



Tunuloa BIORAP – a rapid biodiversity assessment, archaeological survey of the Tunuloa catchment and *Mataqali* consultations to confirm interest to formalize existing Terrestrial Protected Area

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Abstract - *The Global Environment Facility (GEF) funded Fijian Government's Ridge to Reef (R2R) project focuses on activities at the catchment level for six catchments: three on Viti Levu (Tunuloa, Waidina and Ba) and three on Vanua Levu (Tunuloa, Vunivia and Labasa). The Tunuloa Catchment is an important area for the preservation of biodiversity in the southeastern Vanua Levu. The overall survey was conducted to compile a flora and fauna assessment of the forests and the riverine ecosystems in the Tunuloa Catchment and an archaeological survey in accordance with Fiji R2R Project Activity. Findings from the survey include, intact patches of native forest in the Tunuloa Catchment, flora that are rare or threatened, endemic fauna, and culturally significant archaeological sites. These indicate a need for forest rehabilitation, biodiversity monitoring, and formal protection of the Natewa Tunuloa forest.*

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1. Introduction

Tunuloa is one of six priority catchments for the Fiji R2R Project, the other five being: the Ba, Tuva and Waidina catchments on Viti Levu; and the Tunuloa, Labasa and Vunivia catchments on Vanua Levu. Tunuloa catchment was selected having the large remaining tracts of forests on eastern Vanua Levu. The forests in the peninsula still contain remnants of old growth primary forest and is a priority for biodiversity conservation and improved land management in order to enhance sustainable livelihoods, increase carbon sequestration and reduce erosion, flash flooding and downstream sedimentation and provide vital ecosystem services to and rural communities on eastern Vanua Levu. Due to its high biodiversity value, various interventions have been carried out in the past to conserve the globally threatened Silktail (*Limprolia victoriae kleinschmidtii*) endemic to Natewa-Tunuloa and Taveuni. Recently in 2017, a newly identified swallowtail butterfly (*Papilio natewa*) was recorded in these forests and was the first sighting for such species in Fiji. The lowland forests in the area are still unlogged and have been conserved by the community through community agreements and this has been the focus of a multi-taxa biodiversity assessment carried out in November 2020 to document and record the flora and fauna of the area.

The vanua of Tunuloa and Cakaudrove holds a remarkable history of warfare, which is clearly articulated in many literatures written by missionaries, early European settlers and scholars. Similarly, the area is rich with undocumented history in the form of myths, legends and the manifestations of traditional gifts in the various districts.

The Tunuloa Catchment

The Natewa Tunuloa Peninsula is part of the island of Vanua Levu, one of the two largest islands that comprise Fiji, and was assigned as a Key Biodiversity Area (KBA) by Conservation International in 2005. The forest on the peninsula is identified as a Site of National Significance in the National Biodiversity Action Plan and the area is also designated as an Important Bird Area (IBA) by BirdLife International. High biodiversity of gobids and birds and the presence of the seven of the nine subspecies endemic to Vanua Levu island, such as the Silktail (*Lamprolia victoriae*), make this an important area to conserve. The lowland forest on the Peninsula still retains old growth forest, although this is under increasing threat from agriculture and kava cultivation. In 2009 local sub-clans (*mataqalis*) that own the forest land decided to protect an area of 6,000 hectares (ha) using sustainable management methods.

The area has suffered extensive logging in the late 80's which continued into the 90's and was unsustainable, leading land degradation and intrusion of invasive plants and animals into the forests. The Natewa-Tunuloa catchment is source for drinking water for all the villages in the peninsula that includes Drekeniwai in the lower Natewa Bay and stretches right across to Loa. The Buca River system has high goby diversity, with at least a third of the endemic species of Fiji being present here and the largest breeding population of the endemic Orange-Spotted Scaleless Goby, *Schismatogobius chrysonotus* (Jenkins et.al, 2009). The unsustainable logging and poor landuse practices have had huge impacts on water quality and the marine resources in the area.

In 2009, 11 *Mataqali's* signed a Memorandum of Understanding to seek assistance for forest conservation with BirdLife International. Management options were considered after consultations with the relevant *mataqalis* and livelihood opportunities were also identified to increase the conservation value of the forests. *The Sisi Initiative Site Support Group*, a community volunteer group within the 11 *mataqalis* was also established with a specific goal to conserve and sustainably manage the forests and its resources.

