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BY  
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**DEPARTMENT OF THE ENVIRONMENT,  
MINISTRY OF LOCAL GOVERNMENT, HOUSING AND  
ENVIRONMENT**

**SUVA, FIJI**

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## **BACKGROUND TO THE REPORT**

This report has been prepared by the Republic of Fiji for the Conference of the Parties for the Convention on Biological Diversity (CBD), as required by Article 26 of the Convention. As such, the report complies with Decisions II/17 and III/9 of the COP that national reports be submitted by 1 January 1998 in time for the fourth meeting of the COP scheduled for May 1998.

This report is based largely on Fiji's State of the Environment Report, 'Environment Fiji – the National State of the Environment Report' (1992) but has been updated where there is additional information. It summarises the current state of knowledge in respect of Fiji's biodiversity, its status and conservation management.

Fiji is currently in the process of formulating a National Biodiversity Strategy and Action Plan for conservation and the sustainable use of the country's biological diversity. The principal outcome of this process will be a Strategy and Action Plan Report which will be submitted in mid 1998 following wide ranging discussion and consultation on biodiversity and resource use and the priorities for its conservation and sustainable use.

## **1 FIJI - GEOGRAPHICAL BACKGROUND**

### **1.1 AREA**

The Republic of Fiji consists of approximately 300 islands exceeding one half hectare in area with an aggregate land area of approximately 18,300 km<sup>2</sup>, in addition there are many smaller islets, cays and off-shore rocks. Viti Levu (10,544 km<sup>2</sup>) and Vanua Levu (5,535 km<sup>2</sup>) comprise 88% of the total land area. It is estimated that no more than 100 of the islands are permanently inhabited.

### **1.2 GEOLOGY AND LANDFORM**

The Fijian islands form part of a complex arc structure of volcanics, volcanic-derived sediments and reef deposits dating from the early Cenozoic (40-50 million years ago) to the present. This structure is located in a complex convergence plate boundary zone between the Australian and Pacific Plates. In addition to a record of volcanic, sedimentary and reef rocks, uplift and erosion have exposed plutonic and low-grade regional metamorphic rocks of greater age.

Fiji's larger volcanic islands are dominated by steep, mountainous country deeply incised by rivers and streams. The highest summit, Tomaniivi, is 1,323 m and there are 30 peaks over 1,000 m. On the four major islands, 67% of Viti Levu, 72% of Vanua Levu, 49% of Taveuni and 78% of Kadavu is steep land (slopes greater than 18°).

The land forms of the major islands are diverse and often spectacular, marked by sharp volcanic plugs, ruined calderas, deep gorges and ravines carved by mountain streams, and wide, flat-bottomed valleys with impressive rivers terminating in extensive flood plains and mangrove dominated deltas. Limestones of different ages commonly occur on Viti Levu and some bedded deposits are massive, up to 300 m. in height (5 - Appendix 1). Vanua Levu lacks limestone formations.

Only a few of the Fijian islands are classified as true atolls Wailagilala, Qelelevu 57,75 - Appendix 1), but there are many rings or loops of barrier reef with a more than superficial appearance to an atoll. While Vulaga, Ogea and perhaps Kabara are believed to be elevated atolls because the limestone are composed of raised reefs, the majority of Fiji's 'limestone' islands consist of bedded limestone overlying volcanic rocks. Repeated cycles of past volcanic activity, subsidence and uplift have exposed volcanic rocks to a greater or lesser extent on many of these islands.

### **1.3 CLIMATE**

Fiji enjoys a tropical maritime climate without great extremes of heat or cold.

At all seasons the predominant winds over Fiji are the trade winds from the east or south east and in general these are light or moderate. The most persistent being in the period July to December; strong winds are uncommon with the exceptional cyclones which generally occur in the period of November April. About 10-15 cyclones per decade directly affect Fiji with on the average two to four causing severe damage.

Although rainfall is highly variable, the average rainfall increases steadily inland from coastal areas. In addition the windward sides of the major islands intercept the easterly stream and experience far greater rainfall than the leeward sides, consequently providing a marked distinction between 'wet' and 'dry zones'. Rainfall is usually plentiful between December - April, especially over the larger islands, but in May - October it is often deficient in the 'dry zones'. Average rainfalls have been extensively documented, but because of the great variability in the rainfall, averages have little value as indicators of the actual rainfall regime. However, it may be noted that while the 'dry zone' of the larger islands receive an average annual rainfall of between 165-229 cm, the 'wet zone' receives 305-345 cm. Certain localities such as upland Taveuni commonly receive over 1,000 cm of rainfall per year.

## 2 VEGETATION

Rainfall is probably the physical parameter that causes the most marked vegetation changes. Broadly the forests can be divided into four very generalised types of vegetation that correlate primarily with rainfall - wet, intermediate, dry zone and coastal forests. Within these zones, local environmental factors further shape the composition of the forest communities (Parham 1964,1972; Smith 1979).

### 2.1 COASTAL VEGETATION

#### 2.1.1 Coastal Littoral and Marine Vegetation

Coastal littoral vegetation is very similar, both in general aspect and in component taxa, to that found in similar environments throughout the tropical Pacific. Trees, shrubs, vines and herbs that characterise the beach and volcanic and limestone rocky shore flora have, with very few exceptions, easy means of dispersal and establishment. Undisturbed coastal littoral forest remains only on some isolated islands.

The intertidal zone, where suitable mudflats or sandy reefs occur, supports a small number (but vast populations) of seagrass species and a very wide range of marine algae. Zann *et al.* (1997) suggest that there are well over 400 species of marine algae, many of which await scientific description.

