

Strengthening Conservation and Management across the Mt. Navotuvotu – Mt. Kasi Corridor: Biodiversity Summary Report, December 2012

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Introduction

In 2012, the Wildlife Conservation Society (WCS) received a grant from the Critical Ecosystem Partnership Fund¹ to strengthen community-based forest and river conservation in western Vanua Levu, Fiji, with particular focus on regions that had previously defined as key biodiversity areas (KBAs).² The forests within and surrounding the KBAs of Mt. Navotuvotu and Mt. Kasi in Fiji are recognized as critical for conservation both because they contain globally threatened species and because they are sites of national significance for biodiversity conservation. The forests surrounding Mt. Kasi have the highest known single-site species richness on Vanua Levu.³ They include the IUCN red-listed critically endangered *Astronidium kasiense* and *Gardenia anapetes*, and the vulnerable *Metrosideros ochrantha*, all of which are endemic plants to Fiji. *A. kasiense* and *G. anapetes* are additionally found in the Mt. Navotuvotu KBA. While the biodiversity of freshwater fauna from the KBAs is currently unknown, streams within the relatively pristine forests of adjacent districts (Kubulau and Wainunu) in the corridor between Mt. Navotuvotu and Mt. Kasi contain at least five species of endemic freshwater fish (*Redigobius leveri*, *Glossogobius* sp., *Stenogobius* sp., and two species of *Stiphodon*). The streams also support sensitive species, such as *Eleotris melanosoma*, *Butis amboinensis*, *Kuhlia munda*, *Giurus hoedti* and *Redigobius bikolanus*, that are conspicuously absent from other Fiji catchment streams where forests have been cleared and non-native tilapia introduced.⁴

The forested catchments in and around Mt. Navotuvotu and Mt. Kasi provide critical ecosystem services to the people of Bua and Cakaudrove provinces, who are heavily dependent on natural resources for their livelihoods (WCS, unpublished data). Villagers from Kubulau District, located between the two KBAs, rely on forest products for building materials and traditional medicines (S. Singh, unpublished data); streams within the forest corridor support large gudgeons (*Ophiocara porocephalus* and *Bunaka gyrinoides*) that are important to diets of inland communities and have been declining in abundance across Fiji; and largely intact forests provision and filter water. All of these habitats provide essential services for the health of local human populations and downstream freshwater and marine ecosystems.

The forests and freshwater areas of the Mt. Navotuvotu-Mt. Kasi forest corridor are under imminent threat from logging, mining and invasive species. Fifty-nine percent of the Mt. Navotuvotu KBA is currently allocated as logging concessions, while eighty percent of the Mt. Kasi KBA is under mining tenement (WCS, unpublished data). Without management, there is a high risk that: (1) IUCN red-listed

¹ The Critical Ecosystem Partnership Fund (CEPF) is a joint program of l'Agence Française de Développement, Conservation International, the Global Environment Facility, the Government of Japan, the John D. and Catherine T. MacArthur Foundation, and the World Bank.

² Eken G, BEnnun L, Brooks TM, Darwall W, Fishpool LDC, Foster M, Knox D, Langhammer P, Matiku P, Radford E, Salaman P, Sechrest W, Smith ML, Spector S, Tordoff A (2004) Key biodiversity areas as site conservation targets. *Bioscience* 54:1110-1118

³ Olson D, Farley L, Patrick A, Watling D, Tuiwawa M, Masibalavu V, Lenoa L, Bogiva A, Qauqau I, Atherton J, Caginitoba A, Tokota'a M, Prasad S, Naisilisili W, Raikabula A, Mailautoka K, Morley C, Allnut T (2009) Priority forests for conservation in Fiji: landscapes, hotspots and ecological processes. *Oryx* 44:57-70

⁴ Jenkins AP, Jupiter SD, Qauqau I, Atherton J (2010) The importance of ecosystem-based management for conserving migratory pathways on tropical high islands: A case study from Fiji. *Aquatic Conservation: Marine and Freshwater Ecosystems* 20:224-238

plant species will be lost through direct clearing; (2) endemic and vulnerable freshwater fish species will be lost through direct and indirect effects of sedimentation; and (3) there will be irreconcilable damage to downstream coastal and marine ecosystems. Already there have been strong anecdotal reports of massive fish and coral kills coincident with the appearance of sediment-laden runoff from the Yanawai River draining the Mt. Kasi region during the last period of mining activity at Mt. Kasi between 1996 and 1998.⁵ By working with local communities directly to establish community-managed forest parks and riparian buffer zones, we can secure agreements that the communities will not sell off these important areas for logging and that they will make efforts to protest against any future government-backed mining .

Community members and provincial administrators have expressed concern over these threats. In general, the will of the communities is to protect their forests in order to derive benefits from the ecosystem services they provide, such as freshwater provisioning, flood mitigation, and food security. At a recent Protected Area Committee (PAC) planning workshop with provincial administrators organized and facilitated by WCS, representatives from the Cakaudrove Provincial Office and NGOs identified the Mt. Kasi region as a candidate site for a forest reserve. Representatives from the Bua Provincial Office proposed conservation sites around Wainunu and Kilaka rivers as well as forest management around the Mt. Navotuvotu and Kilaka forests.⁶ The terrestrial working group of the PAC has named the Mt. Navotuvotu KBA as one of its top 10 priority locations to increase the current level of terrestrial area under protection in Fiji from 2.9% closer to the 20% target by 2020 set under Fiji's Programme of Work on Protected Areas. The next step is to consult with landowners and government agencies to identify the best types of management under legal or other effective means and the optimum spatial configuration of management actions to reduce the negative impacts from logging and mining.

This report summarizes steps undertaken to collate and collect biodiversity data for the Mt. Navotuvotu – Mt. Kasi Forest Corridor, Vanua Levu, Fiji through the CEPF-funded project to WCS. The long-term goal of the project is to achieve 20% protection of forests/streams inside the Mt. Navotuvotu and Mt. Kasi KBAs and 10% protection of forests/streams in the broader conservation corridor by 2020. In the shorter term (1-3 years), this will be enabled by work to: (1) promote sustainable management of native forest within ten community forest parks (estimated total size = 1825 ha) nested within five district-level ecosystem-based management (EBM) plans within the Mt. Kasi-Mt. Navotuvotu corridor; (2) promote protection of 50 km (100 ha) of river buffer zones (RBZs) priority streams along the Mt. Kasi-Mt. Navotuvotu corridor with the highest biodiversity, clear migratory pathways and least fragmentation, and managed under 5 district-level EBM plans; and (3) support management plan implementation by resource management committees, coordinated through a knowledge sharing network, and at least

⁵ Jupiter SD, Tui T, Shah S, Cakacaka A, Moy W, Naisilisili W, Dulunaqio S, Patrick A, Qauqau I, Yakub N, Caginitoba A (2010) Integrating EBM science to assess marine protected area effectiveness: clues from coral proxies of land disturbance, ecological assessments and socioeconomic surveys. Technical report no. 02/10. Wildlife Conservation Society-Fiji, Suva, Fiji, 24 pp

⁶ Jupiter S, Tora K, Mills M, Weeks R, Adams V, Qauqau I, Nakeke A, Tui T, Nand Y, Yakub N (2011) Filling the gaps: identifying candidate sites to expand Fiji's national protected area network. Outcomes report from provincial planning meeting, 20-21 September 2010. Wildlife Conservation Society Fiji, Suva, Fiji, 65 pp

partially financed by small-scale livelihood activities. Here we report on activities undertaken to support identification of clans with land tenure blocks in areas of high diversity and value for forest ecosystem services, as well as willingness to establish management, as well as the outcomes of our initial consultations with these clans to discuss establishment of community forest parks and river buffer zones.

Biodiversity data collation

Biodiversity data were collated across the study area with a focus on taxa that are endemic to Vanua Levu and/or threatened. Some layers were already available in GIS format (generally those collated by the National Protected Areas Committee as part of a gap analysis exercise in 2010, led by National Trust of Fiji), others were electronic (e.g. spreadsheets with coordinates) but needed to be converted into GIS format, and the remainder were paper records which we georeferenced based on associated places names. The spatial layers were compiled into a GIS which was used to direct survey effort to previously un-surveyed areas within likely intact forests. A summary of the data collated is given in Table 1.

Table 1: Summary of biodiversity data collated.

Dataset	# records	Source	Issues
Plants endemic to Vanua Levu or known only from specific localities	43 collection records	Manual digitizing from place names in hard copy of Flora Vitiensis ⁷	Spatial accuracy is low because no coordinates were available
Rare or threatened plant taxa in Drawa Catchment	Records of 13 taxa	USP Herbarium reports ⁸	Covers Drawa catchment only (part of Wailevu West district)
Globally threatened birds	2 survey sites, one with records of the Vulnerable ⁹ Shy Ground-dove	BirdLife International – collated data from forest surveys between 2002-2005	Small number of records in our study region
Freshwater fish endemic to Fiji	11 collection records	National Trust of Fiji (previously collated from Wetlands International-Oceania records for National Protected Areas Committee work)	Small number of records in our study region
Land snails endemic to Fiji	8 collection records	National Trust of Fiji (previously collated from University of the South Pacific records for National Protected Areas Committee work)	Small number of records in our study region

⁷ Smith AC (1979) Flora Vitiensis Nova: A new flora of Fiji (Spermatophytes only). Volumes 1-5. Pacific Tropical Botanical Garden, Hawaii, USA

⁸ Tuiwawa (1999) Floristic Survey of the native forest catchment in Cakaudrove Province, Vanua Levu, Fiji. October 1999. BOT.02.99.

⁹ Classification from the IUCN Red List (<http://www.iucnredlist.org/>)

We had originally planned to use the biodiversity data to derive input layers for the conservation planning software Marxan, but this was not possible because of the scarcity and patchiness of the collated records. Instead, we decided to use the biodiversity data during our community consultation visits to raise awareness about important endemic or threatened flora and fauna.

As an alternative input to the conservation planning software, we collated and prepared spatial data layers to use as biodiversity proxies. Areas of dense forest cover derived from satellite imagery (mapped from Landsat Thematic Mapper data by researchers at the University of Queensland¹⁰) were the starting point, from which areas of hardwood and softwood plantations were removed, followed by other areas classified as 'non-forest' by the Department of Forestry Forest Function Map. We additionally removed areas within 1 km of major roads, based on a previous study by WCS Fiji which found that invasive species such as rats and mongoose penetrate up to 1 km into forests from roads.¹¹ By removing these areas, we endeavored to use the most intact forest in our analyses (Figure 1).

