

**Institute of Applied Sciences**  
**THE UNIVERSITY OF THE SOUTH PACIFIC**

**Baseline Flora and Fauna of the**

**Sovi Basin, Naitasiri**

**5-17 May 2003**

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**Compiled by**

**Dr Clare F. Morrison**

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**Baseline Flora and Fauna Survey of the Sovi Basin, Naitasiri**

**5-17<sup>th</sup> May, 2003.**



**South Pacific Regional Herbarium, Wildlife Conservation  
Society, Birdlife International and Wetlands International**



**BirdLife**  
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## SUMMARY

A twenty four member team conducted a baseline flora and fauna survey of the Sovi Basin between 5-17 May, 2003. The group members were from a number of organizations including the South Pacific Regional Herbarium (SPRH), Birdlife International, Wildlife Conservation Society (WCS), Biology Department at the University of the South Pacific and the Fiji Department of Forestry. They were joined by several guides and porters from Nadakuni Village.

Despite the Sovi Basin's perceived outstanding biological, geological and scenic attributes there have been very few biodiversity surveys conducted in the area. In addition to conducting this baseline survey to collect data for the PABITRA Project and various other projects [e.g. Birdlife International's Important Bird Area Programme (IBA) and WCS's Forestry Conservation Project], the survey would permit a more informed evaluation of the potential of the Sovi Basin to be Fiji's first World Heritage Site.

Several endangered and many endemic species were among the findings of the trip. The most significant fauna discovery was that of the pink-billed parrot finch (*Erythrura kleinschmidti*) a rare species that is endemic to Viti Levu and is listed as Endangered under international (IUCN) criteria. Over 37 different bird species were recorded in total and included almost all of the 20 specialist species that are only found in Fiji's rainforests.

A large number of freshwater fish were observed including several endemic goby species. The presence of a moray eel adapted to living in freshwater ecosystems was also an interesting find. The sizes of individual fish and their abundance were found to be larger than expected and this was attributed to the isolation of the Sovi Basin and low levels of fishing compared to less accessible areas of Fiji. Due to problems with the electronic fishing gear, a large number of species (especially smaller species) were likely to have gone undetected during the visual surveys. Future surveys with the electronic gear are highly likely to reveal many more species.

Several populations of the endemic Fiji Tree Frog (*Platymantis vitiensis*) were discovered along some of the smaller tributaries in the basin. Several species of lizards were also found including the endemic Fiji Tree Skink, the Pacific Slender-toed Gecko and the Brown-tailed Copper-Striped Skink. The abundance of these animals was very low and was attributed to the presence of rat and

mongoose predators in the areas surveyed. No populations of the endangered Fiji Ground Frog were found, a result also attributed to the presence of predators.

Leaf litter samples were collected to examine the abundance and diversity of three leaf litter invertebrate taxa: rove beetles, weevils, and harvestman. Opportunistic surveys were also conducted for spiders. Several interesting specimens were collected however, due to the time consuming nature of sorting and identifying the specimens the full results of these surveys will not be available until later this year.

Although the plant specimens collected have not all been identified, the total number of species found in the study area is estimated to be around 400. Of these about 80% are expected to be native and about 30-40% are likely to be endemic to Fiji. Five basic vegetation types were identified during the surveys. Four of them (slope, ridge, flat and river vegetation) are mostly pristine, while the other type, forest on former village and garden sites, is probably the results of former disturbances.

All survey groups are unanimous in saying the survey was a success and provided valuable baseline information for a region that had not been previously surveyed. As the survey was limited in terms of the area that could be covered, they are also in agreement that further surveys need to be carried out in the Sovi Basin in order to attain a better understanding of the region and the species found within it. In the meantime, the discovery of several rare species of birds, frogs and plants and the high numbers of endemic species found in the Sovi Basin in conjunction with its current relative inaccessibility, provides good support for the nomination of the Sovi Basin as a World Heritage Site.

The training of local villagers as field guides and/or parataxonomists will also be an important component of future surveys. Many of the villagers in Nadakuni have not been into the Sovi Basin and of those that have, few venture very far. These surveys provide an opportunity for the landowners not only to learn about their land and the species that are found on it but also to learn about ways to survey various taxonomic groups thus ensuring they will be a valuable asset to any future surveys.

## **ACKNOWLEDGEMENTS**

We would like to thank the following organizations for providing the personnel for this trip: The South Pacific Regional Herbarium, Birdlife International, Wildlife Conservation Society, Wetlands International, the Institute of Applied Sciences and the Biology Department of the University of the South Pacific and the Fiji Forestry Department. We are also grateful to the villagers of Nadakuni for their permission to survey the Sovi Basin, for providing us with guides and porters to help us with our work, and their generous hospitality.

This work was funded by a number of organizations including: The McArthur Foundation, The Darwin Initiative, Wildlife Conservation Society, and The Pacific Biological Foundation.

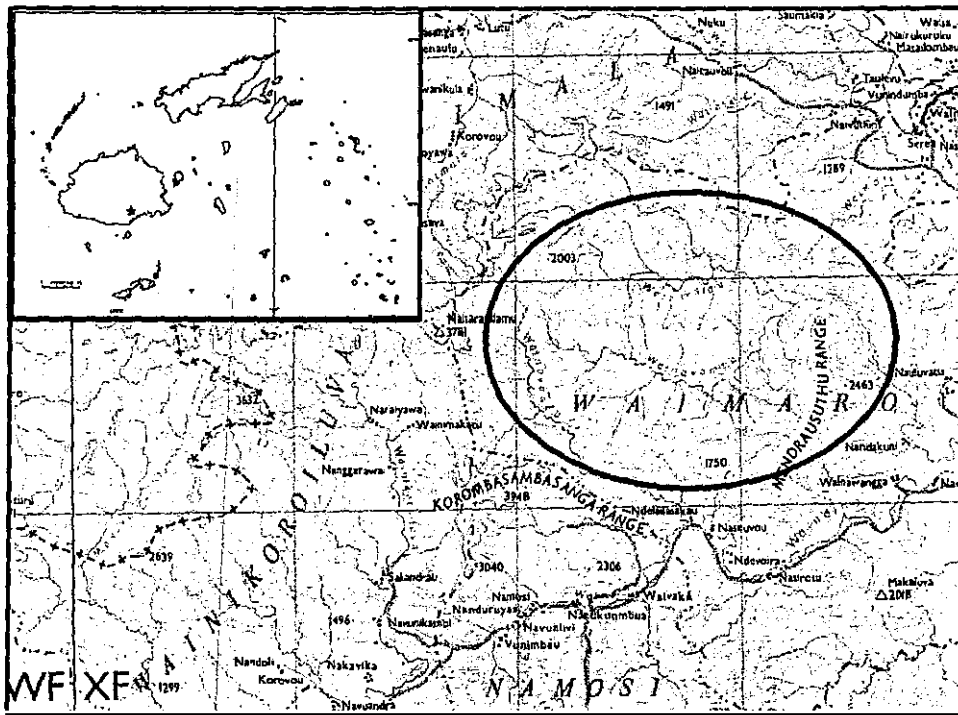
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## INTRODUCTION TO THE SOVI BASIN

### Location and general description

The Sovi Basin is a 19,600ha bowl-shaped landform situated in the interior of Viti Levu (Map 1). The vast majority of the Sovi Basin is located in the Naitasiri Province with about two percent situated in the Namosi Province. The central basin is ringed by volcanic ranges including the Medrausucu Range to the east and the Korobasaga Range to the south comprising some of the highest mountains and ridges in Fiji. Two major rivers, the Wainavobo and the Wainivalau flow through the basin and join to form the Sovi River which flows out of the southeast edge of the basin. There are numerous other smaller waterways and tributaries throughout the basin. The entire basin floor is dominated by mainly undisturbed lowland tropical rainforest.