The Sisi Initiative Site Support Group was established to manage natural resources around the periphery of the Natewa-Tunuloa Important Bird Area. The organization has established a more than 600-hectare community protected forest and developed alternative livelihood options for the area's indigenous landowners. Developed in response to drivers of deforestation and degradation including illegal logging, forest fires, overgrazing, agricultural encroachment and invasive species, the organization uses an innovative incentive scheme to protect the globally important bird and wildlife species in Natewa-Tunuloa. Communities signed a Memorandum of Understanding in which they agreed to protect the community forest and refuse logging concessions. In return, the initiative provides alternative livelihood training and projects in beekeeping, poultry, handicraft and jewelry-making, bakery and pastry-making, and sustainable agricultural practices. The group's model farm and tree nursery also help to reduce deforestation. The initiative has been used as a learning model for community-based conservation and forest management across Fiji (United Nations Development Programme, 2013).

After 10 years since the signing of the MoU by the 11 *mataqali's*, the next step is reviewing the effectiveness of conservation action and interventions by the communities and Birdlife International. A review of the MoU is critical in assessing the benefits and lessons learnt from the community conserved protected area. Through the Fiji Ridge to Reef Project the respective 11 *mataqalis* were revisited and

consultations had with the men, women and youth who may have benefitted indirectly or directly from the community conserved forests.

2. Objective

The remaining forested areas in the Upper Tunuloa Catchment are remnants of Tropical Dry Forest, one of Fiji's most threatened ecosystems (Keppel and Tuiwawa 2007), which should be considered for future protection. The objectives of the study conducted were to:

Document the different vegetation types and habitat types present in the Upper Tunuloa study area

Carry out a multi-taxa biodiversity assessment of the upper Tunuloa catchment

Carry out an associated archaeological survey to assess the time-depth historical cultural importance of the area

Discuss the community protected area status, *mataqali* commitment to the PA, benefits and any emerging issues arising from the PA.

Ensure ownership and commitment by relevant and interested *mataqalis*.

Discuss the possibility of including more *mataqalis* into the community forest protected area.

3. Methodology

4.1 Vegetation Survey

The main scope of the vegetation survey was to survey the forested area in the Natewa and Tunuloa Peninsula. The assessment of the vegetation focused almost exclusively on forested areas, rather than non-forested areas. For the habitat-typing the most prominent topographical feature of the forested area was used and categorized as follows:

- Slope and Ridge top - forested area found on slopes with gradients ranging from 10 to 85 degrees and those found on top or along ridges of mountains or ranges. The width of such ridges could range from less than meter, up to 20 meters, with an undefined length.
- Flat - forested areas with gradients ranging from 0 to 10 degrees. These areas also included raised river flats and flood plains.

The quantitative assessments of different forest types were based on the methodology devised by Tuiwawa (1999), which uses between four and ten 10m x 10m plots to sample and record tree and other plant species along a transect. This validates if a tree species assemblage assessed is representative of the forest type.

4.2 Multi-taxa Biodiversity Assessment

i) Flora - The flora survey comprised two main parts. Firstly, checklists were compiled via a literature survey of A.C. Smith's *Flora Vitiensis Nova* and by searching the South Pacific Regional Herbarium's database for plants previously recorded from the study area. The second part involved field survey and collection where plants were sampled opportunistically while hiking and from within vegetation plots in the Natewa and Tunulua forests and the areas surrounding Mt. Uluiqala.

ii) Terrestrial insects - A number of key habitat types within secondary forests (i.e. within gully, slopes and ridges) and a pine plantation were surveyed within selected vegetation plots to maximise the chance of encountering individuals of focal species as well as to adequately sample the diversity of insects. Leaf litter surveys were conducted targeting different habitat types (i.e. gully, slopes and ridges). 50m transects were sampled within each vegetation sub-plots and leaf litter sampling was undertaken at 50m intervals using 1m² quadrats. This sampling technique specifically targets insects dwelling in leaf litter which have important ecological functions in the decomposition, nutrient cycling, predation etc. Nocturnal surveys targeting night active insects were sampled using light traps.

iii) Freshwater macroinvertebrates and flora - Samples were collected across a total of 10 sites using a kicknet. The sites were selected to cover a variety of micro-habitat types within different freshwater bodies in the Natewa and Tunulua Catchment, in order to assess macroinvertebrate community composition that is representative of the area.

iv) Freshwater fish - A total of ten sampling stations were sampled during this survey, each station being about 100 – 150 meters in length. The stations were sampled from different localities and systems within the Tunulua Catchment. Depending on the characteristics of the site, a large seine net, a medium pole seine net, or observations using mask and snorkel, were used to collect fauna from the river or stream. Approximately one hour was spent sampling at each site.