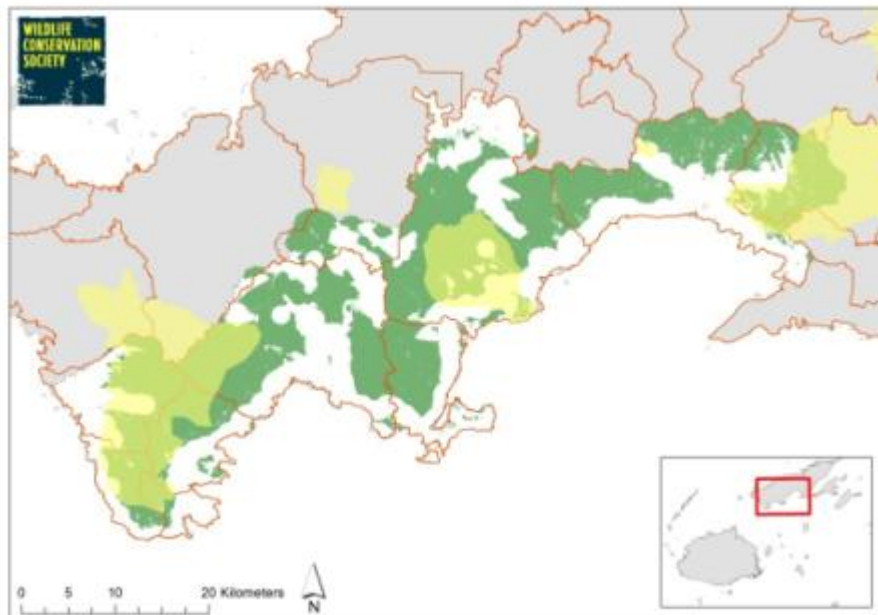


Figure 1: Areas of likely intact native forest (green) overlain with the location of Fiji's Key Biodiversity Areas (KBAs) in transparent yellow. The white backdrop shows the study region for the project. Mt Navotuvotu KBA is in the far west of the map, with Mt Kasi KBA in the centre and Mt Sorolevu KBA in the east. (Nasigasiga is the small KBA just outside the study region).

Threats data collation

In June 2012 we visited stakeholders in Vanua Levu to collate spatial data on potential threats to biodiversity. We visited government offices (Commissioner Northern, Department of Forestry, iTaukei

¹⁰ Details about the forest cover map produced from composite Landsat data from 2000 and 2002 can be found in: Klein CJ, Jupiter SD, Selig ER, Watts ME, Halpern BS, Kamal M, Roelfsema C, Possingham HP (2012) Forest conservation delivers highly variable coral reef conservation outcomes. *Ecological Applications* 22:1246-1256

¹¹ Olson D, Farley L, Naisilisili W, Raikabula A, Prasad O, Atherton J, Morley C (2006) Remote forest refugia for Fijian wildlife. *Conservation Biology* 20:568-572

Land Trust Board, Bua and Cakaudrove Provincial Offices, Department of Agriculture, Department of Lands, Housing Authority, Town and Country Planning) and logging companies (Valebasoga Tropikboard Ltd, Fiji Forest Industries, Fiji Hardwood Ltd, Waiqele Sawmill & Fiji Pine). We also collated data by email from Xinfra, the mining company currently operating the Nawailevu bauxite mine in Lekutu and now exploring potential bauxite sites in Wainunu. We were given consent to use the mining concession data as long as it is not publicly displayed. All datasets were compiled into a GIS so that they could be used as input layers for conservation planning software.

The Department of Forestry and the logging companies were able to provide the location of plantations, logging concessions and some logged out areas. They were not able to confirm which parts of the large logging concessions will actually be logged since they have not yet conducted the forest inventories to map out the forest resources (Figure 2).

A land use capability map was obtained from Department of Agriculture (Land Use section), classifying land into 8 categories according to factors such as slope, fertility, salinity, stoniness and wetness. Land suggested suitable for arable production is categorized in Classes I-IV (Figure 3). Roads data were obtained from Public Works Department (Figure 4).

A blog post describing the data gathering trip can be found at <http://wcsfiji.org.fj/fact-finding-mission-in-vanua-levu-2>.

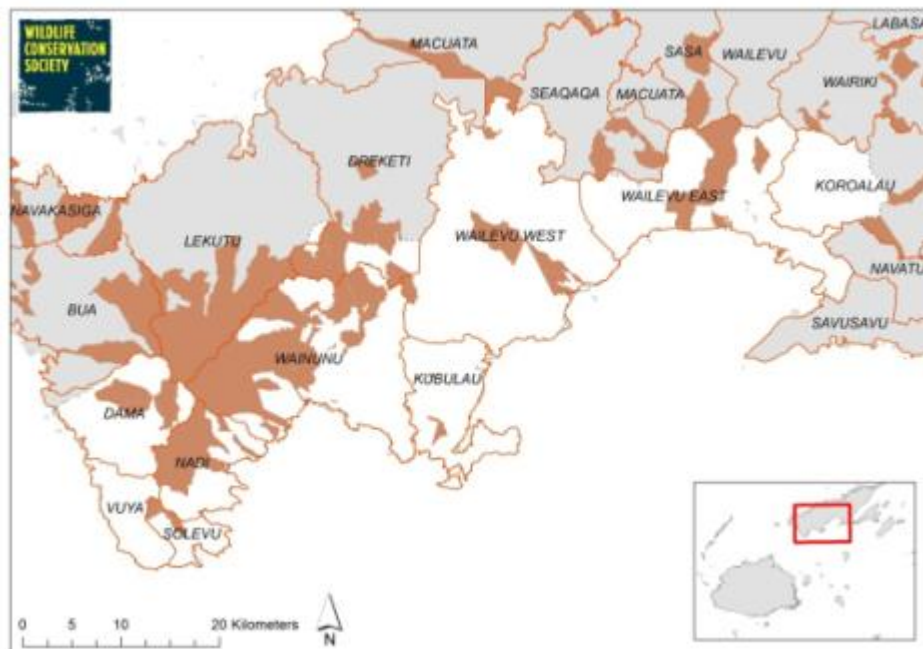


Figure 2: Logging concessions in the study region (all companies combined).

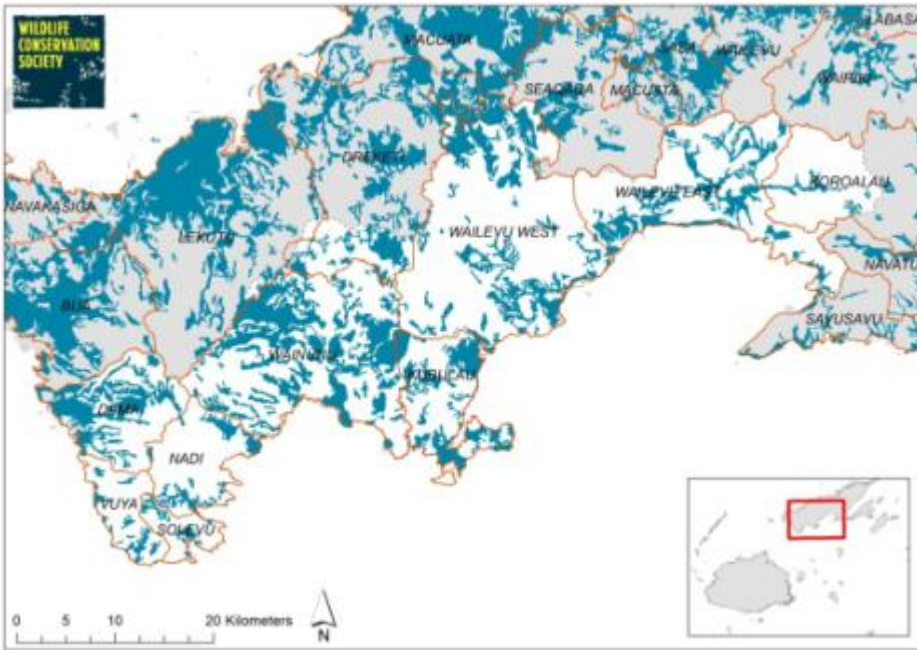


Figure 3: Areas suitable for arable production, based on classes I-IV of the Land Capability Classification.

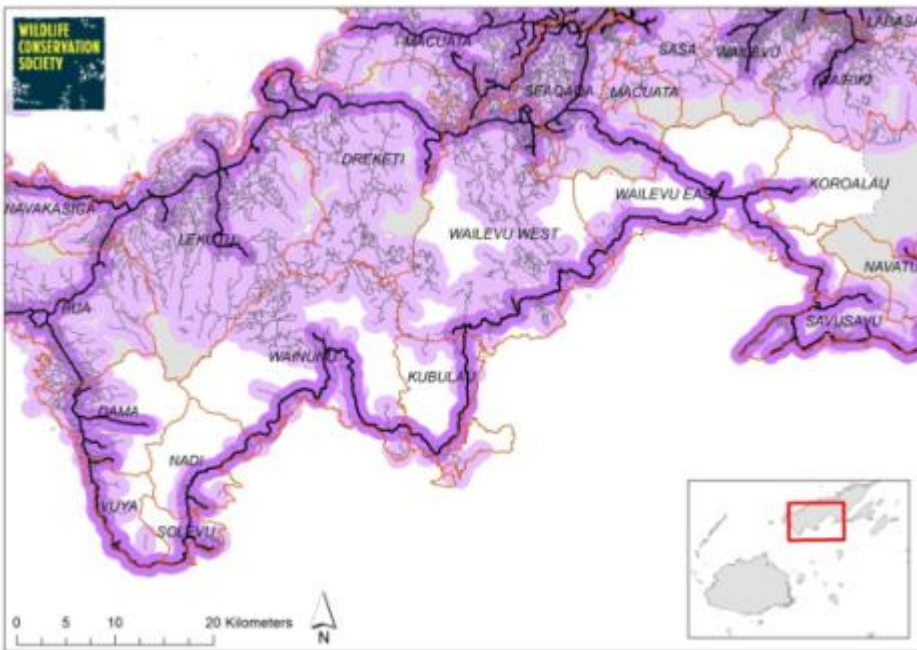


Figure 4: Major roads (black) and minor roads (grey) buffered by 1 km (in purple shading) on each side.

Assessing community willingness

In addition to threats data, information on community willingness to implement forest management was obtained from NatureFiji-MareqetiViti (NFMV). NFMV completed a national round of consultations in 2011 (with funding support from the Critical Ecosystem Partnership Fund), covering 88 clans in Vanua

Levu and recording their willingness to consider future establishment of Permanent Forest Estates (PFEs), part of the Fiji Government’s Forest Policy. This willingness information was linked with land tenure boundaries (Department of Lands, Figure 5), to show the spatial distribution of willing clans (Figure 6).