Map 1. Location of the Sovi Basin on Viti Levu

### Landowners

Nearly all of the Sovi Basin is owned by mataqali within the Tikina Waimaro. The other two tikina that own land are the Wainimala and the Namosi however, these two tikina only own 541ha of the 19,600ha between them. There are 11 mataqali in total that own the land in the Sovi Basin.

Today the landowners live in villages around the periphery of the basin. No one currently lives in the basin however its forests are still utilized by local hunters.

**Climate**

The climate data for the Sovi Basin is collected from the Navua weather station. This station is the closest weather station to the Sovi Basin. The mean annual precipitation for the region is around 3648mm with an average monthly rainfall of 289mm. Monthly rainfall ranges from 173mm in July to 441mm in April (Fig. 1). Mean monthly maximum temperature ranges from 22.4°C in August to 26.6°C in March (Fig. 2).

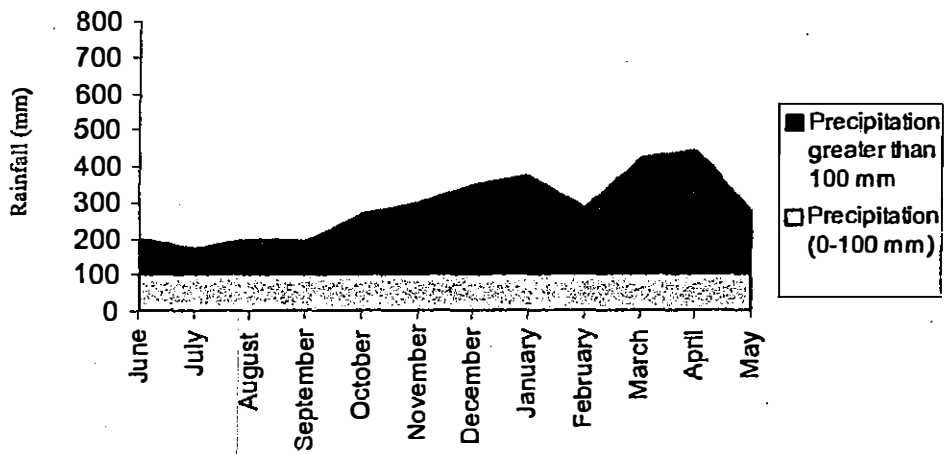


Fig. 1 Average monthly rainfall levels for the Sovi Basin area (from the Navua weather station)

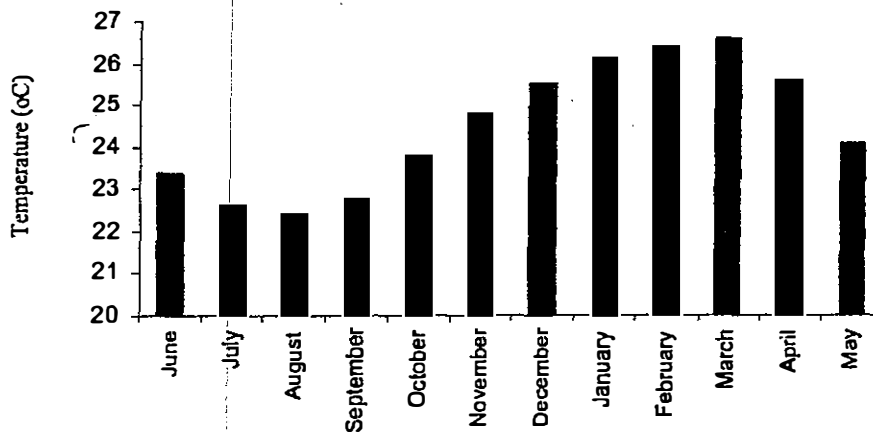


Fig. 2 Average maximum monthly temperatures for the Sovi Basin (from the Navua Weather Station)



**Geology**

This site is composed of the Namosi Andesite and the Nubuonaboto Volcanic Conglomerate. With the inclusion in this site of a number of intrusions belonging to the Colo Plutonics, the area is of great geological interest.

The Namosi Andesite belongs to the Medrausucu Group and the Nubuonaboto Volcanic Conglomerate to the Wainimala Group. The Colo Plutonics were emplaced between the two and are of tonalite-diorite composition.

The Namosi Andesite consists mostly of coarse epiclastic strata ranging from sedimentary rocks to andesitic tuff. The andesitic tuffs, andesites rich in pyroxene, and dacite have all been derived from andesitic volcanic activity. Basal non-andesitic conglomerate and sandstone occur in only a very few places such as Wairokodra and the Naxuniuqa Creek. Along the Sovi gorge, basal andesites are poorly exposed, particularly where blocks of volcanic conglomerate have fallen down the sides. These volcanic conglomerates overlie an inlier of Wainimala Group lavas.

The Sovi study site is marked profoundly by the Colo Plutonic intrusions. Both elongate and oval intrusions are found pushed through Wainimala Group rocks. The rock type of the stocks in this area are tonalite and diorite. The former is most common. The tonalite-diorite suite is believed to have arisen by differentiation from an intermediate magma. There is a gradation from quartz diorite in the earliest intrusions (or parts of intrusions) through tonalite to trondhjemite. However diorite is rare but quartz gabbro is common.

The Nubuonaboto Volcanic Conglomerate is older than the two discussed above, belonging to the Wainimala Group. The Nubuonaboto Volcanic Conglomerate is composed completely of coarse volcanoclastic rocks, mostly conglomerate and breccia, basalt to dacite in composition. East of the Sovi Fault most of the rocks within this study site belong to the Nubuonaboto Volcanic Conglomerate.

## **BIRD SURVEYS**

**Team:** Vilikesa Masibalavu, Digger Jackson and Betani Salusalu (BirdLife-Fiji), Sanivalati Vido (Department of Forestry), Apenisa Tokairavua and Kolinio Namalo (local guides).

### **SUMMARY**

Timed bird surveys were made in forest habitats in several parts of the Sovi Basin over two weeks as part of BirdLife-Fiji's programme of identifying Important Bird Areas (IBAs). The work formed part of a wider programme of biological surveys organised by the University of the South Pacific under its PABITRA project. Although absolute bird abundance was relatively low compared to other sites, avian biodiversity was high; 19 out of 21 of the endemic forest birds found on Viti Levu were recorded. The sighting on several occasions of the rare Pink-billed Parrotfinch, an endemic species listed as 'Globally Endangered', was the most important finding. Given the large extent (196 km<sup>2</sup>) and good condition of the forest in the Sovi Basin, it is likely that the Sovi Basin is a major stronghold for this species. Four endemic species listed as 'Globally Vulnerable' were also recorded, namely Friendly Ground Dove, Masked Shining Parrot, Black-faced Shrikebill and Giant Forest Honeyeater. The Sovi Basin appears to meet all the necessary qualifying criteria for an IBA of global importance, and is likely to be officially listed as such in the future. Given this high conservation importance every effort should be made to ensure the effective protection of the area.

### **AIMS**

The primary aim was to use methods to survey forest birds at several locations in the basin to provide data for IBA assessment. Secondary aims were to assess the general condition of the forest and contribute towards training and community awareness in bird conservation issues.

### **METHODS**

The team was present in Sovi Basin from 5-17 May, 2003 and worked as part of a wider team of biologists carrying out various surveys organised by the University of the South Pacific. A base camp was established at Waibasaga (S 17° 55' 29.9", E 178° 15' 17.5") on 6 May.

Birds were surveyed on most days from first light (about 6 am) until about 10 am, the period of peak activity and maximum detectability. Most of this time was spent in the forest quietly walking along and stopping regularly for periods of several minutes to listen and watch. All birds seen or heard were noted, together with beginning and end times of observation sessions. The timed bird recording sessions were limited to fine weather.

Birds were surveyed on several dates within 1 km of the base camp. These survey sessions were made along the ridge toward the steep cliff of the old village site south of the base-camp (S 17° 55' 37.7", E 178° 15' 22.9"), along the edges of the Wainavobo River and also along the main footpath leading back east out of the basin.

