimbingwe communal area, which is heavily settled. In this area resource demands are markedly higher than elsewhere along the river and its catchment.

Wood Resources

Wood resources are used to construct livestock pens and to line wells. Homesteads are also built with wood resources but to a considerably lesser degree than in other river catchments. Fuel wood demand is high especially in the Otjimbingwe area.

Non-wood Resources

The demand for non-wood resources is not known. It is expected to be highest in the Otjimbingwe area where there is a subsistence farming system, which is known to be dependent (to a degree) on the production of *Faidherbia albida* pods during the dry season.

Tourism/Recreation

There are a number of tourism developments and important sites (e.g. Goanakontes) along the Swakop River. The importance of the riparian woodlands to these enterprises is not known but is likely to be largely associated with the aesthetics of the woodlands.

WATER CATCHMENT MANAGEMENT

RATING: ★ ★ ★

The riparian vegetation along the Swakop River and its tributaries is important in:

Reduction of soil erosion and siltation

Flood attenuation

Groundwater recharge

THREATS

The greatest threats to the riparian vegetation are probably the uncontrolled construction of upper

catchment dams and small impoundments, which result in reduced downstream flows. This results in a depression of the water table and reduced vigour of large trees such as *Faidherbia albida* and *Acacia erioloba*.

MANAGEMENT OPTIONS

The Swakop river drains a catchment that includes Windhoek, Okahandja, Karibib, Usakos and Otjimbingwe. Land tenure systems include free hold farmlands, communal lands and state land.

Forest Act: Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Kuseib River Catchment and Riparian Woodlands

GEOGRAPHIC LOCATION & EXTENT:

The Kuseib River catchment is about half the size of the Swakop River. It is about 15 500 km² and about 400 km long. The location and extent of the woodlands of concern is not known.

GENERAL SITE DESCRIPTION:

The Kuseib is one of the best known of the west-flowing ephemeral rivers and has been the subject of considerable research, particularly its lower reaches that have been intensively studied by the DRFN at Gobabeb. This institution has also undertaken other work in the upper catchment, particularly with regard to water budgets.

The river rises in the Khomas Hochland just to the West of Windhoek. It drains a relatively narrow catchment, which falls entirely on commercial farmlands in its upper reaches and state land (the Namib Naukluft Park) in its lower reaches.

The upper reaches of the river in the Khomas Hochland region tend to be at a high gradient and runoff is rapid. Riparian woody vegetation is not well developed and is often similar to that of the surrounding areas, e.g. *Acacia hereroensis*, *Acacia karoo*, *Ziziphus mucronata* and *Rhus lancea*. Where the gradient decreases and the river broadens out species such as *Acacia erioloba* are characteristic. The Kuseib enters a long and narrow canyon for much of its middle reaches from about the western escarpment to just upstream of Gobabeb. In this canyon area there is little woody vegetation except for isolated trees and patches. Once the river leaves the narrow canyon the valley widens and well developed *Acacia erioloba* and *Faidherbia albida* riparian fringing woodlands are characteristic of the river until about the Rooibank area, near Walvis Bay.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★ ★

Ecological Function

The Kuseib River provides a narrow mesic corridor for species associated with wetter habitats further East. The riverine woodlands in its lower reaches are occupied by species, which would not normally occur in the area, e.g. Chestnut-vented Tit Babbler.

Habitat Diversity

Habitat diversity is thought to be high along the course of the river, with poorly developed woodlands associated with the river in its upper catchment, grading through patchy riparian woodlands in the middle reaches of the river which give way to well developed, tall riparian forests in the lower reaches.

Species Diversity

Species diversity is thought to be moderate to high, especially in relation to the surrounding areas. Species diversity warrants considerable further research especially in the upper catchment.

Endemism

The following endemic and near-endemic species have been recorded in the Kuseib River catchment.

<i>Fringilla monticola</i>	Monticola's Fringilla
<i>Fringilla monticola</i>	Monticola's Fringilla
<i>Agapornis roseicollis</i>	Rosy-faced Lovebird
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Tockus monteiroi</i>	Monteiro's Hornbill

<i>Parus carpi</i>	Carp's Black Tit
<i>Namibornis herero</i>	Herero Chat
<i>Achaetops pycnopygius</i>	Rockrunner
<i>Lanioturdus torquatus</i>	White-tailed Shrike

Red Data Species

The following Red Data Species have been recorded in the Kuiseb River catchment. There are few threats to these species along the course of the river in that most of the catchment falls with commercial farmland or a state conservation area.