Figure 5: Clan land tenure boundaries (in orange outlines) across the study region.

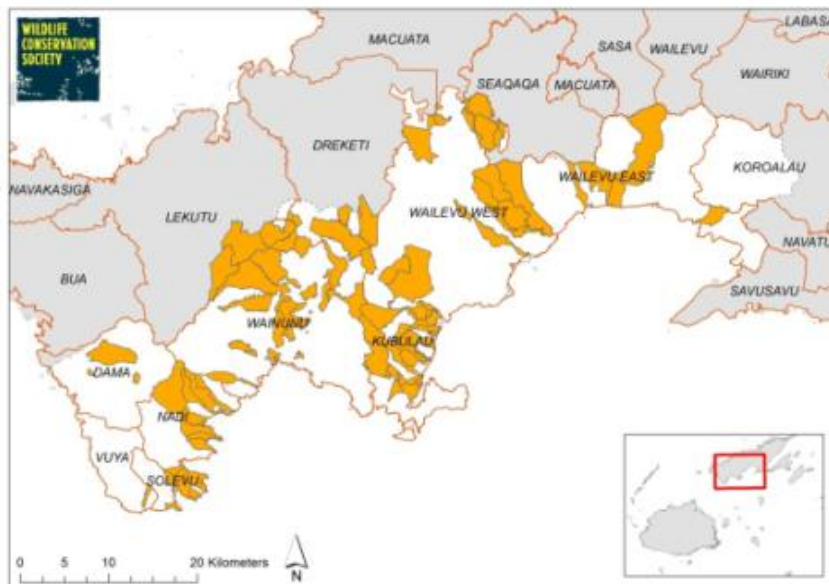


Figure 6: Land parcels (orange shading) belonging to willing clans across the study region.

Field surveys

Surveys of overhanging culverts

Recent, prior surveys of Vanua Levu streams by WCS and Wetlands International-Oceania indicated that overhanging culverts, constructed to let water pass beneath roads, pose a serious threat to fishes making obligatory migrations upstream that are unable to climb over the manmade barriers.¹² From 25 – 29 June 2012, WCS surveyed the locations of overhanging culverts across Bua Province and in Wailevu and Koroalau districts, Cakaudrove Province. Culverts were marked using a GPS and attributes recorded (e.g., whether they were hanging culverts or not, whether there was a fish ladder and any general comments on water flow). Locations of hanging culverts are shown in Figure 7, and a blog describing the surveys can be found at <http://wcsfiji.org.fj/mapping-barriers-to-fish-migration>.

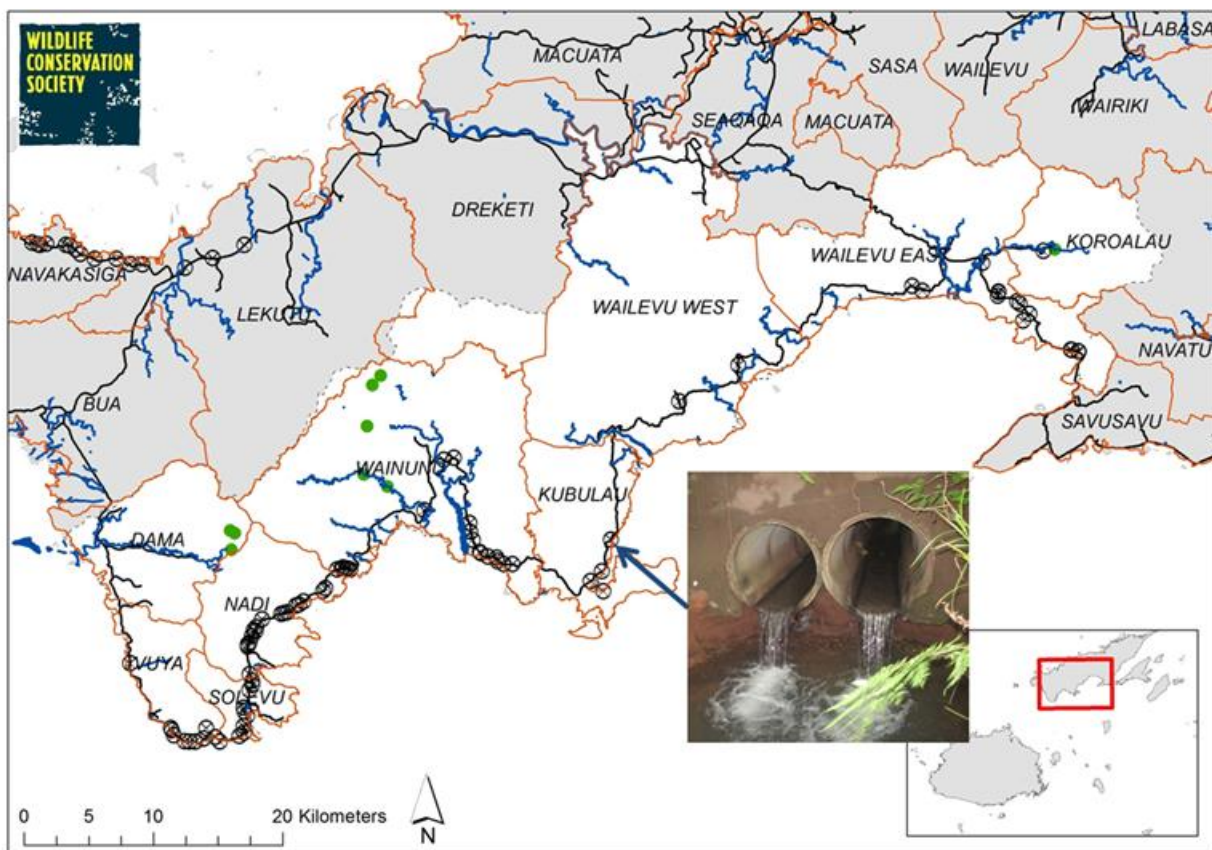


Figure 7: Locations of overhanging culverts surveyed in June 2012 (open circles with hashes) and WCS freshwater biodiversity surveys in July-August 2012 (green circles).

¹² Jupiter S, Jenkins A, Koto K, Ah Tong J, Bwebe T, Cakacaka A, Dulunaqio S, Fox M, Kuritani L, Mario S, Naisililili W, Nand Y, Tukana A, Weeks R, Yakub N (2012) Effects of alteration to catchments and streams on freshwater fish communities of Vanua Levu, Fiji. Wildlife Conservation Society, Suva, Fiji, 17 pp

A synopsis of freshwater fish biodiversity at previously un-surveyed sites across the Mt Navotuvotu - Mt Kasi forest corridor, Vanua Levu, Fiji

WCS staff conducted terrestrial and freshwater biodiversity surveys at un-surveyed sites across the Mt Navotuvotu - Mt Kasi forest corridor from 31 July to 8 August 2012 (also see blog post at <http://wcsfiji.org.fj/plunging-into-fijis-rivers>). These surveys targeted a number of previously un-surveyed freshwater sites within the aforementioned corridor with a prime objective of looking for rare and endemic species of fishes with which to help prioritize the areas and communities for consultation (Table 2). In addition, communities had protected a number of sites through fishing bans (*tabu*) and we were also trying to get impression of the status of these sites based on observations. The survey team consisted of a consultant (Aaron Jenkins), a WCS staff member (Kinikoto Mailautoka) and two new recruits from the Department of Fisheries who had previously been trained by Kinikoto Mailautoka in freshwater survey techniques.

Table 2. Freshwater survey sites across the Mt. Navotuvotu-Mt. Kasi corridor

Date	Village	River	Site	Tabu	GPS - S	GPS - E	Altitude (m)
30/7/12	Nakawaga	Nakawaga	1	yes	16.66388	179.34247	37
31/7/12	Navakasali	Dawacumu	2	no	16.79242	178.84482	259
1/8/12	Navakasali	Wailoaloa	3	yes	16.75710	178.85417	226
1/8/12	Navakasali	Wailoaloa	4	yes	16.76363	178.84825	235
2/8/12	Daria	Wainunu	5	yes	16.83447	178.86005	71
2/8/12	Daria	Wainunu	6	yes	16.826355	178.842475	80
3/8/12	Driti	Dama	7	no	16.87981	178.74709	73
3/8/12	Driti	Dama	8	no	16.86834	178.74931	>233
3/8/12	Driti	Waivilolo	9	no	16.8664	178.74600	249

The following methods were used to survey freshwater fishes at the aforementioned nine river and stream sites. Results are presented in Table 3 below, followed by short, qualitative descriptions of each sampling site.

Underwater observations were made in clear streams. It was very effective for obtaining a very quick overview of the local fish population and relative abundance of species. The method essentially consists of making underwater observations with the use of mask and snorkel. In areas that were shallow

enough and the water was clear enough, a mask and snorkel was used to observe the benthos and fauna that were not being caught by the nets. Notes were recorded on plastic slates or special waterproof paper.

Large seine net (2 m x 7 m, 0.4 cm² mesh) was pulled in a rough circle, with the bottom edge down as close as possible to the substrate and forward of the top floating edge of the net. This technique was executed before anyone entered the water body to minimize the number of fleeing fishes. This was generally used in minor tributaries and slow moving or still waters.

Medium pole seine net (1.2 m x 0.8 m, 1mm² mesh) was used in a variety of ways. Firstly, it was held firmly downstream as people kick and dislodge rubble upstream. This is a useful method for collecting small, bottom dwelling fish. On vegetated banks the net was thrust under submerged vegetation and the vegetation was disturbed on the bank dislodging fishes into the net. Also, this net was used to “scoop” (bottom edge held forward, run along substrate for a few seconds then lifted) from any accessible shallow body of water. This net was particularly useful for narrow streams.

Small hand nets (15cm x 10cm + 10 cm x 8 cm, 1mm² mesh) were used to “scoop” the underside of overhanging rocks and in small crevices in the smaller streams and also to collect fauna when in still water bodies.