From 8-10 May part of the team went about 6 km upstream to conduct bird surveys in the upper Wainavobo River area, the others remained at the base camp. The whole team went up the upper Wainivalau River between 12-14 May and camped by the river at Waibasaga (S 17° 54' 46.11", E 178° 13' 4.7"). The team combined for bird surveys in the morning session only while the midday and afternoon the group split up so that a large area could be covered.

Standard rat trapping was conducted in the forest close to Base Camp for four nights (two nights on each side of the river) and in the forest near the camp at Waibasaga for two nights. Snap traps baited with coconut were put out in pairs at the base of trees approximately 50 m apart along a 1.2 km transect (50 traps in total). The traps were left out overnight and inspected the next day.

## **RESULTS**

The species of birds and mammals and their relative abundance are listed in the Appendix. The abundance of forest birds is summarised graphically in Figure 2.

A total of 29 'observer-hours' of bird recording was achieved, together with many additional hours when incidental records were obtained. This resulted in a total of 32 forest bird species recorded. This includes 19 of 21 forest species that are classified as endemic or regionally endemic in Fiji. Despite the high avian biodiversity, overall abundance of birds was low. The most common endemic species recorded were the Blue-crested Broadbill and Slaty Monarch. The reason for the low abundance of birds in Sovi is not known but is likely to be partly linked to

the relative paucity of fruiting and flowering trees. The very wet and rainy conditions that the Sovi Basin experiences may also contribute to low abundance.

The most notable bird records were the three sightings of the globally endangered Pink-billed Parrotfinch, all within 1 km of the base camp. Four species listed as vulnerable were also recorded, namely Friendly Ground Dove (1 record), Masked Shining Parrot (30 records), Black-faced Shrikebill (2 records) and Giant Forest Honeyeater. (38 records). Disappointingly, two of Viti Levu's rarest forest birds, the Long-legged Warbler and Red-throated Lorikeet, were not recorded, though given the extent of the forest, the presence of these species in the basin cannot be ruled out.

There was a notable lack of introduced bird species in the basin. This reflects the undisturbed nature of the forest. The only species recorded was a single Red-vented Bulbul seen once only at Base Camp. Two waterbird species, Pacific Black Duck and Pacific Reef Egret, were recorded several times along the rivers.

A total of 288 'corrected rat-trap nights' was achieved. This resulted in the capture of four introduced Ship Rats. Rats were caught at both areas trapped. Two rats were also seen around the campsites. These results indicate that, close to the main rivers at least, rats are common in the forest. A domestic cat was seen by one of the guides at night close to the camp at Waibasaga. The introduced Indian Mongoose was not recorded during the visit but the local villagers said they are occasionally seen in the basin. Numerous signs of introduced pigs were seen throughout the forest.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Community Engagement**

The USP and BirdLife teams met with the local Nandakuni Village community a week before field survey and discussed the purpose of the survey and the importance of conservation. The community was very receptive and asked that their guides be trained during the survey. At the end of the visit the local guides made a presentation to the Nandakuni community to report the main findings and their implications.

**Conservation Importance** The Sovi Basin appears to meet all the necessary qualifying criteria for an IBA of global importance, and is likely to be officially listed as such in the future. The several records of Pink-billed Parrotfinch obtained during the survey suggest this species is fairly common in the Sovi area. Given its large size (196 km<sup>2</sup>), the Sovi forest must support significant numbers of this very rare bird and is likely to be one of very few remaining strongholds for the species. The presence of all four of the Viti Levu forest species listed as vulnerable, and the almost total absence of introduced bird species, further adds to the areas overall ornithological importance.

Most local landowners currently favour a future for the Sovi Basin based on conservation rather than logging. Nevertheless, the area remains under threat because the logging concession granted to Merit Company has not expired. It is to be hoped that strong efforts are made towards revoking this concession and achieving effective long-term conservation.

For further information please contact:

Vilikesa Masibalavu (National Project Co-ordinator),

BirdLife International-Fiji

11 Ma'afu St,

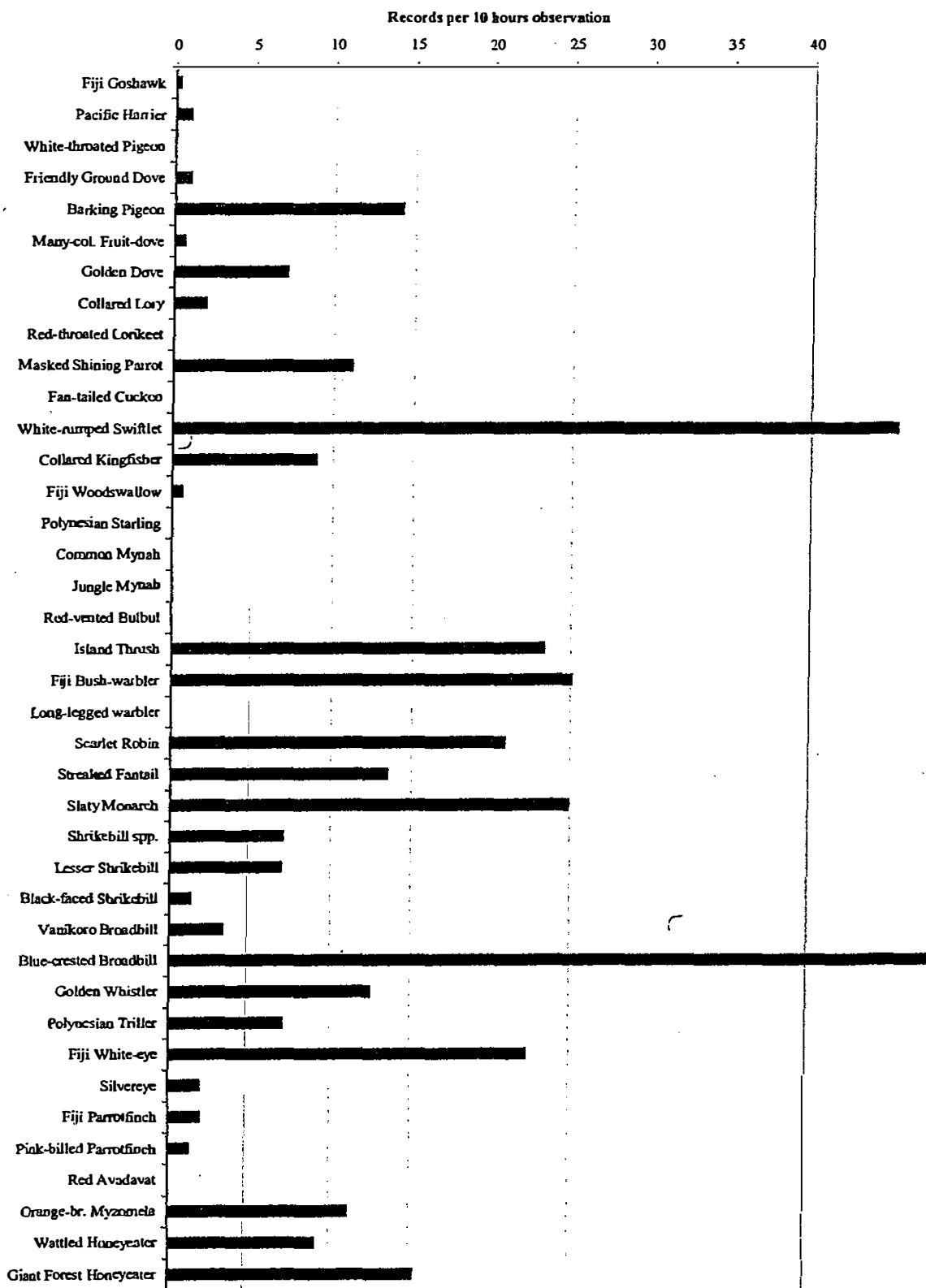
GPO Box 18332,

Suva, Fiji

Tel: +679-3317193, Fax: +679-331719

Email: [birdlifefiji@connect.com.fj](mailto:birdlifefiji@connect.com.fj)

Figure 2. The recording frequency of forest birds at Sovi Basin, May 2003



## HERPETOFAUNA SURVEYS

**Team leader:** Clare Morrison

**Team members:** Alifereti Naikatini, Isaac Rounds, Digger Jackson, Malakai Vonivate, Sairusi Raivoka, Opeti Mataravuravu Jr

### METHODS

A total of seven streams were surveyed between 7-15<sup>th</sup> May, 2003. All streams were surveyed between 2000-2200 by a minimum of 4 searchers on each night. Various habitat details were recorded including: vegetation type and dominant plant species, stream characteristics, and weather conditions. Diurnal surveys were also conducted along stream edges (for frogs) and in other forest habitats (for lizards). These were usually conducted for 2-4 hours on each survey day by 2-3 searchers.