#### 2.1.2 Mangrove Vegetation

Fiji has a considerable mangrove resource. The present best estimate is that approximately 42,000 ha remain. The distribution is irregular, the largest formations are found in deltaic sites at the mouths of the large rivers - Ba, Rewa, Nadi and Labasa and on the leeward coasts protected by barrier reefs.

The underlying structure of the mangrove zonation is simple with climatic conditions playing an important role. In the drier leeward areas with high seasonal evaporation, hyper-saline mudflats are a characteristic feature which are virtually absent from the wetter, windward mangrove areas. The flora consists of only seven obligate species (Watling 1985,1986). These include the *Rhizophora* hybrid 'Selala' (*R. stylosa* x *R. samoensis*) which is of great botanical interest and is not found to any great extent outside of Fiji. There are no endemic mangrove species and no terrestrial vertebrates are known to be confined to mangroves in Fiji.

#### 2.1.3 Dry zone vegetation

The dry zones of Fiji are found on the leeward coasts and extend from sea level up to about 450m. These lands were formerly covered with distinctive dry zone forests and scrublands. On Viti Levu especially and to a lesser degree Vanua Levu, after repeated burning, they have been reduced to grasslands and degraded fernlands which feature many introduced species. Remnants of the original forest still occur at higher elevations, but those at lower elevations are exceedingly rare and often confined to sheltered ravines (Sites 8,14,15,17,20 Appendix 1). The dry zone highland areas are of unusual interest, being well forested and yet more or less separated from the wet zone uplands by

intervening tracts of lower dry areas, predominantly grassland. They have been isolated sufficiently long for a slight degree of taxonomic endemism to have become apparent (Thaman 1996).

On both Viti Levu and Vanua Levu, much of the area once covered by dry zone forest has been converted for sugar cane farming.

#### **2.1.4 Intermediate zone vegetation**

The intermediate zone vegetation is an ecotone between the wet and dry zone communities found where the rainfall is better distributed than that of the dry zone but less consistent than that of the wet zone.

#### **2.1.5 Wet Zone Vegetation**

Wet zone vegetation consists primarily of rain forest and it is found on the windward sides of the larger islands and on some highland areas of the leeward dry zone. The Fijian rain forest is characterised by having a comparatively large number of species of diverse families, without any real dominants. It supports many lianas, ferns and epiphytes including orchids. The trees include at least 50 species with a trunk girth which can attain more than 1.5 m.

Elevations in Fiji are not high enough to break the continuity of the rain forest, and many species have a range extending from near sea level to the highest elevations. At higher elevations the trees are smaller, lianas fewer and undergrowth less varied. However, epiphytes especially orchids and ferns conspicuously increase in number and diversity. The fern flora, in particular, is highly developed with 303 taxa of which 88 (29%) are endemic species (Brownlie 1977). It is a notable but hitherto little mentioned and poorly documented component of the Fijian rain forest.

A great number of forest types within the more general 'wet zone vegetation' description can be distinguished based on species associations which have been largely determined by environmental factors such as aspect, slope, soils and cyclones. Berry and Howard (1973) described 45 different forest types during an inventory of Fiji's timber resources.

##### ***2.1.5.1 Species Diversity***

The most detailed investigation of species diversity in the wet zone rainforest was undertaken in the Natural Forest Management Pilot Project (Vletter 1994). In a 20% sample inventory of a forest area of approximately 315 ha., 133 tree species were identified. Contributing to this inventory, 96 species with dbh over 30cm were identified in an inventory of 53.375 ha (16.9%) and 126 species with dbh over 10cm were identified in an inventory of 10.675 ha (3.4%).

#### **2.1.6 Freshwater**

Fiji's freshwater swamps are very small in extent and restricted to areas of impeded drainage in some river valleys and parts of the coastal plains. One of the largest is the Melimeli peat swamp near Navua on Viti Levu, whose flora consists principally of widespread and introduced species (Ash & Ash 1984). In addition, small areas of swamp exist at elevated altitudes on the Rairaimatuku Plateau, Viti Levu (12,29 - Appendix 1)

while several of the volcanic craters in Taveuni support swamp vegetation, notably that around Fiji's largest natural lake, L. Tagimoucia (Southern et al. 1986) The total area of freshwater swamps in Fiji is reported to be only about eight km<sup>2</sup> but no detailed inventory has been undertaken.

## **2.2 PHYTOGEOGRAPHY AND THE FLORAL INVENTORY**

### **2.2.1 Origin of the Fijian flora**

The vascular flora of Fiji is regarded as an extension of the Indo-Malesian floristic province with about 90% of all seed plant genera found in Fiji being present in New Guinea (Balgooy 1971; Ash 1992). However, affinities do exist with Australia, Hawaii, New Caledonia, New Zealand and French Polynesia (Fuller 1997).

The total number of vascular plants known from Fiji is approximately 2600 of which approximately 1600 are native and 1000 are introduced. The current best estimate is that the Fijian flora consists of 310 pteridophytes (ferns and fern allies from Brownlie 1977) and at least 2225 seed plants (Watkins 1995). Based on Smith's *Flora Vitiensis Nova* (1979-1991), the endemism of Fiji's seed plants is estimated to be 63%, 812 of 1291 native species (Watkins 1995). Smith (1979-1991 records 934 introduced species but this is an underestimate based solely on herbarium specimens. The correct figure is likely to be well over 1000 introduced species.