Results & Site Descriptions

Table 3: Species occurrence by sampling site. Key: h = high density; m = medium density; l = low density; * = endemic

Family	Genus	species	1	2	3	4	5	6	7	8	9
Eleotridae	<i>Eleotris</i>	<i>fusca</i>	l								
	<i>Hypseleotris</i>	<i>guentheri</i>	h								
	<i>Bunaka</i>	<i>gyrinoides</i>	l								
Kuhliidae	<i>Kuhlia</i>	<i>munda</i>	l				h	h			
	<i>Kuhlia</i>	<i>rupestris</i>					h	h	h	h	h
	<i>Kuhlia</i>	<i>marginata</i>	l				h	h			
Anguillidae	<i>Anguilla</i>	<i>marmorata</i>					l	l			
Gobiidae	<i>Schismatogobius</i>	<i>vitiensis</i> *	l								
	<i>Stenogobius</i>	<i>sp.</i> *	l								
	<i>Sicyopus</i>	<i>zosterophorum</i>		h					h	h	h
	<i>Stiphodon</i>	<i>lailai (mn)*</i>		h			l	l	h	h	
	<i>Stiphodon</i>	<i>isabellae (mn)*</i>							l	l	
	<i>Sicyopterus</i>	<i>lagocephalus</i>		h					h	h	h
	<i>Awaous</i>	<i>guamensis</i>		l			l	l			
	<i>Redigobius</i>	<i>leverii*</i>					h	h			



Figure 8: *Stiphodon lailai* (mn), a Fiji endemic freshwater fish.

Site 1. Nakawaga River



On July 30, 2012, our team of freshwater fish surveyors visited Nakawaga Village, which was about half an hour drive from Savusavu town. The residents of Nakawaga had established a 15 year *tabu* on a stretch of river near the village. At first glance, it was apparent that the *tabu* had not been sited with much forethought. The *tabu* was about a 200 meter reach of river directly adjacent to the village on one

side and with hillside gardening on the other. Livestock were wandering through the river and slimy green filamentous algae covered the substrate. This was a low altitude site at only 37 meters with very poor water clarity, preventing any visual census techniques. We initially tried using the electrofisher but it was apparent that this was not going to work so we abandoned this for the traditional survey methods of seine nets. After about an hour and a half of fishing it was clear that this was not a healthy site and also was not working as a *tabu*. Although it had been apparently closed for 15 years, the largest fish seen (*Kuhlia marginata*) was only about 5 cm and abundance was low for all 7 species encountered except the mid-water gudgeon *Hypseleotris guentheri*. This species is often seen in abundance in disturbed areas such as roadside drainage ditches. Two endemics were encountered, however these were the ubiquitous *Schismatogobius vitiensis* and *Stenogobius sp.* In addition, not a single prawn or mollusk was collected in the nets during this time which is very unusual and seems likely a result of poor water quality and perhaps chemical contamination of some sort. We had a discussion with the village that night over kava about the likely impacts of hillside gardening, livestock and frequent village use of the area and the potential of relocating the *tabu* area to a more productive area. They said they would consider it given that the *tabu* had yielded unimpressive results.

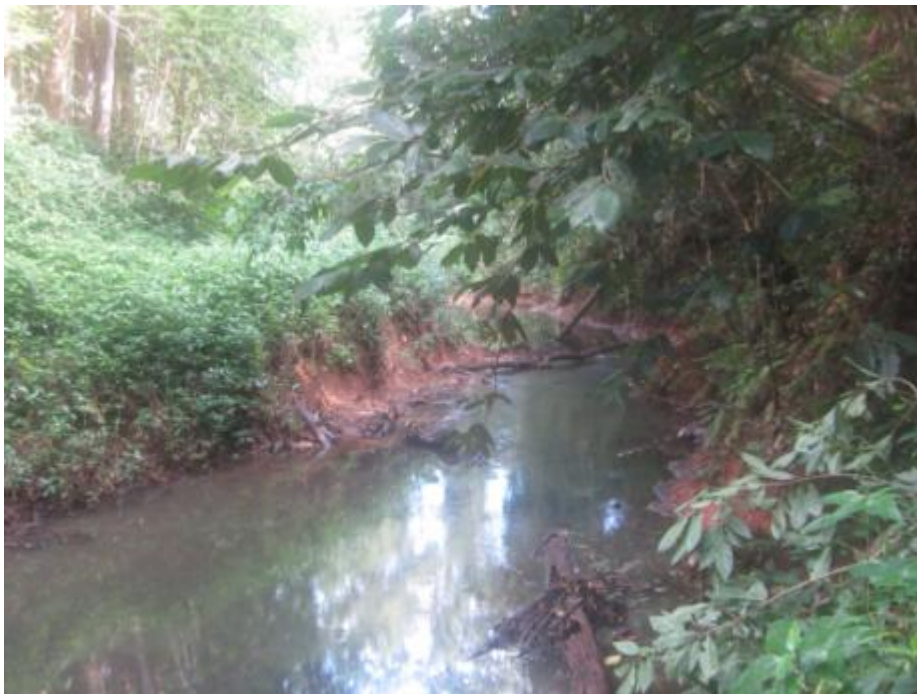
Site 2. Dawacumu River



The following day, July 31, 2012, we made the drive to the interior upland of Bua to the most inland village of Navakasali. This village claimed that we were the first visitors that they had had this year, which is testament to their isolation. The first site we visited was a high altitude site (259 m) on the Dawacumu River. This site was about a kilometer below where they have a *tabu* area. The site was near an old logging road bridge but the forest adjacent to the site seemed like primary forest and provided good overhanging vegetation and cover. Algae were present on the large boulders that made up the

substrate but generally quite a low cover. Water clarity was very high and visual survey methods using a mask and snorkel were used extensively. It was apparent from the first peek underwater that this was a very rich and healthy site. In terms of fish abundance, gobies of the sub-family Sycidiinae were very abundant. All of these species would have to make a full migration from the sea and back again so there are likely very few obstructions in the river corridor below. While two of the abundant Sycidiinae (*Sicyopterus lagocephalus* and *Sicyopus zosterophorum*) are quite hardy, the third species *Stiphodon lailai* (mn) (Figure 8) is very sensitive and the smallest of the endemic Sicydiine gobies. The presence of *S. lailai* is a good sign for the health of this particular site and the river corridor below. While only one endemic was seen, this is a sensitive indicator species. Also the abundance of prawns in this site was astounding, particularly *Machrobrachium spp.* We saw evidence of traditional fishing and were told that they only fish for prawns in this site using this method which involves lining up rocks in a “V” shape along the shallow edge of the stream and placing rotten coconut in the inner part of the “V”. At night they come and collect prawns by the hundreds from the “V”. If this is the case, then this seems like a sustainable harvest method as the in situ abundance of prawns was still very high.

Site 3. Wailoaloa River



On August 1, 2012, still based at Navakasali, we followed the old logging road inland as far as we could go and ended up at the Wailoaloa forestry station. We then descended through apparently secondary forest to the Wailoaloa River at about 226 m altitude to a river *tabu* site. The substrate was a fine red soil covered in a fine blanket of filamentous algae and no boulders were present. We pulled seine nets and hand nets through the murky water and caught nothing. It was completely devoid of life: no fish, no prawns, no mollusks, not even any insects or insect larvae. The local village guides said that inhabitants

of the forestry station would often use chemical fishing techniques (i.e. herbicides) to fish here and that is why it was so devoid of life. This was a stark contrast to the previous site we had visited.

Site 4. Wailoaloa River

We then followed the river to a higher altitude of 235 m to see if we could find any life in the *tabu* area that had been established on this part of the river. Again, absolutely nothing was found. It was as if the entire reach of river had been stripped of life. This particular reach of river was adjacent to a mahogany plantation and apparently before planting had begun many years ago, herbicides were used extensively to clear the area. Also the villagers admitted that chemical fishing had been frequently used in the past at this location. The *tabu* was probably established in a vain attempt to restore life to an already denuded river.

Sites 5 & 6. Wainunu River



On August 2, 2012, we relocated to Daria village where we began to work in the upper Wainunu River at around 71 meters altitude. The first and second sites we visited were also apparently a *tabu* area that extended for about a 200 m reach. The substrate was large boulders that had almost no algae present. The edges of the river, within a small floodplain, were planted with an extensive taro (*dalo*) plantation. Despite riverside gardening, water clarity was very high. Overall diversity of fishes was moderate, with seven mostly ubiquitous species. The outstanding aspect of this site was a large population of very large size *Redigobius leveri*, a Fiji endemic. *Redigobius leveri* is probably one of the only completely freshwater resident species. *Stiphodon lailai* (endemic) was also seen at this site but only in very small numbers. Somewhat odd was the complete lack of any crustaceans of any sort.

Site 7. Upper Dama River



On August 3, 2012, we travelled to Driti Village which was located on the banks of the Dama River. We hiked from the village inland to begin a full day of hiking and sampling in the Dama river valley. Gardens and livestock were along the river near the village and for about 45 minutes to an hour walk inland but then the forest became primary and the river became relatively untouched. Our first site was near the confluence of two tributaries at around 73 meters. The substrate was algae free, large boulders and clear water heavily aerated by the rapids. This site was a haven for Sicydiine gobies with four species including the relatively rare endemic *Stiphodon isabellae* (ms) (Figure 9). *Macrobrachium* prawns were also in abundance.



Figure 9: *Stiphodon isabellae* (mn) in the upper Dama (site 7).

Site 8. Upper Dama



From the first Dama river site, we continued to follow the river upwards and encountered a number of large pools and waterfalls. The pools often contained large *Kuhlia rupestris* and were filled with giant *Macrobrachium lar*. Again, sampling at the second Dama river site (Site 8) at an altitude of > 233 meters revealed the same group of species that are all amphidromous migratory species, suggesting an unimpeded path from this high altitude to the sea. The water was crystal clear and cold and the populations of fishes and invertebrates seemed to be in quite a pristine state.

Site 9. Waivilolo



We then hiked over a ridge to get to another upper tributary of the Dama called Waivilolo and sampled this area at around 250 m altitude. Again the forest around this tributary was pristine, although the actual flow of the stream was less than the previous site that we had sampled. *Macrobrachium* prawns were again in abundance but the numbers of fishes seemed lower than the previous site. Only three common species were seen at this site. There was evidence on the ridge path of wild pigs in the area. The village guides also said that there were occasionally feral cows up in this forest, which we found quite surprising.

Recommendations from freshwater surveys

The state of upper catchments is highly varied between sites. Often gardening, livestock and forestry have already impacted on the fauna within these upper catchments. In terms of prioritizing areas for conservation, we would give highest priority to the Dawacumu and upper Dama rivers as they possess the most unique biodiversity and intact populations and the forest is in the best condition of the sites sampled. It would be also worth discussing the upper Wainunu based on the large population of large sized *Redigobius leveri*. There is a clear need to do some awareness raising on the dangers and heavy impact of both chemical based fishing as well as the impacts of herbicide use for clearing undergrowth prior to planting of timber trees. Both of these practices are having a severe impact on waterways in Fiji and even in some very isolated and remote upper watershed areas.