### RESULTS

The weather was often not conducive for the diurnal surveys (usually raining). No species were found sheltering under bark, logs or leaf litter in the forest habitats; the only skinks found were active on the few days of bright sunshine, whilst the only geckoes found were located at night. Mongoose and rats (and one cat) were recorded from the area which would have an effect on the species abundance and diversity.

The Fiji Tree frog, *Platymantis vitiensis*, was recorded on four of the seven streams surveyed. Individuals found included adult males and females (though none were gravid) and numerous juveniles (ranging in size from 11mm to 21mm Snout-Vent Length). The number of individuals found was usually low (between 2-8) on each of the streams. No clutches of eggs were found however as the surveys were conducted in May, this was not surprising. No Fiji ground frogs, *Platymantis vitanus*, were recorded during any of the surveys.

Three species of lizards were found during the surveys; the Pacific Slender toed Gecko (*Nactus pelagicus*), the endemic Fiji Green Tree Skink (*Emoia concolor*) and the Copper-striped Brown-tailed Skink (*Emoia cyanura*). The *N. pelagicus* individuals were observed at night and were usually active on soil banks near the water. Only eight individuals were seen in total. The *E.*

*cyanura* and the *E. concolor* were both observed on trees during hours of bright sunshine. Numbers of these species were very low (only one *E. cyanura* and two *E. concolor* were observed).

### **RECOMMENDATIONS**

Further surveys in more suitable weather (i.e. in the wet season between December-March) and less disturbed habitat (away from the base camp area at the junction of the Wainavobo and Wainavalau Rivers) may result in the observation of additional species, however, due to the presence of the predators (mongoose and rats), the abundance of these species is likely to remain low.



## **FISH SURVEYS**

**Group leader:** David Boseto

**Group members:** Kini Koto Snr, Kini Koto Jnr, Sanivalati Vido, Sairusi Raivoka, Timoci Raivuku, Kolinio Namalo

## **METHODS**

Visual survey and spear guns were used in the three main rivers and the three tributaries that join into the main rivers. The main rivers are the main Sovi River, the Wainavobo River and the Wainivalau River. The three tributaries that flow into these three main rivers are as follows; the Wainadi and Wainisa Creeks flow into Wainavobo and the Waibasaga Creek flows into the Wainivalau River.

## **RESULTS**

A checklist of the freshwater species found is presented in Table 1. In this visual survey an endemic goby (*Schismatogobies chrysonata*) was observed. Most of the other gobies are native species. The other native families include the Eleotrid, Kuhlia, Anguilla, and the Moray eel (*Gymnothorax polyuranodon*).

Several of the gobies and an Anguilla in Table 1 are only identified to genus level. Four of these genera (*Awaous*, *Lentipes*, *Sicyopterus* and *Stiphodon*) are actually represented by more than one species, but could not be positively identified to species level. All of these fish need to be collected in order to determine their species name.

Details of the locality and collection data are presented in Appendix 3. Distribution of the fish species is found in Appendix 4.

**Table 1.** Checklist of Freshwater Fishes seen in Sovin Basin during 5 May – 16 May 2003. (Endemic species record for Sovin Basin indicated by asterisk)

Common Name	Family Name	Genus Name	Species Name	Fijian Name	Status
Eel fish	Anguillidae	<i>Anguilla</i>	<i>marmorata</i>	Diria	Native
		<i>Anguilla</i>	<i>sp</i>	Kalau Sasalosi Tautaudale	Native
Moray Eel	Muraenidae	<i>Gymnothorax</i>	<i>polyuranodon</i>	Dadarikai	Native
Gudgeon	Eleotridae	<i>Beloranchus</i>	<i>belobranchus</i>	Vou loa	Native
Gobies	Gobiidae	<i>Awaous</i>	<i>sp</i>	Voudina	Native
		<i>Sicyopus</i>	<i>zosterophorum</i>	Beli	Native
		<i>Schismatogobies</i>	<i>chrysonota</i>	Beli	Endemic
		<i>Sicyopterus</i>	<i>sp</i>	Siri beli	Native
			<i>sp (male)</i>	Beli	Native
		<i>sp (female)</i>	Beli	Native	
Jungle Perch	Kuhliidae	<i>Kuhlia</i>	<i>Marginata</i>	Ikadroka	Native
		<i>Kuhlia</i>	<i>rupestris</i>	Sakelo	Native
Prawns	Natansia (Peineidai)	<i>Macrobrachium</i>	<i>rosenbergii</i>	Uradina	Native

## DISCUSSION

The endemic goby species was found in the Sovi River just in front of the base camp at the junction of the Wainivalau and the Wainavobo Rivers. The *Anguilla sp.* was seen in the lower part of the Wainadi River near the junction to the Wainavobo River and the *Lentipes sp.* was seen at the head waters of Wainadi at an altitude of 256m.a.s.l. An individual Moray eel (*Gymnothorax polyuranodon*) was found in the Wainavobo River at the location, S 17°55.635' and E 178°14.121', at an altitude of 75m while two others were seen at the mouth of the Wainisa Creek. The other fish species and prawns were evenly distributed in all the major rivers and the side creeks. The biggest *Anguilla marmorata* was captured in the Wainivalau River.

Another interesting observation was the sizes of the *Awaous*, *Sicyopterus* and *Stiphodon*. Individuals were generally larger in all the creeks and rivers of the Sovi basin compared to other streams like the Savura Creek and the Tavoro Creek nearer to villages. The *Kuhlia rupestris* measured 327 mm in standard length for the biggest fish and the *Kuhlia marginatas* measured 281 mm in standard length for the biggest fish size. The biggest *Anguilla marmorata* was measured 1100 mm in total length and weighed about 5 kilograms. The *Anguilla marmorata* and the *Kuhlia marginatas* and the *Kuhlia rupestris* were caught using a spear gun.

The larger size and abundance of freshwater fishes in the Sovi basin is largely attributed to the fact that the Sovi basin is isolated from daily human visits and waterways are therefore not fished frequently.

### RECOMMENDATIONS

There remains much work to adequately document the freshwater fish fauna of the Sovi basin. I strongly feel that the visual survey conducted on this trip is inadequate and does not provide a true representation of the freshwater fish fauna of Sovi Basin. The visual survey was carried out in the three main river and three side creeks while several tributaries remain unsampled. These unsurveyed tributaries have unique ecology compared to the ones that have been surveyed in this trip. The drainage areas of many of the other streams are in the thick lowland rain forest and might potentially have a quite different fauna.

The recommendation is that any further freshwater survey work be carried out using electroshocking rather than visual and spear guns. By using a portable electroshocker, the freshwater fish community could be adequately studied (one was taken on the trip but was damaged in transit to the base camp).