There is a single endemic family, Degeneriaceae, and 11 of the approximately 450-470 genera are endemic. These are:

*Degeneria* (Degeneriaceae), *Alsmithia* (Arecaceae), *Goniocladus* (Arecaceae), *Neovetchia* (Arecaceae), *Gillespeia* (Rubiaceae), *Hedstromia* (Rubiaceae), *Readea* (Rubiaceae), *Squamellaria* (Rubiaceae), *Sukunia* (Rubiaceae), *Amaroria* (Simaroubaceae), *Pimia* (Sterculiaceae)

As to be expected in an isolated island flora, genetic radiation and endemism in some groups is extreme. For instance the genus *Psychotria* (Family Rubiaceae) is represented by 76 species of which 72 are endemic.

Palms are the best studied floral group in Fiji and the group documents very clearly the presence of highly restricted ranges, yet recent work shows how poorly we understand even this well-studied group. Watling & Chape (1992) reported that Fiji has 27 palms of which 26 are endemic and 12 of these have restricted ranges. Fuller (1997) after a year of field work has revised the palm flora to consist of 32 species in 15 genera of which 14 genera and 27 species are considered indigenous, and of these, all 27 species and one genus are endemic to Fiji.

### **2.2.2 Adequacy of the floral inventory**

Although Fiji's flora is well researched in comparison with those of other South Pacific archipelagoes, there remain many localities that have never or scarcely been collected. New plant species are being regularly discovered, even though current floral research is minimal. On the basis of the number of species known by only a single collection it seems probable that there could be up to 200 species that remain undocumented.

The floristic diversity of Fijian forests has not been adequately documented but it is greatly in excess of 100 species per kilometre square. It is likely that at least one thousand herbarium collections per 100 kilometre square are required to obtain a reasonable estimate of the floristic composition of an area and on this basis there are few, if any, areas in Fiji for which the species composition is adequately known (Ash and Vodonivalu 1989). As to be expected the distribution of Fiji's endemic species is skewed heavily in favour of the larger high islands (Viti Levu, Vanua Levu and Taveuni). Of the remaining islands, only Ovalau has significantly more endemic species than might be expected from its area. This probably reflects its status as a land bridge island formerly connected to Viti Levu in times of glacial maxima.

### 3 TERRESTRIAL AND FRESHWATER INVERTEBRATES

Fiji's invertebrate fauna has received little attention and many groups have not been studied at all. Literature on the other groups is scanty and well scattered in the scientific literature. However, the following are some readily available data.

#### 3.1 INSECTS

Robinson (1975) suggested that the total number of insect species inhabiting the Fiji group is in excess of 3500. A summary of the pterygote insect orders is provided in Table 1.

**Table 1 A summary of the approximate number of species of pterygote insects from Fiji.**

	<b>Insect Order</b>	<b>Number of Species</b>
1.	Ephemeroptera	2spp.
2.	Odonata	30-40spp.
3-8.	Orthopteroid orders (Blattodea, Isoptera, Mantodea, Demaptera, Orthoptera, Phasmatodea)	60-100spp. of which at least a third are Orthoptera
9-12	Hemipteroid orders (Psocoptera, Phthiraptera, Hemiptera, Thysanoptera)	350-400spp., probably over 300spp. of Hemiptera
13.	Neuroptera.	10+spp.
14.	Coleoptera.	?1000spp. including 112 Cerambycidae
15.	Strepsiptera.	2spp. known
16.	Siphonaptera.	?10+spp
17.	Diptera. Most groups unworked and grossly under-collected.	300+spp.
18..	Trichoptera.	20-30spp
19.	Lepidoptera. 400spp. of Macrolepidoptera probably at least 600spp. of Microlepidoptera	1000+spp.
20.	Hymenoptera.	250+spp.

Source: Robinson 1975

Of the macrolepidoptera, which is by far the best studied group, Fiji has 400 spp. with seven endemic genera. Fiji has more endemic genera and more endemic radiation than any other Pacific island group with the exception of Hawaii. However, the degree of radiation is not great, there is endemic radiation in *Lophocoleus* with six species, while radiation from a single apparent ancestor occurs in five other genera with between three and six species.

Fiji's cicadas is another group which has received relatively detailed study (Duffels 1988). The Fijian cicada fauna consists of 15 species, of which 14 (93%) are endemic. These include one endemic genus *Fijipsalta*. Tillyard (1929) recorded 33 species of Odonata (dragonflies and damselflies) from Fiji, of which 22 (67%) were endemic.

### 3.2 MOLLUSCS

No review of Fijian terrestrial molluscs appears to have been undertaken, but Solem (1974) records 58 species for Viti Levu. Barker (in litt.) states that the fauna has been largely neglected by contemporary malacologists with many species remaining undescribed and most described species being known only from shell characters. Haynes (pers. comm.) has recorded 39 species of freshwater gastropods of which 3 (8%) are endemic and one of which is an endemic monotypic genus, *Fijidoma*

## 4 TERRESTRIAL AND FRESHWATER VERTEBRATES

### 4.1 BIRDS

Birds are Fiji's most conspicuous wildlife with:

- 55 terrestrial, breeding species of which 24 are endemic (44%).
- there are 7 endemic genera *Prosopeia* (the Tongan population is introduced), *Phygis*, *Chrysoenas*, *Trichocichla*, *Lamprolia*, *Vitia*, *Xanthotis*, with radiation of three species in *Chrysoenas* and two<sup>1</sup> in *Prosopeia* with very marked subspecific variation in *Trichocichla*, *Lamprolia*, and *Vitia*.
- 1 inland migrant
- 16 coastal migrants (waders of annual or very regular occurrence)
- 15 confirmed breeding seabirds (a similar number are regularly observed in Fiji waters but there is no record of breeding).
- 11 introduced species are naturalised

### 4.2 MAMMALS

Fiji's only indigenous mammals are bats of which there are six known species, four of which are megachiropterans and two microchiropterans. One of the former, the Fiji Flying Fox *Pteralopex acrodonta* is endemic. Feral populations of domesticated species excluded, there are five other introduced species now naturalised (four rodents and the Indian mongoose *Herpestes auropunctatus*).