Conservation Planning

The conservation planning software Marxan¹³ was used to conduct two parallel spatial prioritization exercises, one for forests and one for rivers. In simple terms, Marxan works to find the most efficient solutions for positioning protected areas, while minimizing costs and meeting conservation targets. We used Marxan specifically to select a set of high priority clans whose land has the potential to meet our conservation targets. We used the Selection Frequency outputs of Marxan to drive the next stage of our consultations in the most inclusive way, rather than the Best Solution (the single network which meets the targets most efficiently) which may have excluded certain clans that happened not to be selected in that particular run.

Community Forest Parks

As explained above, a spatial layer of likely intact native forest was prepared (Figure 1). This was used as the biodiversity feature which Marxan aims to include in potential network configurations. The spatial units we used in the network design were the boundaries of the clan land tenure parcels. These are the units which are either selected or not in each run of Marxan.

Based on our previous work with communities in these areas, we made the assumption that communities would be willing to protect around 20% of their lands, and that 50% of consulted clans would take this work forward to establish a Community Forest Park. We therefore applied a multiplier of 10 to our ultimate target of 1825 hectares, and set targets for forest inside KBAs at 12167 ha and outside KBAs at 6083 ha, making a total of 18250 ha for this stage of the process.

¹³ Ball IR, Possingham HP (2000) MARXAN (V1.8.2): Marine reserve design using spatially explicit annealing, a manual. University of Queensland, Brisbane

We derived costs layers from the spatial information on logging concessions (Figure 2), mining exploration areas, areas suitable for arable farming (Figure 3), areas within 1 km of roads (Figure 4), and community willingness to participate (Figure 6). For community willingness, the cost was an inverse binary measure, while all other costs were calculated as a proportion of each land parcel that was occupied by that particular threat.

Proposed protected areas belonging to two clans in Kubulau were ‘locked in’ to the solution, and freehold land parcels were ‘locked out’. The resulting selection frequency output from 100 runs is shown in Figure 10, where redder areas indicate clans that should be targeted with the highest priority for initial consultations to establish community forest parks. The Kubulau clans are also marked as red because, being locked in, they automatically were selected in any resulting Marxan solution.

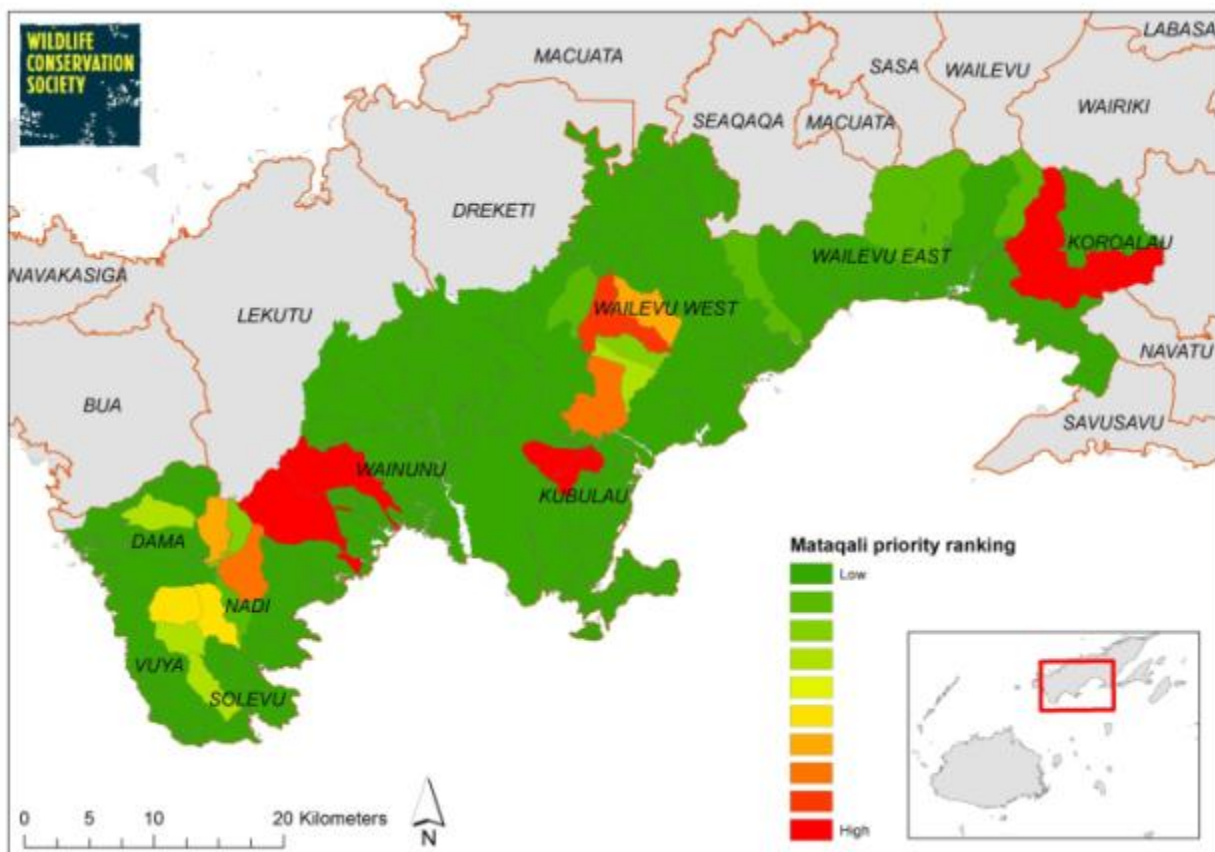


Figure 10: Selection frequency from the Marxan analysis, showing the relative frequencies with which each land parcel was selected to be part of protected area network in order to meet our targets.

Note that in Figure 10, two clans in Wainunu and two clans in Koroalau districts are coloured red. These clans were selected in 100% of the runs. In the case of Koroalau, this reflects the large areas of likely intact native forest on their lands, and a relatively low number of threats. In Wainunu, although the land parcels are covered by large logging concessions, they were consistently selected because of the

significant tracts of likely intact native forest on these lands, indicating that it is essential to include these forests in a future protected area network.

River Buffer Zones

To prepare a layer of priority areas to establish Riparian Buffer Zones (RBZs), the rivers and major creeks maps from Lands Department were extensively cleaned, before being buffered by 100 m on either side of the river or creek. Buffered rivers and creeks with downstream hanging culverts were 'locked out' of the analysis, as well as rivers and creeks which were found to be dry during the June 2012 culvert surveys.

Based on our previous work with communities in these areas, we made the same assumption as for Community Forest Parks – that communities would be willing to protect around 20% of a buffered riparian strip (either shorter than the proposed section, or potentially narrower, to a minimum of 30 m buffer on each side), and that 50% of consulted clans would take this work forward to establish an RBZ. We therefore applied a multiplier of 10 to our target to protect 100 ha (resulting in a target within Marxan of 1000 ha), and we set targets for riparian forest inside KBAs at 5333 ha and outside KBAs at 2667 ha.

We derived costs from the same spatial layers as for the Community Forest Parks analysis, but treated them in different ways. A fragmentation index was calculated for each potential River Buffer Zone (RBZ) as a ratio of the RBZ area to RBZ perimeter (Figure 11). Mining was only considered if an exploration area fell upstream of a River Buffer Zone. Future management costs were taken into account by adding a cost to RBZs which form district boundaries (meaning that at least 2 clans would be involved in managing the area), and accounting for RBZs which cross multiple land tenure boundaries (which would require cooperation across multiple clans). An inverse of community willingness was included as a binary cost, as for forests.

The output of the Marxan analysis was surprising (Figure 12). The same network was selected in each run, therefore giving a binary selection frequency ("selected" versus "not selected"). We think this might be because the options available for configuring networks of RBZs are much more limited. Nevertheless, the binary output was still a useful one for consultations, as it showed the preferred location of RBZs to minimize costs and protect biodiversity efficiently.

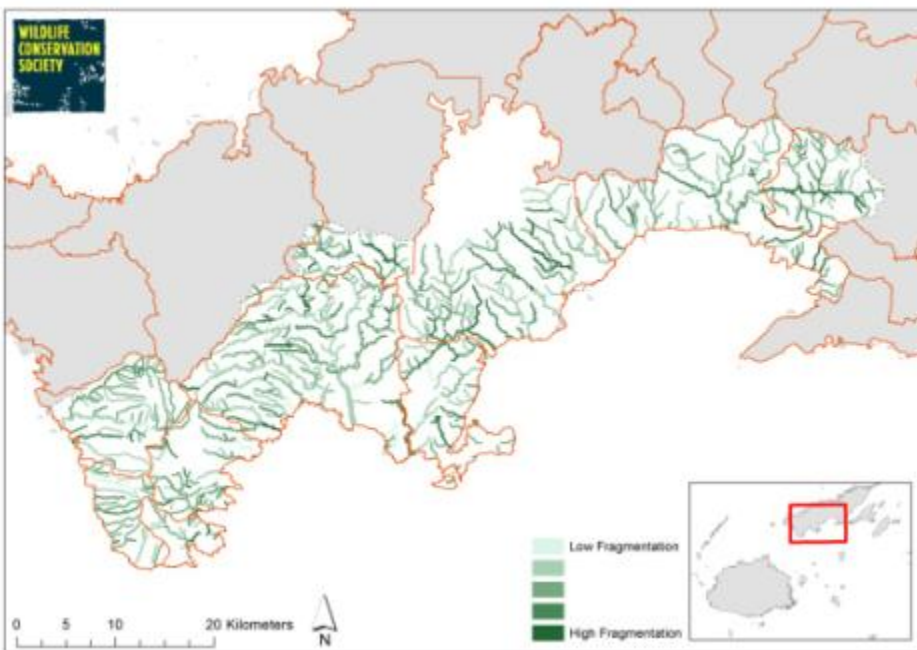


Figure 11: Fragmentation index for rivers in the study region.