### INVERTEBRATE SURVEYS

**Team members:** Akanisi Cagitoba & Ana Tabutabu (*Wildlife Conservation Society*)

Insects and other invertebrates comprise the vast majority of species in Fiji's forests. Many of these species occur only in Fiji, and some are restricted to certain areas within Fiji. We know some birds and plants live on single islands in Fiji, but little is known about how restricted invertebrates are to single islands or smaller areas within islands. For example, some insects in other tropical forests are known only from single mountaintops or mountain ranges. Our research is aimed at estimating the degree of local endemism (e.g., found only in a certain place) in Fiji's invertebrate communities. In order to conserve the full range of Fiji's species, community conservation areas and forestry reserves would need to be distributed to cover all the distinct invertebrate assemblages in Fiji. We are confident that conservation areas in Taveuni, Viti Levu, Vanua Levu, and Kadavu are important, but we do not yet have a sense of the distribution of unique species within the larger islands.

We are studying a subset of the invertebrate fauna to assess the degree of local endemism. Leaf litter invertebrates are abundant, easy to sample, and have a propensity for restricted ranges. Rove beetles, weevils, and harvestman are three leaf litter taxa that are species rich, relatively easy to differentiate morphospecies, and can be efficiently sampled. These invertebrates are sampled through sifting leaf litter through a screen and then placing the material in a sack to hang for two days. As the litter dries, most of the invertebrates fall out into a bottle below. We are comparing the species found in the Sovi samples with those collected in other areas around Viti Levu, such as Namosi, Qvalau, Tomaniivi, and Korobaba.

The lowland forests of Sovi enjoy abundant rainfall and the leaf litter is relatively thin due to rapid decomposition. Leaf litter invertebrates were abundant in the leaf litter, but not at the levels typically seen in mid-elevation forests elsewhere in Fiji. This is a common pattern in the tropics where leaf litter invertebrates peak in diversity and sometimes biomass at mid-elevations.

The samples collected during the Sovi survey are currently being processed and compared to other samples from Viti Levu. We anticipate preliminary results will be available in the Fall of

2003. Working together with regional biodiversity specialists and students, we will develop a consensus map of biological provinces for Fiji that will provide a guide for minimum representation for forest conservation areas. This activity will involve a synthesis of existing data and targeted field research for forest types and several key taxa including plants, invertebrates, reptiles and amphibians, birds, and freshwater fish.

## **FLORA SURVEYS**

*Compiled By G. Keppel*

**Team leader:** Marika Tuiwawa, Curator, SPRH

**Team Members:** Alivereti Naikatini, Senior Technician, SPRH; Isaac Rounds SPRH; Greg Plunkett, Virginia Commonwealth University; Mosese Moceyawa, Parataxonomist, Nakavu Village; Mataiasi Ucutabua, Nadakuni Village; Sairusi Raivoka, Nadakuni Village; Timoci Rairuku, Nadakuni Village; Gunnar Keppel, Biology Department, USP

## **INTRODUCTION**

Our team spent 12 days in the south-eastern Sovi Basin (see Figure 4). Our research was composed of two major parts:

- 1) Qualitative Taxonomic Survey to determine species present in the study area.
- 2) Quantitative Vegetation Survey to determine the various vegetation types present in the study area and their species composition.

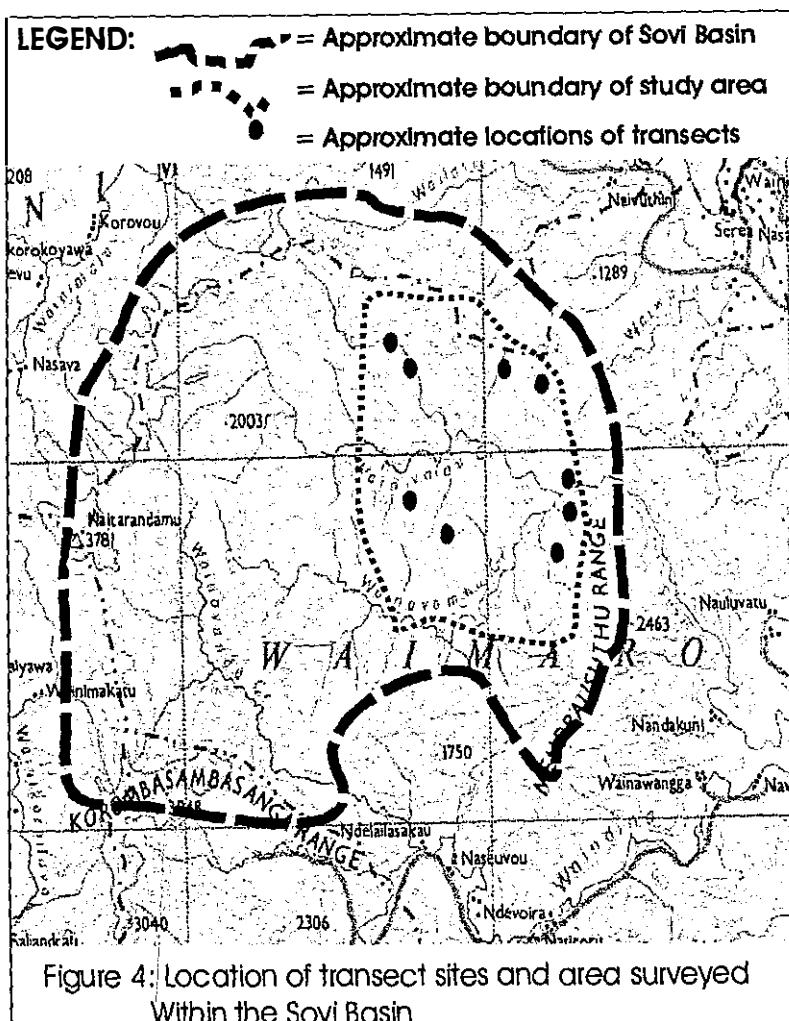
## **METHODS**

### *Qualitative Taxonomic Survey*

All vascular plant species observed in the study area were recorded. Those that could not be identified in the field and those that were either flowering or fruiting were collected for identification and preparation of voucher specimens. Plant identification is currently in progress. All voucher specimens will be deposited at the South Pacific Regional Herbarium.

### *Quantitative Vegetation Survey*

Nine 60 × 6m transects (some were only 40 × 6m), spread throughout the study area (Figure 4), were placed into homogenous vegetation types. Three were placed on ridges, three on slopes, two on previously disturbed vegetation (sites of villages and gardens about 100 to 200 years ago), and one on a flat. Within each of these transects every tree of 10cm or more in diameter (diameter at breast height, dbh) was identified and approximately mapped. For each selected tree, the dbh was measured and the bole height, crown height and crown width estimated. Analysis of this data will commence after the identification of the species is completed.



## RESULTS

### Preliminary Results of Taxonomic Survey

Although, all specimens have not yet been identified, it is possible to estimate the number of species found in the study area from our records. We recorded more than 200 species and collected almost 200 voucher specimens and, therefore, estimate the total number of species to be around 400. Of these about 80% are expected to be native and about 30-40% are likely to be endemic to Fiji. There was a high abundance of taxa that are usually associated with wet locations, such as bryophytes (not investigated in this study), ferns, gymnosperms, and a vast array of angiosperms. In addition some of the tree species grew relatively large (see Table 2).

Table 1: Maximum trunk diameters (dbh) of species in the southeastern Sovi Basin.