### 4.3 REPTILES

Fiji's wholly terrestrial reptile fauna consists of:

- 3 snakes (1 endemic genus);
- 2 iguanas (1 endemic species);
- 10 geckos (2 endemic species); and,
- 12 skinks (5 endemic species)

Of a total of 27 reptile species, nine are endemic (33%). The single endemic genus is the elapid snake *Ogmodon*. The two species of iguana *Brachylophus* spp. are of special interest. Three of the skinks have been described within the last decade an indication that the reptile fauna is as yet incompletely known.

### 4.4 AMPHIBIA

Two indigenous amphibia, both endemic frogs of the genus *Platymantis* occur in Fiji. One introduced species the giant toad *Bufo marinus* is naturalised widely.

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<sup>1</sup> Three are distinguished by Rinke (1989)

#### **4.5 FRESHWATER FISH**

Ryan (1980) provides a comprehensive list of Fijian freshwater and brackish fish containing 96 recorded species, three additional species have also been recorded from Taveuni (Ryan, 1981). Four of these (4%) are endemic, though Ryan (loc.cit.) considers that this figure is likely to be increased on more intensive work on islands other than Viti Levu. Ten introduced species are naturalised.

### **5 MARINE FAUNA AND FLORA**

Zann (1992) provides an overview of marine biodiversity in Fiji and the use and status of marine ecosystems. The following sections are derived from his analysis.

#### **5.1 PHYSICAL DESCRIPTION**

Fiji's insular shelf is relatively narrow but extensive reef formation has occurred around all islands. Fiji has one of the largest, and best developed coral reef systems in the South Pacific. All of the major reef types are represented (fringing reefs, barrier reefs, platform reefs (with and without sand cays), oceanic ribbon reefs, drowned reef shoals, atolls and near atolls). Fiji has one of the longest fringing reefs (the Coral Coast of Viti Levu), and one of the longest barrier reefs (the Mamanuca / Yasawa / Great Sea Reef complex) in the world. The coral reefs are poorly studied.

#### **5.2 CURRENT STATUS OF KNOWLEDGE OF MARINE BIODIVERSITY AND ECOSYSTEMS**

Fiji's marine flora and fauna are moderately well known because of a history of active marine research at the University of the South Pacific and the Fisheries Division. About 1,200 different species of fish, belonging to about 162 different families; about 200 different corals, and 1,100 different molluscs (snails, bivalves etc.) have been identified; and many thousands of other invertebrates (sponges, worms, crustaceans, starfish, sea urchins etc.) have been described. With the identification of new collections, the number of fish is expected to reach 1,500 (Zann *et al.* 1997).

Fiji's marine reptile fauna includes three species of sea snake which breed and two turtles which nest, the Green Turtle *Chelonia mydas* and the Hawksbill Turtle *Eretmochelys imbricata*. In addition, the Loggerhead turtle *Caretta caretta* is uncommon visitor, while Ridelys Turtle *Lepidochelys olivacea* and the Leatherback Turtle *Dermochelys coriacea* are rare to occasional visitors.

The number of species is somewhat lower in Fiji than in the west ((eg the Great Barrier Reef), reflecting Fiji's geographic isolation, and the general trend of lowered diversity eastward across the Pacific. A relatively large number of new species have been described in Fiji, many of which have yet to be found outside the Group. However this generally reflects more the poor state of knowledge of the region rather than a high degree of endemism in the Group.

### **5.3 STATUS OF MARINE ECOSYSTEMS**

#### **5.3.1 Impacts on reefs**

Cyclones regularly cause great damage to Fijian reefs. Destructive waves physically break up the more fragile, faster growing species, and heaps them into rubble banks and new landforms. Lowered salinity and sedimentation following flooding and 'coral bleaching events' regularly affect coral reefs on a large scale. Outbreaks of the coral-eating crown-of-thorns starfish (*Acanthaster planci*) have caused large scale destruction of reefs in the Indo-Pacific in recent decades. Moderate outbreak episodes have occurred in 1967-70; 1978-83; and 1986-88.

Localised severe damage has been caused to reefs and shore environments in Fiji by the construction of ports; wharves and marinas; seawalls; and reclamations. Major areas of mangrove have been reclaimed for farming (especially in Ba, Labasa areas), for tourism (Nadi Bay) and for urban development (especially in Suva area).

Dredging of silted estuaries (particularly Rewa, Ba and Navua Rivers) may create an additional siltation problem on nearby reefs. Dredging for coral sand used in the manufacture of cement is undertaken in the Suva lagoon.

#### **5.3.2 Overfishing**

Invertebrates which are widely overfished but not biologically threatened, include the trochus, mud crabs, and certain of the beche-de-mer species. Those which are seriously overfished such as to be threatened either locally or throughout the group include the turtles which are rapidly declining, giant clams (two species extinct), and coconut crabs (rare, to locally extinct on almost all islands). Many fish species (eg. of Serranidae, Lethrinidae) in the more heavily populated areas are growth overfished (ie small sizes at capture). Several species are stock overfished (eg mangrove crabs, giant clams, trochus, beche-de-mer, pearl oysters in most areas; mullet in certain areas) have been very severely depleted and require urgent management.

Destructive fishing practices are a serious problem in parts of Fiji. Dynamiting is prevalent in some areas of northern Viti Levu and northern Vanua Levu. Use of traditional fishing poisons (eg duva or derris) is common, and use of modern pesticides and bleach is occasional.