<i>Lygodactylus bradfieldi</i>	Namibian dwarf gecko
<i>Mabuya spilogaster</i>	Namibian tree skink
<i>Thallomys phaedulus</i>	Tree rat
<i>Gyps africanus</i>	White-backed Vulture
<i>Torgos tracheliotus</i>	Lappet-faced Vulture
<i>Aquila rapax</i>	Tawny Eagle
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Haliaeetus vocifer</i>	African Fish Eagle
<i>Phoeniculus damarensis</i>	Violet Woodhoopoe
<i>Poicephalus rueppellii</i>	Rüppell's Parrot
<i>Parus carpi</i>	Carp's Black Tit
<i>Tockus Monteiroi</i>	Monteiro's Hornbill
<i>Lanioturdus torquatus</i>	White-tailed Shrike

SOCIO-ECONOMIC

RATING: ★

The socio-economic value of the woody plant resources along the Kuiseb River is likely to be low as few people live within the catchment. Along the lower reaches, however, sizeable populations of Topnaar people is settled along the river and are dependent to an extent on the woody plant resources there.

Wood Resources

Generally thought to be unimportant with the exception of the Topnaar people resident in the lower reaches of the river. Wood is used in the construction of homesteads and livestock pens and is important in terms of cooking and heating fuel.

Non-wood Resources

The seed pods of *Faidherbia albida* are important in the subsistence livestock farming practiced by the Topnaar people.

WATER CATCHMENT MANAGEMENT

RATING: ★★

The riparian woodlands of the Kuiseb River and its tributaries are all important in:

Reduction of soil erosion and siltation

Flood attenuation

Groundwater recharge

THREATS

The principal threat to the riparian woodlands of the Kuiseb River is the reduction of runoff in the upper catchment as a result of the increasing numbers of farm dams and small impoundments.

MANAGEMENT OPTIONS

The Kuiseb River rises in the Khomas Hochland near Windhoek and traverses private farmlands and state land. Communal farming systems are practiced within the Namib-Naukluft Park.

Forest Act: Nature Reserves, Community Forests, Forest Management Area

Parks & Wildlife Management Bill: National Park, Natural Monument, Nature Reserve, Protected Landscape, Conservation Area.

Cuvelai Drainage Agro-Forestry System

GEOGRAPHIC LOCATION & EXTENT:

The Cuvelai drainage system is poorly defined, but encompasses the complex system of oshanas and drainage lines in eastern Omusati, the Oshana Region and parts of the western Ohangwena and Oshikoto regions. The extent and location of the forests of national importance have yet to be determined. The landscape in the Cuvelai is largely anthropogenic and the central issue of interest here is the agro-sylvi-pastoral system, of which a significant part is indigenous fruit tree production.

GENERAL SITE DESCRIPTION:

The Cuvelai area is centrally located on the northern border of Namibia where it occupies a broad plain of low relief. The area is traversed by shallow, ephemeral water courses called oshanas that originate in Angola. The oshanas and surrounding lowlands of the Cuvelai are underlain by silts and clays and are mostly covered by a variety of grasslands.

The Kalahari sands on the higher ground between the drainage channels support a number of woody vegetation types. These include palm tree and fruit-tree woodlands of anthropogenic origin, characterized by species such as *Hyphaene petersiana*, *Sclerocarya birrea*, *Berchemia discolor* and *Diospyros mespiliformis*. Other areas are dominated by dense stands of *Colophospermum mopane* many of which have been structurally altered over many years of heavy utilization. Northern units dominated by *Colophospermum mopane* are characterized by trees, whereas further south the mopane is largely shrubby. In those areas in the east of the oshanas the upland sites have deeper sandy soils and many of the species here are characteristic of the Kalahari areas further east. Species here include *Combretum collinum*, *Pterocarpus angolensis*, *Schinziophyton rautenanii* and *Terminalia sericea*.

SITE SELECTION VALUES

BIODIVERSITY

RATING: ★

Habitat Diversity

Habitat diversity is relatively low, with soils and topography being relatively uniform. The whole Cuvelai basin is flat with very small changes in topography determining flood periodicities and vegetation distribution. Most woodland woodlands are situated on the higher ground.

Species Diversity

The Cuvelai drainage systems have been markedly altered in terms of natural vegetation in the past 100 years. The landscape is characterized by the influences of man and could be considered to be anthropogenic. Species diversity is as a result low, with diverse woody plant communities having been replaced by selected fruit trees and other plants of utilitarian importance.

Endemism

Endemism is low, with only one species present.

<i>Agapornis roseicollis</i>

Rosy-faced Lovebird

Red Data Species

The Red Data Species listed below are not all known from the area, but are suspected to occur. Most species have undergone massive declines in numbers and distribution in the last 50 years. Resource demand by an expanding human population has resulted in significantly altered habitats.