Species	Fijian Name	Family	Maximum dbh
<i>Agathis macrophylla</i>	dakua makadre	Araucariaceae	113.0
<i>Retrophyllum vitiensis</i>	dakua salusalu	Podocarpaceae	101.0
<i>Endospermum macrophyllum</i>	kauvula	Euphorbiaceae	96.8
<i>Dacrycarpus imbricatus</i>	aumunu	Podocarpaceae	93.0
<i>Bischofia javanica</i>	koka	Euphorbiaceae	92.0
<i>Palaquium hornei</i>	sacau	Sapotaceae	77.6
<i>Dacrydium nidulum</i>	yaka	Podocarpaceae	68.6
<i>Calophyllum cerasiferum</i>	damanu drau lailai	Clusiaceae	66.3
<i>Degeneria vitiensis</i>	masiratu	Degeneriaceae	62.3
<i>Gonystylus punctatus</i>	mavota	Gonystylaceae	58.4
<i>Parinari insularum</i>	sa	Chrysobalanaceae	57.7
<i>Calophyllum vitiense</i>	damanu	Clusiaceae	54.7
<i>Trichospermum richii</i>	mako	Tiliaceae	49.3
<i>Kingiodendron platycarpum</i>	moivi levu	Caesalpinaceae	45.2
<i>Haplolobus floribundus</i>	kaunigai	Burseraceae	44.6
<i>Xylopia pacifica</i>	dulewa	Annonaceae	43.3
<i>Gnetum gnemon</i>	sukau	Gnetaceae	38.0

### Preliminary Description of Vegetation Types

We noted five basic vegetation types, four (slope, ridge, flat and riparian vegetation) are mostly pristine, and forest on former village and garden sites (are probably the results of former disturbances). Each vegetation type is being described below.

#### *Slope Forest*

Most of the study area is covered by slopes and narrow valleys that are covered by mixed lowland rainforest, dominated by angiosperms. This is a very diverse forest type, with different species assuming dominance. However, some of the more common species found in this vegetation type include *Heritiera ornithocephala*, *Myristica gillespieana*, *Syzygium fijiense*, *Palaquium hornei*, *Haplolobus floribundus*, *Trichospermum richii* and *Garcinia myrtifolia*. On some slopes the vegetation is dominated by the native bamboo *Schizostachyum glaucifolium*. There is ongoing



debate as to the cause of this monodominant forest although the more popular theory of shallow topsoil favouring this bamboo is widely accepted.

#### *Ridge Forest*

Undisturbed ridges have a unique vegetation type dominated by gymnosperms (*Agathis macrophylla*, *Dacrycarpus imbricatus*, *Dacrydium nidulum*, *Podocarpus neriifolius* and *Gnetum gnemon*) and old angiosperm lineages (*Degeneria vitiensis*, species of *Myristica*, and species in the Annonaceae). Therefore, these ridges host several species of Gondwanic affiliation. Recent angiosperm elements are rare compared to the slope forest but include species of *Syzygium* and *Calophyllum*.

#### *Riparian Vegetation*

Along the banks of the Wainavobo, Wainivalau and Waibasaga Rivers, typical river vegetation is found. Common species include the three endemic obligatory riverine species of *Acalypha rivularis*, *Syzygium seemannianum* and *Ficus bambusifolia*. Other species commonly found here include *Diplazium sp.*, *Acalypha insularis* and *Glochidion cordatum*. However, in many locations, the river vegetation is dominated by introduced species such as *Kyllinga polymorpha* and *Piper aduncum*.

#### *Flat Vegetation*

Due to a general lack of undisturbed flat vegetation only a single transect was set in this vegetation type and may, therefore, not necessarily be representative. This is possibly caused by the topography that is dominated by slopes and narrow valleys and the suitability of plains as village and garden sites. The only possibly “undisturbed” flat we were able to locate in the study site was dominated by the conifer *Retrophyllum vitiense* and the angiosperm *Atuna racemosa*. Other species commonly found here included *Dillenia biflora*, *Macaranga graeffeana*, *Girroniera celtidifolia* and *Parinari insularum*.

#### *Forest on former Village and Garden Sites*

War trenches, raised house foundations and history (preserved by Nadakuni Villagers) indicate that the Sovi Basin was once inhabited. One of our transects was located on an old village site and another an old garden site. Although their species composition differed, *Bischofia javanica* and *Atuna racemosa* were common components of both sites and also dominated several other areas. Other plant species commonly found in such areas include *Cananga odorata*, *Artocarpus*

*altilis*, *Dillenia biflora*, *Ficus obliqua*, *Citrus maxima* and *Veitchia joannis*, indicator species of past anthropogenic activities.

### Threats to the Vegetation of the Sovi Basin

In Sovi Basin besides the current threat of logging, the presence of eleven plant species that are considered to be either serious weeds and/or invasive species world wide were found in the area.

The plant species are:

- 1). *Merremia peltata* (wa bula) – native to the Pacific Islands and has become a very serious invasive liana. It is known to have a smothering effect on trees on forest edges. In Sovi it dominated vegetation along the edges of the main drainage systems and was common in former settlement areas.
- 2). *Spathodea campanulata* – African tulip tree – native to central Africa. It is a serious invasive tree species in some Pacific Islands. In Sovi mature plants were found in all forest types surveyed.
- 3). *Piper aduncum* (onalulu, yaqoyaqona) – native to tropical America. The tree shrub was common in areas regularly flooded and in disturbed areas.
- 4). *Solanum torvum* (kosipeli, prickly solanum) – native to the Caribbean. A noxious shrub with thorns that was common in areas regularly flooded, and in the Waibasaga area was locally common on the river flats.
- 5). *Mikania micrantha* – mile a minute – native to tropical America. Common climber along forest edges, recently disturbed areas and edges of rivers and creeks.
- 6). *Clidemia hirta* – Korster's curse – native to tropical America. Common woody herb/shrub in all forest types.
- 7). *Urena Lobata* – hibiscus burr – native to tropical Asia. Common along the main river edges and creeks frequented by humans.
- 8). *Mimosa pudica* – sensitive grass – native to tropical America. Common along river and creek edges frequented by humans.
- 9). *Kyllinga polyphylla* – Navua sedge – native to tropical Africa. Common along river and creek edges frequented by humans.

The weed species deliberately and recently introduced (past 50yrs) into the area that have dominated specific areas like river flats include:

- 1). *Brachiaria mutica* – para grass – native to north Africa. Favored pasture grass for wet areas with high rainfall and or near river and creek flats. According to the local informants attempts were made in the 1960's to raise cattle in the Waibasaga and Wainavobo river flats.
- 2). *Imperata sp.* – white grass. Good fodder for cattle and restricted to the upper reaches of the Wainivalau creek.

## DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The forest system in the Sovi Basin can be described as a wet lowland tropical rainforest. The relatively high percentage of native flora (ca. 80%) found in the area supports this description. Preliminary results (data currently processed) indicate that the canopy is a mixed - species assemblage. On closer observation conglomerations of one or two species sometimes resulted in monodominant canopies and stands. Example of these were noticed with almost pure stands of *Atuna racemosa* (makita) on gentle slopes, *Atuna racemosa* - *Retrophyllum vitiensis* (dakwa salusalu) stands on flat landscape (relatively rare) and on steeper slopes, *Schizostachyum glaucifolium* (native bamboo).

The dominant tree species (based on dbh measurements) found in the area (see Table 1) included *Agathis macrophyllum*, *Retrophyllum vitiensis*, *Endospermum macrophyllum*, *Dacrydium imbricatum*, *Bischofia javanica*, *Palaquium hornei*, *Dacrydium nidulum*, *Calophyllum neobudicum* and *Degeneria vitiensis*. Most of these trees had dbh's greater than 60cm. Trees of this size are not common, were usually widely dispersed or were in isolated clusters in the area. Common tree species found include *Dillenia biflora*, *Myristica sp.*, *Podocarpus neriifolius*, *Gnetum gnemon*, *Garcinia pseudoguttifera*, *Aglaia sp.*, *Syzygium sp.* and *Dysoxylum sp.*

In areas where the forest is relatively intact, trees can grow to heights of up to 25m with an occasional emergent attaining heights of up to 30m. Three distinctive canopy layers were observed i.e. canopy layer 15-25m, subcanopy layer 8-18m and the ground cover. An interesting feature about the intact forest areas surveyed was the large number of *Degeneria vitiensis* observed. This Gondwanic relict flowering tree is so common that Sovi can be considered the center of dispersal for this tree in Fiji.