#### **5.3.3 Pollution and water quality**

Potential sources of point source pollution in Fiji include: mining, shipyards and slipways, moorings, tourist developments, sugar mills, timber mills, cement factories, municipal waste disposal sites, sewage, agricultural pesticides and herbicides, changing land use, and various industries. A review of pollution in Suva Harbour found elevated biochemical oxygen demand (BOD), elevated nutrients (nitrates and phosphates), high suspended solids, pH, and high coliform bacterial levels, in discharges from a large number of light and medium industries in the city. Levels of tributyl tin (TBT) were higher in Suva Harbour than in any port reported in the literature. Indiscriminate use of TBT in antimildew paints may also have contributed to the high levels.

Levels of heavy metals in Suva harbour are also high, and are equal to the most polluted harbours in Australia. Lagoonal sediments and shellfish from the Lami area have high levels of mercury, zinc and lead.

Litter is a conspicuous source of pollution in marine and aquatic environments in Fiji. Solid wastes such as plastic bags, metal cans, glass etc are often discarded indiscriminately on beaches, in mangroves and in the sea. All urban areas in Fiji encounter some solid waste disposal problems. All but two of Fiji's dumps for domestic and industrial wastes are situated in mangrove areas or next to rivers, effectively alienating these very important ecological areas.

Sedimentation following large scale clearing of land for agricultural purposes poses an agricultural problem in the wet tropics, and a major problem for coral reefs. Some reefs in the Suva area had already deteriorated by the 1920s because of sedimentation from the Rewa watershed. Nutrients (nitrates and phosphates) are high, to extremely high in the Suva area. The nutrient problem may not be confined to the urban areas of Fiji as the large amounts of fertiliser applied to sugarcane and rice is expected to increase nutrient levels in adjacent waters. Although no field studies have been undertaken, sedimentation and eutrophication of the leeward, inner-shelf reefs of northern Viti Levu and Vanua Levu may be serious.

#### **5.3.4 Aquatic introductions**

A very wide range of fish, shellfish and crustaceans have been introduced into Fiji. Some were introduced as ornamentals, for sports fishing or as biological controls, but most were introduced for aquaculture. At least 21 species of fish (brown trout, bass, mollies, guppies, swordtails, mosquitofish, carps, tilapia, grunters, Australian bass, herrings etc), four species of prawns (*Macrobrachium*, *Penaeus*), six species of bivalves (oysters and mussels) and one seaweed (*Eucheuma*) have been introduced into Fiji. The Tilapia *Oreochromis mossambica* has thrived in every river to which it has been introduced and is considered to have had a detrimental effect on the status of certain native species, in particular, the Ika ni Vatu *Kuhlia rupestris*.

## **6 LEGISLATION FOR CONSERVATION AND BIODIVERSITY PROTECTION**

### **6.1 CURRENT LEGISLATION**

An annotated list of the principal laws and regulations pertaining to conservation and biodiversity protection in both terrestrial and marine environments is provided in Table 2.

Much of the legislation and penalties are a relic of the colonial era and are not effective in a modern conservation management context. The Birds and Game Protection Act (1923) is an exception, being the product of foresight, in which all native species are fully protected. Unfortunately there is no legal protection whatsoever for the internationally renowned Crested Iguana and for any other reptiles or native mammals (turtles excepted, they are included in the Fisheries Act).

Fiji's marine environment is better served by laws and regulations than any other sector and some of the stiffest penalties are to be found in fisheries associated legislation.

### **6.2 Fiji's Sustainable Development Bill**

The Sustainable Development Bill is new legislation currently in the final stages of preparation and which will replace all existing environmental, resource management and conservation legislation. It is a very comprehensive piece of legislation with 293 Clauses in the final draft form. In a preamble of the Sustainable Development Bill, it states that the Act will:

- 1 Establish the legal and administrative mechanisms to achieve sustainable development in Fiji;
- 2 Reform the law relating to environmental protection and resource management;
- 3 Create new legal frameworks and effective administrative mechanisms for environmental impact assessments, pollution and waste management, integrated natural resource management; biodiversity conservation and national parks management;
- 4 Establish mechanisms for meaningful public participation in all aspects of environmental and resource planning management; and,
- 5 Provide for the implementation of Agenda 21, the Rio Declaration, the Barbados Programme of Action and a number of international treaties and agreements in the area of sustainable development, environmental protection and resource management