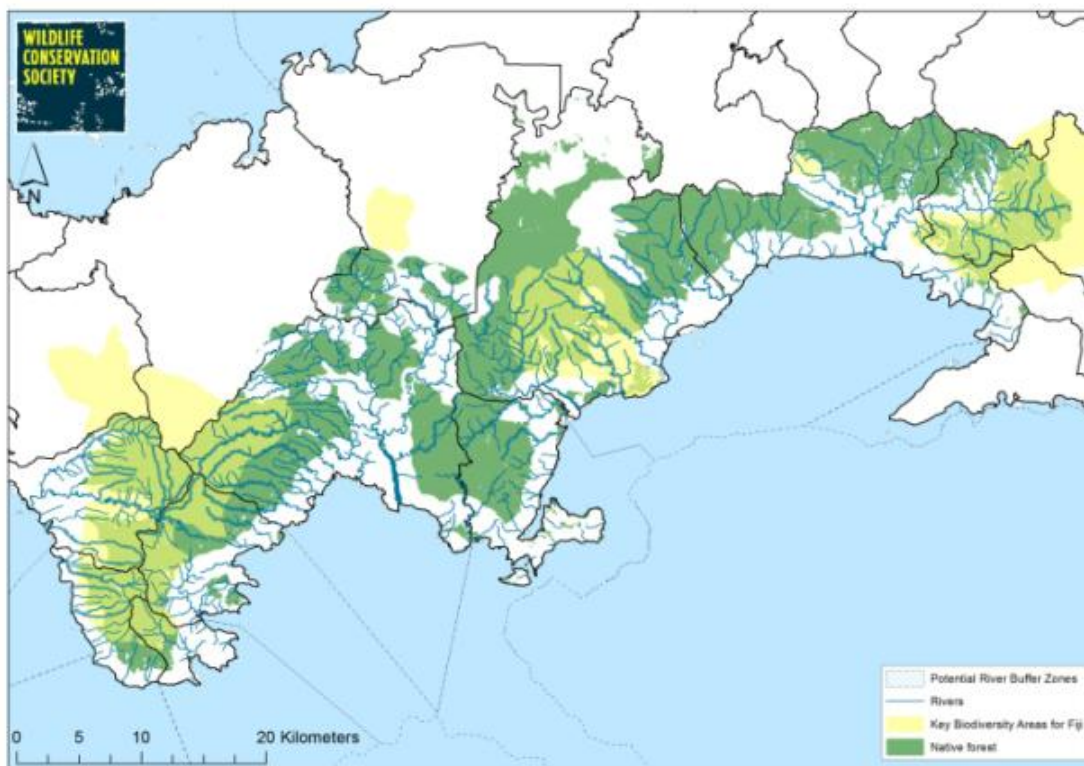


Figure 12: Potential RBZs identified by Marxan analysis.

Community Consultations

We selected the clans with the top 20 selection frequencies from the Community Forest Parks analysis as an initial list for consultation, and presented this to our Steering Committee in October. Five clans in Wailevu West district, Cakaudrove Province, were excluded from further consultation on the advice of the Steering Committee because they are already part of a Department of Forestry / SPC-GIZ project on sustainable forestry ('Drawa block').

To replace these 5 Drawa block clans, an additional 8 clans were added to the list for consultation from Wainunu and Koroalau districts; they had already proposed tentative boundaries for community forest parks but were not part of the Marxan selection. Possibly they were excluded from selection by Marxan because of the relatively high 'costs' on their land since they fall in mining exploration area and/or logging concessions.

We arranged initial consultation visits with these 23 clans across Vuya, Dama, Nadi, Solevu, Wainunu, Kubulau, Wailevu and Koroalau districts, from November 5-12, 2012. We used a consultation team made up of some of the Steering Committee members: WCS, Department of Forestry, iTaukei Land Trust Board and representatives from the Bua and Cakaudrove Provincial offices. Facilitator notes were drafted for each clan, laying out the any potential conflicts with establishing protected areas (e.g. with logging concessions, downstream hanging culverts) and highlighting interesting results from biodiversity surveys in their forests and rivers. These facilitator notes are included at

Appendix 1: Facilitator notes for initial consultations with clans. The consultations used printed maps with data showing the threats, administrative boundaries, biodiversity features and proposed areas for protection, including all of the features listed below (Figures 13 and 14):

- Clan land tenure boundaries
- Likely intact native forest
- Areas of steep slope
- Logging concessions
- Softwood and hardwood plantations
- Rivers and proposed river buffer zones
- Farming areas (mapped by communities in 2011 resource mapping exercise)
- Point locations of endemic plants & snails
- Point locations of previous bird & freshwater surveys
- Fiji’s national Key Biodiversity Areas
- Boundaries of any protected areas already proposed by communities

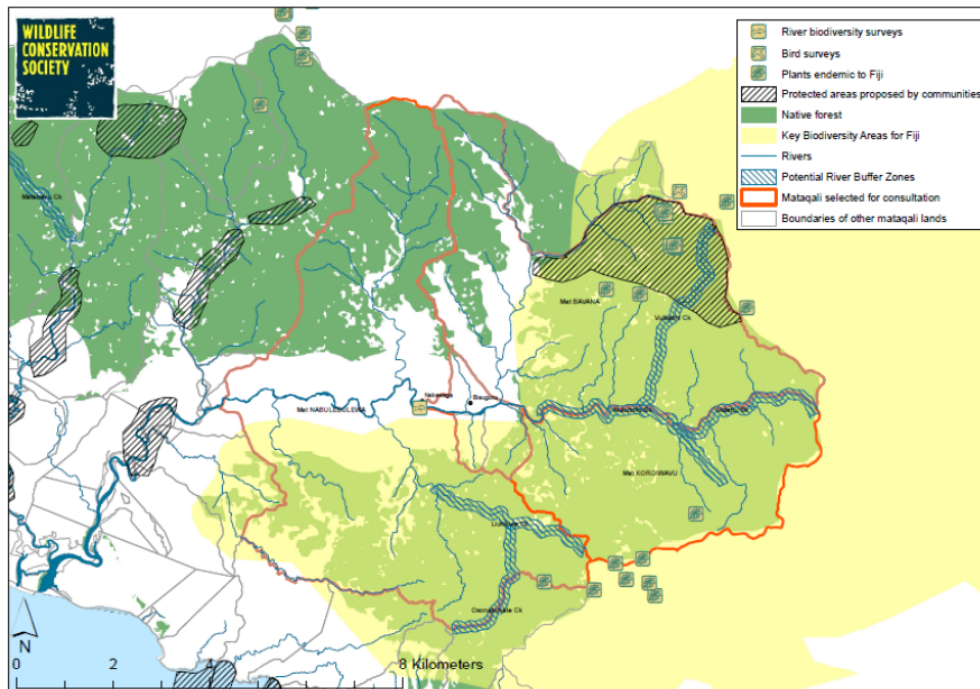


Figure 13: Example of map used in consultations, focusing on biodiversity elements. This example shows 3 clans in the district of Koroalau selected for consultation.

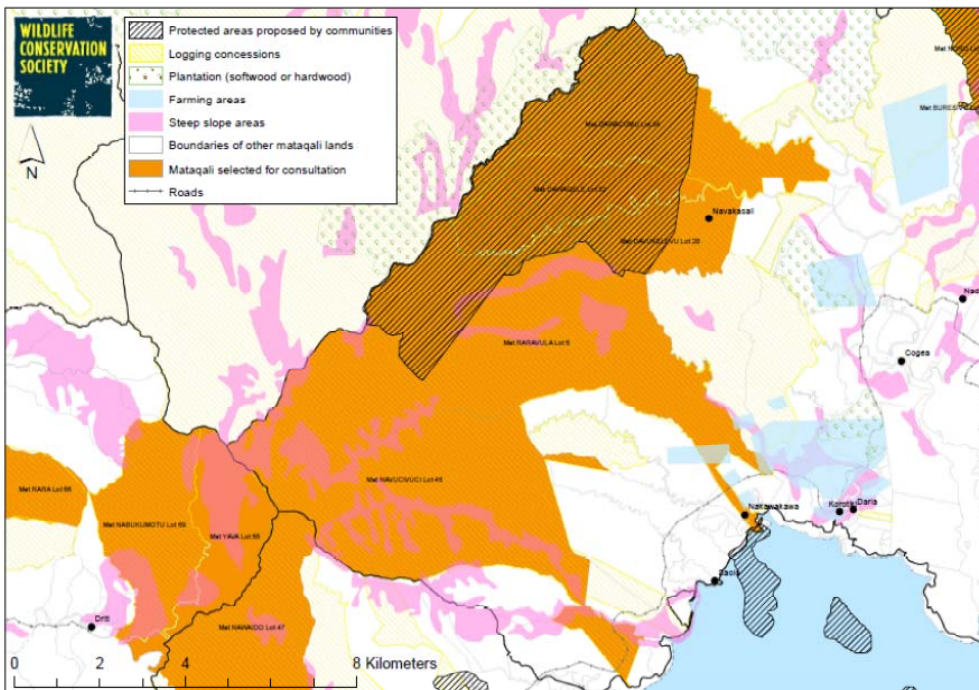


Figure 14: Example of map used in the consultations, focusing on threats and ongoing activities. This example is for land tenure parcels belonging to 5 clans (*mataqali*) in the western part of Wainunu District. The largest land parcel belongs to Mataqali Navucivuci, which was selected in all of the 100 Marxan runs, showing its importance in protecting the native forests in the region.

Consultations observed proper traditional protocols for visiting Fijian villages, and villages were informed through the Provincial Offices. Consultations were held in the format of a *talanoa* session around the kava bowl, to build relationships and trust with the communities. Unfortunately, some clans were unaware of the planned visit as they had not been properly informed by their Provincial Office. Contact phone numbers for all the clans were gathered during these initial visits and will be valuable for arranging the follow up consultations. Notes were made from each consultation visit, included below at Appendix 2: Notes from initial consultations with clans.

Conclusions and Next Steps

Initial consultations were held with landowners from 15 clans to discuss recommendations for places to establish community forest parks and river buffer zones based on the outputs of biodiversity surveys and our spatial prioritization. To date, 8,503 hectares of community forest park and river buffer zones have already been proposed by communities and discussed at initial consultation meetings, though we note that in most cases these areas were pre-existing sites identified from district-level ecosystem-based management planning workshops. Of these areas, 5,790 ha have been already endorsed as community forest parks in Kubulau and Wainunu districts, while 2,713 ha of community forest parks are awaiting endorsement in Wailevu, Nadi and Solevu districts. Further consultations within the clans and with WCS and partners are required before new areas are finalized to reach the targets of 1825 ha of new community forest parks and 100 ha of new riparian buffer zones. Outcomes from the initial

consultation visits indicate that there is good potential for at least 10 clans to progress to designating new community forest parks and/or river buffer zones. Follow up consultations will be conducted in February 2013, during which community members will be encouraged, if interested, to define boundaries of proposed protected areas and designate rules and management action plans.