Lots of traditional house foundations and war trenches were also noticed. Logging by previous inhabitants of the Sovi Basin may explain the absence of many big trees (dbh > 80m) in these areas.

Very little can be said about the rare and threatened flora of Fiji found in the Sovi Basin due to the incomplete taxonomic work on identifying specimens collected. The occurrence of the rare and critically endangered *Acmopyle sahniana* in the upland and cloud montane forest of the Medrausucu range is highly likely. Unfortunately we were not able to access this area on this trip. Further work is envisaged for sections of the Sovi Basin not accessed on this trip. This includes the upland and cloud montane forest of the Medrausucu range and the headwaters of streams and creeks that drain into the Sovi River.

Finally, education awareness for the local resource owners with regards to the impacts of invasive flora and fauna is vital to maintain the unique biodiversity of the area. Also alternative sources for income generation should be put into place to reduce the desire to log the area.

## **RECOMMENDATIONS**

### **Support for Sovi Basin to be designated a World Heritage Site**

A number of different land uses have been proposed for the Sovi Basin: the main one being logging. As the area has not been previously logged, it is seen as a valuable timber resource and there has been strong interest expressed by local and international companies to log the area. Despite the area being part of a logging concession, litigation over the concession has resulted in the basin remaining untouched by loggers. Water supply and hydroelectricity schemes have also been proposed but were later considered to not be economically viable.

There have been a number of recommendations to protect the Sovi Basin due to its perceived outstanding biological, geological and scenic attributes and its potential to be Fiji's first World Heritage Site. Not only will the designation of the Sovi Basin as a World Heritage Site act to protect the area, it will also potentially prove to be a large draw card for Fiji tourism due to global shift from the traditional beach scenario towards more eco-friendly "nature-based" tourism.

The discovery of several rare species of birds, frogs and plants and the high numbers of endemic species found in the Sovi Basin in conjunction with its current relative inaccessibility provides good support for the nomination of the Sovi Basin as a World Heritage Site.

### **Future survey work**

All survey groups are unanimous in saying the survey was a success and provided valuable baseline information for a region that had not been previously surveyed. As the survey was limited in terms of the area that could be covered, they are also in agreement that further surveys need to be carried out in the Sovi Basin in order to attain a better understanding of the region and the species found within it. A large portion of the area was not able to be surveyed on this trip due to time constraints and general logistics, future work will attempt to survey less accessible areas within the basin as well as obtain more detailed information on the areas surveyed on this trip.

The training of local villagers as field guides is also an important component of future surveys. Many of the villagers in Nadakuni have not been into the Sovi Basin and of those that have, few venture very far. These surveys provide an opportunity for the landowners not only to learn about

their land and the species that are found on it but also to learn about ways to survey various taxonomic groups thus ensuring they will be a valuable asset to any future surveys. The money that they receive for their services also provides an alternative income for many families.

Appendix 1: Forest birds recorded during 29 hours of bird survey work in the Sovi Basin forest in May 2003.

Forest birds (Viti Levu)	Fijian name	Scientific name	Endemic/ introduced	IUCN Status	No. records	10-hr Index	Abundance
Fiji Goshawk	Reba	<i>Accipiter rufitorques</i>	Fiji endemic		1	0.3	Rare
Pacific Harrier	Manu levu	<i>Circus approximans</i>			1	1.0	Rare
White-throated Pigeon	Socelo	<i>Columba vitiensis</i>			0	0.0	Not recorded
Friendly Ground Dove	Oilu	<i>Gallicolumba stairi</i>	Regional endemic	Vulnerable	1	1.0	Rare
Barking Pigeon	Soqe	<i>Ducula latrans</i>	Fiji endemic		38	14.3	Common
Many-coloured Fruit-dove	Kulavotu	<i>Ptilinopus nerousii</i>	Regional endemic		2	0.7	Rare
Golden Dove	Bunako	<i>Ptilinopus luteovirens</i>	Viti Levu endemic		19	7.1	Common
Collared Lory	Kula	<i>Phievs solitarius</i>	Fiji endemic		6	2.0	Uncommon
Red-throated Lorikeet	Kulawai	<i>Chamosyna amabilis</i>	Fiji endemic	Endangered	0	0.0	Not recorded
Masked Shining Parrot	Kaka	<i>Prosopaea personata</i>	Viti Levu endemic	Vulnerable	30	11.2	Common
Fan-tailed Cuckoo	Todi	<i>Cacomantis flabelliformis</i>			0	0.0	Not recorded
White-rumped Swiftlet	Kakabace	<i>Collocalia spodiopygius</i>			134	45.5	Very common
Collared Kingfisher	Lesi	<i>Todiramphus chloris</i>			7	9.0	Common
Fiji Woodswallow	Vukase	<i>Ariamus mentalis</i>	Fiji endemic		2	0.7	Rare
Polynesian Starling	Vocea	<i>Aplonis tabuensis</i>	Regional near-endemic		0	0.0	Present
Common Mynah	Maina	<i>Acridotheres tristis</i>	Introduced		0	0.0	Not recorded
Jungle Mynah	Maina	<i>Acridotheres fuscus</i>	Introduced		0	0.0	Not recorded
Red-vented Bulbul	Ujuna	<i>Pycnonotus cafer</i>	Introduced		0	0.0	Present
Island Thrush	Tola	<i>Turdus poliocephalus</i>			60	23.4	Very common
Fiji Bush-warbler	Manu	<i>Cettia ruficapilla</i>	Fiji endemic		56	25.1	Very common
Long-legged warbler	(none)	<i>Trichocichla rufa</i>	Fiji endemic	Data deficient	0	0.0	Not recorded
Scarlet Robin	Diriawala	<i>Petroica multicolor</i>			17	21.0	Very common
Streaked Fantail	Sasaira	<i>Rhipidura spilodera</i>	Regional near-endemic		34	13.6	Common
Slaty Monarch	Sasaira	<i>Mavornis lessona</i>	Fiji endemic		20	25.0	Very common
Shrikebill sp.		<i>Clytorhynchus sp.</i>			14	7.1	Common
Lesser Shrikebill	Digisau	<i>Clytorhynchus vitiensis</i>	Regional endemic		7	7.0	Fairly common
Black-faced Shrikebill	Kiro	<i>Clytorhynchus nigroocularis</i>	Fiji endemic	Vulnerable	4	1.4	Uncommon
Vanikoro Broadbill	Maiavalo	<i>Myiagra vanikorensis</i>	Regional near-endemic		7	3.4	Fairly common
Blue-crested Broadbill	Batidamu	<i>Myiagra azureocapilla</i>	Fiji endemic		39	48.0	Very common
Golden Whistler	Ketedromo	<i>Pachycephala pectoralis</i>			29	12.6	Common
Polynesian Triller	Manusa	<i>Lalage maculosa</i>			21	7.1	Common
Fiji White-eye	Qiqi	<i>Zosterops explorer</i>	Fiji endemic		56	22.4	Very common

## Appendix 1 continued

Forest birds (Viti Levu)	Fijian name	Scientific name	Endemic/ introduced	IUCN Status	No. records	10-hr Index	Abundance
Silvereye	Qiai	<i>Zosterops lateralis</i>			6	2.0	Uncommon
Fiji Parrotfinch	Qiqikula	<i>Erythrura pealii</i>	Fiji endemic		6	2.0	Uncommon
Pink-billed Parrotfinch	Sitibatibua	<i>Erythrura kleinschmidti</i>	Viti Levu endemic	Endangered	4	1.4	Uncommon
Red Avadavat	Sitii	<i>Amandava amandava</i>	Introduced		0	0.0	Not recorded
Orange-breasted Myzomela	Delakula	<i>Myzomela jugularis</i>	Fiji endemic		28	11.2	Common
Wattled Honeyeater	Kikau	<i>Fouletho carunculata</i>	Regional Endemic		23	9.2	Common
Giant Forest Honeyeater	Sovau	<i>Gymnomyza viridis</i>	Fiji endemic	Vulnerable	38	15.3	Common



Appendix 2: List of non-forest birds and other animals recorded in the Sovi Basin during the May 2003 survey.