**Table 2 : Fiji's principal resource management, conservation and biodiversity protection legislation.**

<b>Legislation</b>	<b>Outline of Conservation Provision</b>	<b>Penalty</b>	<b>Authority Responsible</b>
<b>Land &amp; Resource Use</b>			
Forest Decree (1992)	Minister may declare Nature Reserves	\$10,000 and/or imprisonment of upto 12 months	Conservator of Forests & Ministry of Forests
Native Land Trust 1940 (Cap 134)	Can lease Native Land (which is not Native Reserve) with any restrictions regarding land use.	Civil Remedies	Native Land Trust Board
Land Conservation and Improvement Act 1953 (Cap 141)	Land Conservation Board may make 'Conservation Orders'.	Max fine \$200 and/or 6 months imprisonment	Land Conservation Board, Ministry of Agriculture, Fisheries & Forests
<b>Conservation</b>			
Birds & Game Protection Act 1923 (Cap 170)	Prohibits wounding, killing, selling, holding in captivity or exporting protected birds	Max fine \$50 or 3 months imprisonment	Ministry of Agriculture, Fisheries & Forests
National Trust for Fiji Act 1970 (Cap 265)	Power to purchase land. May enter into voluntary agreements to protect land.		Ministry for Local Government, Housing and the Environment
Plant Quarantine Act 1982; Noxious Weeds Pests and Disease of Plants Act 1964 (Cap 133)	Quarantine powers including declaration of noxious pests, removal of pests, prohibited animal/plant imports	Various	Ministry of Agriculture, Fisheries & Forests
Animal Importations Act 1970			Ministry of Agriculture, Fisheries & Forests
<b>Marine Conservation</b>			
State Lands Act 1946	Control over the littoral zone, foreshore and submerged sea floor is held by the State		Ministry of Lands & Mineral Resources
Marine Spaces Act 1977 (Cap 158 A)	Management and conservation of fisheries within Fiji's economic zone	Maximum fine \$100,000	Office of the Prime Minister
Fisheries Act 1941 (Cap 158)	Licence to fish required.  Prohibits use of dynamite	Max fine \$50 and/or 3 months imprisonment. \$200 – 6 months	Ministry of Agriculture, Fisheries & Forests
Fisheries Regulations 1965	Prohibited methods and areas eg poison, Protection of Turtles etc.	Max fine \$50 and/or 3 months imprisonment	Ministry of Agriculture, Fisheries & Forests

Source: Modified from Watling & Chape 1992

## 7 PROTECTED AREAS

There is no systematic establishment of protected areas in Fiji. Legislative and institutional responsibilities are weak and ill-defined with the Departments of Environment, Fisheries and Forestry and the National Trust for Fiji all having some legislative responsibilities for the management of the protected areas in Fiji.

Fiji's established protected areas system is weak and rudimentary and one which was not selected on ecological grounds and whose legislative backing is insufficient to ensure long term security.

The principal threat to setting up a viable protected area system is inadequate existing legislation and institutional responsibility, combined with the rapid fragmentation and degradation of the forest resource which will increasingly preclude it being conserved as viable ecological units.

### 7.1 EXISTING RESERVES AND PROTECTED AREAS

#### 7.1.1 Sigatoka Sand Dunes National Park

In early 1988, the Cabinet of the Fiji Government decreed the Sigatoka Sand Dunes as Fiji's first national Park. An area of outstanding landscape and biological interest, the Sand Dunes also contain one of the most important archaeological sites in the Pacific, a burial ground of more than 100 people dating back nearly 2000 years. Administration of the Park has been delegated to the National Trust for Fiji. An Interpretive Centre has recently been constructed at the Park and management staff engaged.

#### 7.1.2 Reserves of the Department of Forestry

Two reserve categories are institutionalised in the Forestry Decree (1992), being carried over from the Forest Act (Chapter 150). In summary, as of 1992, there were:

*Nature Reserves* - Six reserves totalling 5,719 ha. Protected forest

*Forest Reserves* - 24 reserves totalling approximately 33,200 ha.

As a consequence of the legislation and management policy of the Department of Forestry, only Nature Reserves can be considered to have biodiversity conservation significance, Forest Reserves being almost completely utilised for Mahogany Plantation.

The Department of Forestry also recognises an additional management classification of relevance but without legal foundation, **Protection Forest**. Following the original resource survey (Berry & Howard, 1973), approximately a third of the forest resource was designated as Protection Forest on environmental grounds. Although both the Department of Forestry and the Native Lands Trust Board (NLTB) support this designation, logging and clearance occurs commonly in Protection Forests.

### **7.1.3 Koroyanitu Conservation Area**

Although the Koroyanitu Conservation Area has no legal designation, it represents the most ambitious biodiversity conservation initiative yet attempted in Fiji. It consists of an area of 25,000 ha. of upland forest over 600 m. belonging to 50 landowning units residing in 13 different villages. The forest is one of the last remaining intact areas of tropical mountain forest in west Viti Levu.

### **7.1.4 Other Protected Areas**

Several other categories of protected areas exist (Table 3). Of major ecological significance are the Garrick Memorial Park (400 ha) which has been extensively logged, and the Yadua Taba Wildlife Sanctuary (70 ha), set up to protect the world famous Crested iguana. A management plan for the Garrick Park has been prepared but there is effectively no management. Yadua Taba has no management plan but a warden has been appointed and international funds have been acquired to assist in caretaker management. Both are administered by the National Trust for Fiji. Namenalala island Reserve (43 ha) with its important seabird colony and beachforest habitat is leased by the NLTB to a private operator who runs the vast majority of the island as a nature reserve.

Landowner managed protected areas have received considerable attention in the last decade but with mixed success. These include the Bouma Forest Park on Taveuni which is administered by the landowners with assistance from the Ministry of Forestry and bilateral aid finance. Additional initiatives of the same type include the Tavuni Hill Fort in the Sigatoka Valley; the Waikatakata Forest and Archaeological Park on the coral Coast and the Waisali Forest Reserve near Savusavu, Vanua Levu.

### **7.1.4 Marine Protected Areas**

There are no formally designated Marine Protected Areas, although there are several local initiatives resulting in the protection for certain sites. Included amongst these are the reefs of Naitaba Island, Namenalala and Eleuvia (Tai) Island.

The Fisheries Department is currently embarking on an initiative of promoting Community Marine Reserves which are managed by Traditional Fishing Rights Owners.

## **7.2 FINDINGS ON THE EXISTING RESERVES AND PROTECTED AREAS**

The present system is seriously inadequate for the following reasons:

- No ecological or heritage considerations were involved in the selection of all but one or two.
- Protection forests, given their present legal status and management, have no long term conservation value.
- Forest and Nature Reserves are departmental rather than national institutions. They have inadequate legislative and institutional support to counter the inevitable, political and social pressures which will increasingly involve them.
- Dereservation of Reserves has increased in recent years and requires only Ministerial approval.