Through the project implementation process to date, we have learned a few key lessons, which include:

- 1) The Marxan analysis conducted with rivers did not produce as many options for protection as expected – the results consistently selected the same river buffer zones (RBZs) for protection. This means that in the multiple iterations of a Marxan run, the solution (a network design) which meets the protection targets and minimizes the cost is always the same solution. Therefore we could not rank priorities – we could only produce a binary output of ‘good’ and ‘bad’ sites to establish RBZs. We decided to increase the protection targets to create a larger network of proposed RBZs so that the landowners had more choice in which RBZs to protect. In the future, a spatial prioritization exercise that takes a more simple approach using criteria in a GIS could be a better solution for identifying high priority RBZs than Marxan.
- 2) Making initial contact with the clans selected for the initial consultations was very difficult. We followed the proper communication protocols, as instructed by the iTaukei Affairs Board, using the Bua and Cakaudrove Provincial Offices to relay the times and dates of our visits to the communities. In Cakaudrove Province, this system works efficiently and communities were well informed and expected our arrival. However, In Bua Province, partly due to the remoteness of some villages but also because of poor communication from Bua Provincial Office to the villages, the communities were often not aware of the planned consultation and hence clan members were away from the village in Suva or at plantations. Yet, now that direct contact has been established with these clans (with a list of names and contact numbers), in future we will inform the Provincial Offices of our work and talk directly to the clans to schedule our visits.
- 3) Village schedules during the school holidays in December and January are too busy to allow any successful consultation visits. All the clans visited during the initial consultations confirmed that they would not be available until February for the follow-up visits. In the future, the Christmas holiday period should be avoided for scheduling consultations.

Appendix 1: Facilitator notes for initial consultations with clans

Mataqali Navakalama, Natua Village, Wailevu West

- This parcel covers 4055 acres (1641 hectares)
- No logging concession, although communities reported some logging at south west part of land when WCS did resource mapping surveys in 2011.
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010
- Naurere proposed Community Forest Park was already suggested on this mataqali land as part of our consultations for Wailevu EBM plan – would be good to know why was this patch chosen (seems to be near/overlap area that communities said were being logged)? Maybe because it is close to the village so easier to monitor/enforce.
- Good cover of native forest on most of their lands – see biodiversity map
- Discuss possibility of another reserve in the interior of their lands, perhaps including some areas of steep slope that are not appropriate for any logging.
- Bird survey was conducted by Vilikesa in 2004 found 28 different species (although no Globally Threatened Species such as Shy Ground Dove, Long-legged Thicketbird or Pink Billed Parrotfinch). Otherwise no endemic plants have been found here (maybe no one has looked!) or freshwater biodiversity surveys carried out
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish

Mataqali Nabulebulewa, Nakawaga Village, Koroalau

- This parcel covers 9400 acres (3804 hectares), of which about half the land is covered by one of Fiji's Key Biodiversity Areas (Mt Sorolevu KBA) – shown in yellow on the biodiversity map
- No logging concessions
- Good cover of native forest away from the roads and villages – see biodiversity map
- Discuss possibility of another reserve in the interior of their lands, perhaps including some areas of steep slope that are not appropriate for any logging.
- Discuss finding of Freshwater Biodiversity Surveys, July 2012:

Mataqali Koroiwavu, Nakawaga Village, Koroalau

- This parcel covers 3791 acres (1534 hectares), all of which is covered by one of Fiji's Key Biodiversity Areas (Mt Sorolevu KBA) – shown in yellow on the biodiversity map
- No logging concessions
- Refer to findings of Freshwater Biodiversity Surveys above. This mataqali covers the headwaters of Turiwai Creek/Nukubolu Creek, so a commitment to protect the forests surrounding this, and set up River Buffer Zones, could have significant downstream impacts

- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- Endemic plants have been recorded on their land, near the source of Wailoaloa Creek

Mataqali Bavana, Nakawaga Village, Koroalau

- Although this mataqali wasn't selected by the analysis, we have added them to the discussions because they have already proposed a forest protected area on their lands – Nukubolu reserve
- This parcel covers 6729 acres (2723 hectares), and more than half is inside one of Fiji's Key Biodiversity Areas (Mt Sorolevu KBA) – shown in yellow on the biodiversity map
- No logging concessions
- Refer to findings of Freshwater Biodiversity Surveys above. This mataqali covers the headwaters of Tuiwai Creek/Nukubolu Creek, so a commitment to protect the forests surrounding this, and set up River Buffer Zones, could have significant downstream impacts
- Many endemic plants have been recorded on their land
- Bird surveys by Vilikesa in Delaikoro forest in 2004 found 29 species including Shy Ground Dove – listed as Vulnerable on IUCN Red List

Mataqali Nadicake, Kilaka Village & Nadivakarua Village, Kubulau

- This parcel covers 2061 acres (834 hectares)
- The west part of their lands are covered by a Bauxite exploration area
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010
- No logging concession. Already part of the proposed Kilaka forest reserve.
- According to the map there is no land that they own which is of >30% slope – is this correct?
- The area not covered by the proposed forest reserve is for their gardening (check)
- Kilaka river is still free of invasive fish and earlier surveys of fish freshwater biodiversity found encouraging results (refer to Biodiversity map for survey locations)
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- Discuss short-term & long term economic (REDD+, protected areas fund, ecotourism) and environmental benefits

Mataqali Naqarani, Nakorovou Village, Kubulau

- This parcel covers 1446 acres (585 hectares) and almost the whole land parcel was added to the proposed Kilaka Forest Reserve in 2011, included in the updated EBM plan for Kubulau
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010
- Only a small logging concession in the south – is this correct? Look at map and discuss

- According to the map there is no land that they own which is of >30% slope – is this correct?
- The area not covered by the proposed forest reserve is for their gardening (check)
- Kilaka river is still free of invasive fish and earlier surveys of fish freshwater biodiversity found encouraging results (refer to Biodiversity map for survey locations)
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- Discuss short-term & long term economic (REDD+, protected areas fund, ecotourism) and environmental benefits

Mataqali Navucivuci, Saolo Village, Wainunu

- This parcel covers 7786 acres (3151 hectares)
- This mataqali is a top priority, because of their large areas of native forest. However, a very large logging concession covers all their lands, although this won't all be logged. Communities need to think about siting a protected area on steep slopes to avoid conflict with FFI (the logging company) and possibly moving the protected area to an unlogged area in future.
- Note that the road to access this area is being built and the logging is expected in the next 5 years
- Discuss possibilities to work with neighbouring mataqali Raravula to get a large contiguous chunk of forest and joining these to the proposed Rasakalau protected area (covering mataqali Dawacumu, Dawaqele and Davukelevu).
- Endemic plants have been recorded here, but no freshwater fish or bird surveys
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish

Mataqali Dawacumu, Navakasali Village, Wainunu

- Although this mataqali wasn't selected by the analysis, we have added them to the discussions because they have already proposed a forest protected area on their lands
- This parcel covers 3561 acres (1441 hectares)
- All this land parcel is under logging concession
- Part of their lands are covered by a Bauxite exploration area
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- Surveys of Wailoaloa creek (at the northern end of these mataqali lands) in July/Aug 2012 found disappointing results (first paragraph is from the site further downstream on mataqali Nakorolilai land):

Mataqali Dawaqele, Navakasali Village, Wainunu

- Although this mataqali wasn't selected by the analysis, we have added them to the discussions because they have already proposed a forest protected area on their lands
- This parcel covers 1806 acres (731 hectares)

- No logging concession
- Part of their lands are covered by a Bauxite exploration area
- Their lands include the only known location of an endemic plant, collected in 1934! *Guioa cappillacea*(Sapindaceae)
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- Surveys of Dawacumu creek in July/Aug 2012 found excellent results, the best of 9 sites surveyed:

Mataqali Davukelevu, Navakasali Village, Wainunu

- Although this mataqali wasn't selected by the analysis, we have added them to the discussions because they have already proposed a forest protected area on their lands
- This parcel covers 1579 acres (639 hectares)
- All this land parcel is under logging concession
- Part of their lands are covered by a Bauxite exploration area
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010

Yavusa Raravula, Nakawakawa Village, Wainunu

- This parcel covers 6049 acres (2448 hectares)
- This mataqali is a top priority, because of their large areas of native forest. However, a very large logging concession covers all their lands, although this won't all be logged. Communities need to think about siting a protected area on steep slopes to avoid conflict with the logging company and possibly moving the protected area to an unlogged area in future.
- Note that the road to access this area is being built and the logging is expected in the next 5 years
- Discuss possibilities to work with neighbouring mataqali Navucivuci to get a large contiguous chunk of forest and joining these to the proposed Rasakalau protected area (covering mataqali Dawacumu, Dawaqeale and Davukelevu).
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- Nalomate River on their lands was part of the 2012 Freshwater biodiversity surveys:

Yavusa Maururu (extinct Mataqali Noro land), Nadua Village, Wainunu

- Although this mataqali wasn't selected by the analysis, we have added them to the discussions because they have already proposed a forest protected area on their lands
- This land parcel covers 1451 acres (587 hectares)
- All land is covered by a logging concession, but there is also lots of steep slopes, so hopefully only small patches would be logged
- This site is covered by Maururu West protected area – need to discuss how this fits with logging concession (potential resiting after logging, e.g. to steeper ground?)
- In terms of biodiversity, the southern part of the mataqali is covered by native forest, with the northern part covered by mahogany plantation

- Endemic plants recorded in the north, but probably before the mahogany plantation!
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- There are no invasive species known in the Wainunu River

Mataqali Bekalevu, Nadua Village, Wainunu

- Although this mataqali wasn't selected by the analysis, we have added them to the discussions because they have already proposed a forest protected area on their lands ((Maururu West and East)
- One land parcel covers 902 acres (365 hectares) (Lot 13, NLC 156), the other covers 1312 acres (531 hectares) (Lot 26, NLC 188)
- All land in Lot 13 is covered by a logging concession, but has also been nominated to be part of Maururu West proposed forest reserve – discuss what this might mean in future
- All forest in Lot 13 is mahogany plantation, not native forest
- Lot 26 (Maururu East reserve) is not under logging concession but is a mahogany plantation
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- There are no invasive species known in the Wainunu River

Mataqali Buresivo, Nadua Village, Wainunu

- Although this mataqali wasn't selected by the analysis, we have added them to the discussions because they have already proposed a forest protected area on their lands (Maururu West)
- This land parcel covers 1535 acres (621 hectares)
- In terms of biodiversity, the southern part of the mataqali is covered by native forest, with the northern part covered by mahogany plantation. This mahogany plantation is also the part included in Maururu West proposed forest reserve (refer to map) – discuss what this might mean in future
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- There are no invasive species known in the Wainunu River

Mataqali Navunivuvudi, Nadua Village, Wainunu

- Although this mataqali wasn't selected by the analysis, we have added them to the discussions because they have already proposed a forest protected area on their lands (Maururu East)
- This land parcel covers 1609 acres (651 hectares), not under logging concession
- Part of their lands are covered by a Bauxite exploration area (not where the Maururu reserve is located)
- Most lands are mahogany plantation

- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010
- There are no invasive species known in the Wainunu River

Mataqali Batinisalaivanua, Nasolo Village, Nadi

- This parcel covers 2293 acres (928 hectares), all of which is under logging concession
- Almost all lands are part of one of Fiji's Key Biodiversity Areas (Mt Navotuvotu KBA) – shown in yellow on the biodiversity map
- Native forests covers most of the lands
- The land does not appear to have particularly steep areas (refer to pink parts on map)
- Need to discuss that any proposed community forest park may have to be moved when logging happens, bearing in mind that logging is unlikely to cover the whole area of the concession
- Endemic plants recorded along Sigasigau creek
- Unfortunately, this river does have overhanging culverts downstream, which would block migration routes for endemic fish. Consider building fish ladders for these culverts?