English name	Fijian name	Scientific name	Endemic or introduced	IUCN Status	Abundance
<b>Non-forest birds</b>					
Pacific Black Duck	Ganiviti	<i>Anas superciliosa</i>			Common along main rivers
Eastern Reef Heron	Belo	<i>Egretta scara</i>			Uncommon along rivers
Peregrine Falcon	Gānivatu	<i>Falco peregrinus</i>	Regional endemic race		Not recorded
Barn Owl	Lulu	<i>Tyto alba</i>			Not recorded
Pacific Swallow	Manumanu ni Doa	<i>Hirundo tahitica</i>			Not recorded
<b>Mammals</b>					
Ship Rat (Black Rat)	Kalavo	<i>Rattus rattus</i>	Introduced		6 caught/seen
Mongoose	Manipusi	<i>Herpestes auro-punctatus</i>	Introduced		Not recorded, probably present and uncommon
Feral cat	Pusi	<i>Felis catus</i>	Introduced		1 seen at night by guides
Feral dog		<i>Canis domesticus</i>	Introduced		
Feral pig	Vuaka ni veikau	<i>Sus scrofa</i>	Introduced		common
Pacific Flying-Fox	Beka ni bogi	<i>Pteropus tonganus</i>			uncommon
Samoan Flying-Fox	Beka ni siga	<i>Pteropus samoensis</i>			uncommon

**Appendix 3** Summary of locality and collection Data for freshwater fish collections from the Sovi basin collected 5 May – 16 May 2003.

Date	Locality	GPS Location	Observers	Physical Parameters	Remarks Substrates
6 May 2003	Sovi River		David, Marika	T- 23.7, pH- 6.3, Us – 51 S – 0, Sp – rapid flow	Rubbles and sand D – 1.2m, L – 10 m, W – 7m
7 May 2003	Lower Wainidai Creek		Kolio, Kini Koto 1 & Kini Koto 2, Vonto, Sairusi, Willie and David Boseto	T – 23.8, pH– 6.3, Us – 60.2, & S – 0 (quiet pool)	Large Boulders, Rockwall, Sand and rubbles D – 51cm L – 10m W- 4.3 m
8 May 2003	Mid Wainidai Creek		Kini Koto 1 & Kini Koto 2	T – 23.8, pH– 6.3, Us – 66.5 & S – 0, sp – 0 (quite pool)	Sand D – 65cm L – 12m W – 3.5m
8 May 2003	Wainibobo River	S 17°55.635' E178°14.121'	Kolio David	T- 23.6, pH– 6.3, Us – 52, sp – slow flow	Rubbles, sand. D – 42cm, L - 8m, W – 4m
9 May 2003	Wainisa Creek		Kolio, Timothy, Vinto & David	T- 23.7, pH– 6.3, Us – 60.7 & S- 0, Sp – 0 quiet pool	Rock Wall, sand D -60cm, L – 10m W – 5m
13 May 2003	Wainivalau River		Kini Koto 1, Sairusi and David	T- 23.7, pH– 6.3, Us – 48 & S – 0, Sp - rapid	Boulders, Rubble and sand D – 30 cm, L – 10m, W – 5m

14 May 2003	Waibasaga Creek	Kini Koto 1, Sairusi and David	T – 23.8, pH – 6.3, Us – 66.5 & S – 0, SP, 0 (quite pool)	Rock Wall, Rubbles & Sand D – 1.5m L – 10 m W – 5m
15 May 2003	Upper Wainidai River	Kini Koto 1, Kini Koto 2 and David	T – 24.2, pH – 6.3, Us – 46 & S – 0, Sp – 0 (quite pool)	Rubbles and Sand D – 30 cm L – 3m W – 1.5m

Note: Physical parameters: T – Temperature, pH – pH measurements, Us- Conductivity, Sp – Speed. The Dissolve oxygen cannot be measured due to unavailable of DO meter.

River Measurements: D – Maximum depth sampled, L – Maximum length sampled, W – Maximum width of the river and creek.

Appendix 4 Distribution of freshwater fish in the Sovi Basin based on surveys from 5-17 May 2003.

Fish Species	Fijian Name	Sovi River	Wainavobo River	Wainadi Creek	Wainisa Creek	Wainivalau River	Waibasaga Creek	Other Comments
<i>Anguilla marmorata</i>	Diria	✓	✓	✓	✓	✓	✓	Native
<i>Anguilla sp.</i>	Kalau/Sasalosi/Tautaubale			✓				Native
<i>Gymnothorax polyuranodon</i>	Dadarikai		✓		✓			Native
<i>Beloranchus beloranchus</i>	You loa	✓	✓	✓	✓	✓	✓	Native
<i>Awaous sp.</i>	You dina	✓	✓	✓	✓	✓	✓	Native
<i>Sicyopterus zosterophorum</i>	Beli*			✓				Native
<i>Schismatogobies chrysonota</i>	Beli*	✓						Endemic
<i>Sicyopterus sp</i>	Siribeli	✓	✓	✓	✓	✓	✓	Native
<i>Siphodon sp (male)</i>	Beli*	✓	✓	✓	✓	✓	✓	Native
<i>Siphodon sp (female)</i>	Beli*	✓	✓	✓	✓	✓	✓	Native
<i>Kuhlia marginata</i>	Sakelo	✓	✓	✓	✓	✓	✓	Native
<i>Kuhlia rupestris</i>	Ikadroka	✓	✓	✓	✓	✓	✓	Native
<i>M. rosenbergii</i>	Uradina/Urabatibua	✓	✓	✓	✓	✓	✓	Native

\* Note: Beli is the common name used for the gobies in Fijian

## Appendix 5 List of survey participants and contact details

Name	Institute	Phone number	Email Address
Marika Tuiwawa	South Pacific Regional Herbarium	3212970	tuiwawa_m@usp.ac.fj
Isaac Rounds	South Pacific Regional Herbarium	3212975	s99001454@yahoo.com
Alifereti Naikatini	South Pacific Regional Herbarium	3212975	naikatini_a@usp.ac.fj
Clare Morrison	South Pacific Regional Herbarium	3212975	morrison_c@usp.ac.fj
David Boseto	South Pacific Regional Herbarium	3212975	s96007778@student.usp.ac.fj
Gunnar Keppel	South Pacific Regional Herbarium	3212455	keppel_g@usp.ac.fj
Greg Plunkett	Virginia Commonwealth University		gmplunke@vcu.edu
Akanisi Cagitoba	Wildlife Conservation Society	3315174	atokotoaa@hotmail.com
Ana Tabutabu	Wildlife Conservation Society	3315174	a_tabu2@hotmail.com
Betani Salusalu	Birdlife International	3317193	bsalusalu@hotmail.com
Vilikesa Masibalavu	Birdlife International	3317193	birdlife@connect.com.fj
Digger Jackson	Birdlife International	3317193	digger@connect.com.fj
Kini Koto Snr	Wildlife Conservation Society	3315174	
Kini Koto Jnr	Wildlife Conservation Society	3315174	
Sanivalati Vido	Dep. of Forestry	3320211	
Mo	c/- South Pacific Regional Herbarium		
Matai Ucutabua	Nadakuni Village		
Apenisa Tokairavua	Nadakuni Village		
Opeti Mataravuravu Sr	Nadakuni Village		
Opeti Mataravuravu Jr	Nadakuni Village		
Malakai Vonivate	Nadakuni Village		
Sairusi Raivoka	Nadakuni Village		
Timoci Raivuku	Nadakuni Village		
Kolinio Namalo	Nadakuni Village		