- Without landowner approval and economic involvement, the present Reserves on native land have no long term security. Even those on State Land will be subject to increasing piecemeal loss and degradation.
- Marine Protected Area establishment without Fishing Rights Owners approval and economic involvement is virtually impossible.
- Planning and the limited attempts at implementation of Reserve establishment are being undertaken by at least four different institutions with inadequate objectives and coordination.

### **7.3 SETTING UP A NATIONAL PARKS AND RESERVES SYSTEM.**

The National Trust for Fiji drew up a major report in 1980 which identifies a national Park and Reserve system (WWF 1980) This is a significant contribution which identified the majority of the most important sites but there has been no implementation in the decade since its publication. Recently, a New Zealand based conservation group made further recommendations but these also appear to have no better prospect for implementation. Recently, compensation for landowners for foregone timber royalties in Reserves has been agreed to by the Fiji Government and this has enabled the MOF to look seriously at the establishment of new Reserves and this is being undertaken.

If this is not successful then any future system will more likely be selected on the grounds of what is left rather than by ecological and heritage values.

**Table 3 Fiji's Protected Areas with Biodiversity Conservation Significance**

Protected Area Status	Date of Establishment	Location	Principal Features	Tenure	Area (ha)	Administering Institution
<b>National Parks</b>						
Sigatoka Sand Dunes	1988	South West Coast, Viti Levu	Sand Dunes, Beach Forest	State, Native and Freehold	240	National Trust for Fiji
<b>Nature Reserves</b>						
Ravilevu	1959	Taveuni Island	Rain Forest	State	4020	Dept.of Forestry
Naqarabuluti	1958	Viti Levu		State		Dept.of Forestry
Nadarivatu	1956	Viti Levu	Rain Forest	State		Dept.of Forestry
Tomaniivi	1958	Viti Levu	Rain Forest	State		Dept.of Forestry
Vunimoli	1968	Vanua Levu	Rain Forest			Dept.of Forestry
J.H. Garrick Memorial Park	1986	Viti Levu	Rain Forest			
Namenalala Island	1984	South of Vanua Levu	Seabird Colony, Beach Forest.	Native	43	Lessee/ NLTB <sup>1</sup>
<b>Forest Park and Amenity Areas</b>						
Colo-I-Suva	1952	Suva, Viti Levu	Forest, Streams	Native	91	Dept.of Forestry
Draunibota and Labiko Islands	1959	Suva Harbour	Coastal Islands	State	2.16	Dept.of Forestry
Vuo Island	1960	Suva Harbour	Coastal Island	Native	1.2	Dept.of Forestry
Lololo	C 1972	Viti Levu	Riparian Forest, Stream		0.5	Fiji Pine Ltd.
Tavakubu	c. 1972	Viti Levu	Pine Forest, Stream	Native	1	Fiji Pine Ltd.
Bouma Forest Park	1991	North Taveuni	Waterfalls; Rainforest	Native	c.100 <sup>2</sup>	Landowners with NLTB
Waikatakata Forest Park	1990	South Viti Levu	Rainforest	Native	c.100	Landowners with NLTB
Waisali Dakua Reserve		Vanua Levu	Rainforest, <i>Agathis</i>	Native	c. 150	National Trust for Fiji
<b>Wildlife Sanctuary</b>						
Yadua Taba Island	1981	West coast of Vanua	Beach forest, Crested	Native	70	National Trust for Fiji

		Levu	Iguana			
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Source: Modified from Watling & Chape 1992

Notes 1/ NLTB - Native Lands Trust Board

2/ Area not defined but currently about 100 ha with plans for a much greater area

## **8 FIJIAN SPECIES WHOSE STATUS GIVES RISE FOR CONCERN.**

### **8.1 PRINCIPAL THREATS – TERRESTRIAL SPECIES**

Habitat loss (effectively forest loss) remains the most serious threat to Fiji's endemic terrestrial fauna and flora. Deforestation in Fiji is moderate but continuing. Since the mid 1960's an estimated 90-140,000 ha (11-16%) of the nations forests have been converted to non-forest land use (Watling & Chape 1992) Of major conservation significance is the increasing fragmentation of the forestry estate. The depredations of the introduced Indian mongoose have devastated the ground living reptile and bird faunas (and probably the larger invertebrates too) on the five islands to which it has been introduced (Viti Levu, Vanua Levu, Beqa, Rabe, Kioa).

### **8.2 PLANT SPECIES**

Lear & Woods (1992) first attempted to identify rare, threatened or endangered species of Fijian flora. Their very preliminary assesment relied entirely on an examination of herbarium specimens as documented in *Flora Vitiensis Nova* - Volumes 1-4 (Smith 1979, 1981, 1985, 1989. Note Volume 5 was included) and thus on the vagaries of plant collectors and accessible collecting localities.

The results of the assessment were:

- 116 species selected as potentially rare, threatened or endangered;
- 73 of these were considered threatened to some degree;
- 20 are considered endangered; and,
- 9 have not been found in recent years and are possibly extinct.

GTZ (1994) adopted a more objective analysis of all five volumes of Smith's *Flora Vitiensis Nova* and included in addition Fiji's Fern flora (Brownlie 1977). In all 153 species which are currently known from only the type specimen/location were extracted and plotted on the Forestry GIS. All these species can be considered endangered until further information is available.