Mataqali Nawaido, Nasawana Village, Nadi

- All lands are under logging concession
- This land parcel covers 3284 acres (1329 hectares)
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010
- All lands are covered by native forest according to our maps, with most of this area inside one of Fiji's Key Biodiversity Areas (Mt Navotuvotu KBA) – shown in yellow on the biodiversity map
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish

Mataqali Navilobo, Makolei Village, Solevu

- This land parcel covers 2167 acres (877 hectares)
- Almost all the land is covered by native forest, and over half (in the north) is part of one of Fiji's Key Biodiversity Areas (Mt Navotuvotu KBA) – shown in yellow on the biodiversity map
- About 25% of the land parcel (the northern end) is under logging concession – look at map & discuss with communities. Avoid this area for any proposed protection.

- Discuss the proposed protected area for the rivers and forests beside rivers – e.g. how far from river should this extend?
- Unfortunately, this river does have overhanging culverts downstream, which would block migration routes for endemic fish. Consider building fish ladders for these culverts?

Mataqali Rokowaqa, Nakoroba Village, Vuya

- This land parcel covers 1898 acres (768 hectares)
- No logging concession.
- Almost all their land is mapped as native forest, all inside one of Fiji's Key Biodiversity Areas (Mt Navotuvotu KBA) – shown in yellow on the biodiversity map
- Likely that this mataqali has not had many workshops or awareness raising, so will need to be clear on the ecosystem service benefits. Can also mention the WCS reef resilience surveys planned Nov-Dec.
- Communities didn't sign up as willing during NFMV's previous work but may not have been able to attend
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish

Mataqali Malawai, Nadawata Village, Vuya

- This land parcel covers 2538 acres (1027 hectares)
- No logging concession, most of lands covered by intact forest although not as isolated as Yava
- All land is inside one of Fiji's Key Biodiversity Areas (Mt Navotuvotu KBA) – shown in yellow on the biodiversity map
- Communities didn't sign up as willing during NFMV's previous work but may not have been able to attend
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish

Mataqali Rara - Nacolo, Naruwai Village, Dama

- This land parcel covers 2390 acres (967 hectares)
- A logging concession covers this whole parcel of land. Need to discuss that any proposed protected area may have to be moved when logging happens, therefore best to place in steep ground where logging is less likely. Logging won't cover the whole area.
- The most interior part of their lands is mapped as native forest, and this is the part which falls inside one of Fiji's Key Biodiversity Areas (Mt Navotuvotu KBA) – shown in yellow on the biodiversity map
- Record of endemic plants on Warimatutu Creek

- There are no invasive species known in the Dama River
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- This mataqali expressed willingness to work towards Permanent Forest Estates in NatureFiji-MareqetiViti's consultations in 2010 (but might have been mataqali members from a different village)

Mataqali Yava, Driti Village, Dama

- This land parcel covers 1522 acres (616 hectares)
- No logging concession, and lands are inside one of Fiji's Key Biodiversity Areas (Mt Navotuvotu KBA) – shown in yellow on the biodiversity map
- This parcel of land has almost full native forest cover and would be an excellent area for protection (also a large proportion of steep areas)
- Endemic plants have been recorded on their land
- Communities didn't sign up as willing during NFMV's previous work but may not have been able to attend
- There are no invasive species known in the Dama River
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- The Dama River on their lands was part of the 2012 Freshwater biodiversity surveys and the sites surveyed were found to be in excellent condition:

Mataqali Nabukumotu, Driti Village, Dama

- This land parcel covers 2212 acres (895 hectares)
- There is a logging concession over this whole parcel of land. Need to discuss that any proposed protected area may have to be moved when logging happens, therefore best to place in steep ground where logging is less likely – e.g. steeper areas in south. Logging won't cover the whole area.
- Numerous endemic plants have been recorded on their lands, including one known only from this location (called Niuniu)
- There are no invasive species known in the Dama River
- There are no known downstream obstructions (hanging culverts) to their rivers, so protecting the River Buffer Zone could lead to good populations of migrating fish
- The Dama River on their lands (bordering mataqali Yava) was part of the 2012 Freshwater biodiversity surveys and the sites surveyed were found to be in good condition:

Appendix 2: Notes from initial consultations with clans

Mataqali (clan) name, Village, District	Comments from initial consultation visits, 5th – 12th November 2012	Initial consultation successful	Continue to next consultation
Navakalama, Natua Village, Wailevu West	some women and man turned up they were members of the mataqali, whereas others were busy with their daily chores, (we need to confirm parcel cover), mataqali owners are not aware of the forest protected area, they only aware of the streams, the area that they wanting to log is not within the proposed area but inorder to reach the proposed logged area they will need to cut through the proposed area, they request more awareness and consultation within the mataqali together with Forestry, TLTB & other stakeholders . Mataqali members need clarification from TNK about the proposed areas and rules in place	Yes	Yes
Nabulebulewa, Nakawaga Village, Koroalau	Members of this mataqali were present in large numbers, compared to the other 2, a common issue was raised but it had nothing to do with this consultation, I advised if they could relay proposed area information to their Bose Vakoro and inform us when they have made a decision about it, issue raised will be addressed by Provincial Office (ART) , proposed areas need to be agreed by 70% of the mataqali members, also the TNM was not in the village as he was away in Suva and has been there for the last couple of months, turn out was great we had lots of community members who attended the talanoa session, they have lots of resources available but they need to monitor and manage,they questioned WCS on what terms can we compensate them once they give up their forests and streams to be protected, only brief answer I gave was, protecting all your forests will later provide you with clean drinking water, better protection against disaster, readily availability of medicinal plants, food security ; Forestry officer discussed about the Soweni Nursery which can be a long term goal for the mataqalis involved in this village but they could look into other alternative sources of livelihood for a short term period. They also requested Forestry to help them in setting up a small nursery which Vili agreed to do, but they will need to formally write to DFO northern for	Yes	Yes

	<p>this, we noticed alot fo differences amongst the mataqali members, we advise them that the proposed areas willneed to be taken back tothe bose vakoro and everyone be informed about it and they all need to agree. The Acting Roko tui has adviced then that the Roko in charge of this area will visit them again for a talanoa session regarding their issues, we informed them that nothing is confirmed yet and this is a consultation process.</p>		
Koroiwavu, Nakawaga Village, Koroalau	<p>they will need to take this to their bose vakoro and inform members of the mataqali they will then finalise everything with everyones consent, Waikoravaloa as listed should be corrected to Wailoaloa</p>	Yes	Yes
Bavana, Nakawaga Village, Koroalau	<p>they will need to take this to their bose vakoro and inform members of the mataqali they will then finalise everything with everyones consent, Tuiwai as listed should be corrected to Turiwai</p>	Yes	Yes
Nadicake - Kilaka & Nadivakarua, Kubulau	<p>they will need to clarify there parcel cover and if this could be converted to acres so it can be easy for them, we will need to work with the map from Forestry to cross check parcel cover, logged areas and unlogged area.</p>	Yes	Yes
Naqarani, Nakorovou Village, Kubulau	<p>they need clarification of their parcel cover and they have not logged so far, since it's a very small portion</p>	Yes	Yes
Noro, Nadua Village, Wainunu	<p>as for now, this mataqali is now extinct since none of its members exist so this piee of land now belongs to the Yavusa Maururu</p>	No	No
Bekalevu, Buresivo, Navunivuvudi (& Yavusa Maururu for ext. Mat Noro) in Nadua Village, Wainunu	<p>Although the place is under logging concession, once its logged, FFI will still abide by the Forest act and the logging Code of Harvest, which informs us the if they propose within the concession areas chances of it destroyed is minimal as Forestry is now monitoring all logging activisties around Vanua Levu, all members of this mataqali need to find out how much land do they have (Qele kovukovu)</p>	Yes	Yes
Davukelevu, Dawaqeli & Dawacumu - Navakasali Village, Wainunu	<p>most of them attended a funeral in Dreketi</p>	No	Yes
Navucivuci, Saolo Village, Wainunu	<p>check the parcel cover and convert this to acres, message will need to be conveyed to mataqali members as most of them were out on a funeral</p>	Yes	Yes

Raravula, Nakawakawa Village, Wainunu	although there was a death in the village we manage to meet with the head of this mataqali who advised that he will call a meeting with the mataqali members to clarify this to them and they will proposed another site	Yes	Yes
Batinisalaivanua, Nasolo Village, Nadi	we were told that they are having a district meeting, only to find out from Provincial office a day later that it was later cancelled	No	Yes
Nawaido, Nasawana Village, Nadi	we were told that they are having a district meeting, only to find out from Provincial office a day later that it was later cancelled	No	Yes
Naivilobo, Makolei Village, Solevu	most of them attended a funeral in Nawaido	No	Yes
Rokowaqa, Nakoroba Village, Vuya	this mataqali members now resides in Nakoroba which is just their piece of land, but all of them now works and resides in Suva	No	No
Malawai, Nadawata Village, Vuya	this mataqali resides in Nadawata instead of Wairiki village, visited the village and most members of this mataqali are in Suva	Yes	Yes
Rara - Nacolo, Naruwai Village, Dama	this area was logged out 20 years ago and they had replanted it with pine, they have a logging concession with Fiji Pine, they are not aware of THE pfe consultation with NFMV, there are quite a lot of Rara mataqalis and they reside also in Banikea and other neighbouring villages	Yes	No
Yava, Nabukumotu - Driti Village, Dama	mataqali members were not in large #s, so they will need to advise other mataqali members on this, maybe we can visit them on our next round for confirmation	Yes	Yes