The most comprehensive analysis of the conservation status of any group of plants is for palms by Fuller (1997). His analysis indicates that of the 27 endemic palms, 13 (48%) should be recognised as threatened following IUCN Red List categories. Data are still deficient for a further six (22%) species due to insufficient field and population data. The remaining 8 species can be placed in a Lower Risk category.

### **8.3 TERRESTRIAL VERTEBRATES**

Two species frequently listed for Fiji are considered to have become extinct in the last century, the Wandering Whistling Duck *Dendrocygna arcuata* and the endemic Barred-wing Rail *Nesoclopeus poecilopterus*

The Fiji Petrel *Pseudobulweria macgillivrayi* is Fiji's only indubitably endangered bird (Watling & Lewanavanua 1985), nonetheless its exact status is not known. Other species probably in the endangered category include the Long-legged Warbler *Trichocichla rufa* (both subspecies) and the Pink-billed Parrotfinch *Erythrura kleinschmidti*.

Species whose status is considered threatened or vulnerable are detailed in Table 4.

#### **8.4 INVERTEBRATES**

With the exception of the Lepidoptera, the invertebrate fauna is too poorly known and documented to comment on the status of species. Robinson (1975) discussed the Lepidoptera. He concluded that the moths *Heteropan dolens* and *Levuana iridescens* are definitely extinct (as a result of introduced biological control agents). Lepidoptera species now possibly extinct in Fiji are *Xanthodes congenita* and *Hypena commixtura*. *Utetheisa clareae* is considered threatened, as are all species confined to primary forest.

Ryan, Beaver & Bornemissza (1990) discuss the threatened status of the very rare longicorn beetle *Xixithurus heros* which is possibly the largest beetle in the world.

#### **8.5 RARE, ENDANGERED AND THREATENED MARINE SPECIES**

Two species of giant clam (*Tridacna gigas* and *Hippopus hippopus*) have become extinct in Fiji in recent times. A newly discovered species (*Tridacna tevola*) which is endemic to Lau and northern Tonga, has a very limited geographic distribution and has been depleted by industrial fishing since 1985. The two turtle species nesting in Fiji (*Chelonia mydas* and *Eretmochelyes imbricata*) have been very seriously over hunted and suffer continuous disturbance of rookeries. Numbers are estimated to be 'in the hundreds' for the former, and 'several hundreds' for the latter. Probably most of the several hundred turtles commercially sold in Fiji each year are migrants from French Polynesia and the Great Barrier Reef. The giant coconut crab (*Birgus latro*) has been seriously over-harvested and is locally extinct on many islands of Fiji. Sea birds have also been seriously depleted through eggging at rookeries, introduction of predators, and disturbances of nesting sites through clearing for gardens, tourist resorts etc.

**Table 4 'Threatened or Vulnerable' endemic Fijian vertebrate species**

Species	Distribution	Comments
<b>Mammals</b>		
Fiji Flying Fox <i>Pteralopax acrodonta</i>	Taveuni	Single-island endemic; forest only; population estimate of 600 (Ingelby 1991) is speculative.
<b>Birds</b>		
Fiji Petrel <i>Pseudobulweria macgillivrayi</i>	Gau	Single-island endemic; indubitably critically endangered.
Whistling Dove <i>Ptilinopus layardi</i>	Kadavu	Single-island endemic; probably secure
Yellow-breasted Musk Parrot <i>Prosopiea personata</i>	Viti Levu	Single-island endemic; probably secure but massive recent logging may have an effect which is not immediately apparent
Kadavu Musk Parrot <i>Prosopiea splendens</i>	Kadavu	Single-island endemic; probably secure but nestlings need protection from trade
Kadavu Honeyeater <i>Xanthotis provocator</i>	Kadavu	Single-island endemic; probably secure
Pink-billed Parrotfinch <i>Erythrura kleinschmidti</i>	Viti Levu	Single-island endemic; very rare for unknown reasons
Long-legged Warbler <i>Trichocichla rufa</i>	Viti Levu and Vanua Levu	No confirmed record of the Viti Levu race this century; Vanua Levu race discovered in early 1970's. Very rare for unknown reasons
Red-throated Lorikeet <i>Charmosyna amabilis</i>	Viti L, Vanua L, Ovalau, Taveuni	Very rare for unknown reasons
Vanua Levu Silktail <i>Lamprolia victoriae kleinschmidti</i>	Vanua Levu (Natewa Peninsula)	Restricted range but not unduly rare or threatened as popularly described.
<b>Reptiles</b>		
Crested Iguana <i>Brachylophus vitiensis</i>	Yadua Taba	Distinctive form restricted to 70 ha island sanctuary. Population of about 5,000. Other forms occur on islands of Yasawas, Mamanucas and outliers.
Fiji Burrowing Snake <i>Ogmodon vitiensis</i>	Viti Levu	Single-island endemic. Restricted to wet zone. Rare, probably because of introduced predators.
Rotuman Gecko <i>Lepidodactylus gardineri</i>	Rotuma	Single-island endemic; probably secure
Campbell's Skink <i>Emoia campbelli</i>	Viti Levu	Known only from one highland area but possibly more widespread
Onoilau Skink <i>Leilopisma alazon</i>	Yanuya I., Ono-i-lau.	Single-island endemic; Only known from a single collection on this small, 2 ha. islet.
<b>Amphibia</b>		
Fiji Ground Frog <i>Platymantis vitianus</i>	Viwa, Ovalau, Taveuni, Gau, Koro?	Threatened by introduced predators.

**Source: Dick Watling**

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**APPENDIX 1**

**A PRELIMINARY REGISTER OF SITES OF NATIONAL SIGNIFICANCE  
(from `Environment:Fiji. The National State of the Environment Report')**