v) Herpetofauna – Herpetofauna were assessed using sticky traps, night transect active search, and daytime active and opportunistic search. Sticky traps were placed at 50m intervals along a 1km transect

and left overnight. Night searches were conducted at least 30 minutes after sunset for two hours, along streams and creeks. The main target species for night searches were the two Fiji endemic frogs. Daytime active and opportunistic search involved checking sticky traps and searching under debris, dead wood, fallen branches, under rocks/boulders and under dead bark.

vi) Birds - The survey was carried out both systematically and opportunistically. The systematic survey involved the Variable Circular Plot Method. Opportunistic bird surveys were also carried out, which included bird observations outside the morning bird counts surveys, while moving from one area to another, and while resting.

vii) Mammals – Three methods comprised the mammal survey. The rodent surveys followed the similar methods developed by the Pacific Invasive Initiative (Resource Kit for Rodent and Cat Eradication). The trapping stations were placed together with the herpetofauna survey stations. Each station contained two snap traps baited with roasted coconut and a mammal cage baited with tuna flakes. A total of 16 stations were established, 50m apart, to cover a large section of the the different sampling localities within the catchment. Visual sightings were recorded for the presence of rodents, mongoose and cats, most of which were carried out after 4pm during active periods. Visual sightings of bats were also conducted at dawn and dusk from lookout points. Community discussions with village elders and pig hunters were also an opportunity to gather valuable information on the location of bat roosts and caves.

4.3 Archaeological Survey

General areas and specific locations of archaeological sites were documented and mapped based on community discussions and surface reconnaissance.

4.4 Mataqali Consultations

Mataqali discussions involved all the men women and youth that are part of the *mataqali*. Women that have been married into the *mataqali* are also involved in the discussions. The men, women and youth were separated into groups and topographic maps were used to highlight areas that are still protected and areas that have been encroached by agriculture. Discussions were also centred on benefits from the community protected area, challenges and emerging issues after the 10 years of protection. Butcher papers were provided to capture key discussion points.

5 Results

3.1 Vegetation Survey

The Ministry of Forestry has done vegetation work in the Natewa-Tunuloa Peninsula through the National Forest Inventory (NFI) Project. In the last NFI survey carried out, nine (9) forest types are identified to be present. However, the largest percentage area is covered by Non-forest (33%), followed by Multiple Use Forest-Open Forest (31%). Refer to map and table below.

3.2 Multi-taxa Biodiversity Assessment

- I. Flora – The Bio RAP identified the vegetation types present in the Natewa-Tunuloa Peninsula area based on Mueller-Dombois (1998). Five main vegetation types are identified – Cloud (>650m asl), Upland (>450m<650 asl), Lowland (>20m <450m asl), Coastal-Littoral (<20m asl) and Mangrove vegetation. The Cloud and Upland Vegetation only cover 0.5% and 5% of the total area but they are the most critical systems in terms of the R2R project that needs to be protected. The Lowland Vegetation is the most dominant vegetation type covering 59% of the total area but this includes the intact primary rainforest, dry forest, hardwood plantation, softwood plantation and secondary forest systems. Non-forest vegetation is the second dominant with 28% coverage.
- II. Terrestrial insects - A total of 682 insects were sampled from the four sampling techniques that were employed within the sub-plots. The most abundant taxa sampled using leaf litter and light trap techniques were the *Coleoptera* (beetles) recording 21 families sampled within the assessment areas. The richness of Coleopteran families within the sampled sites at Natewa is quite remarkable and suggests that the forest system is in good health. From leaf litter sampling alone, the beetle families *Staphylinidae* (rove beetles) and *Carabidae* (ground beetles) were the most commonly encountered. *Staphylinids* have special ecological roles primarily as predators but are not discriminatory feeders; they are also scavengers and can consume detritus. On the other hand, within natural systems, Carabid beetles are important indicators of pollution, progress in restoration efforts, and habitat fragmentation and conservation tactics. Within the sites at Muana, Natewa i.e. upland and lowland forests, it was evident from the samples that the upland forest areas within the Buca Catchment were most intact and had a greater diversity (beetle family richness and abundance) for *Coleoptera* which serves as a good indicator of the health of the forest and the

ecosystem services they support within leaf litter and soil habitats such as soil processing, herbivory, decomposition, seed dispersal etc.

1km transects for sampling the recent invasive ant, *Technomyrmex albipes* commonly known as the white-footed ant (WFA) was also conducted. The invasive WFA seems to have displaced pre-existing invasive ants in Fiji and have been responsible for plant infestations resulting in death and damage to plants. At Natewa, the 1km transect was set at Mika Tings Farm running into the lowland forest system focusing on the invasive white-footed ant species, *Technomyrmex albipes*. This survey showed an absence of the invasive WFA within the farm area and thus no further incursion into the forested areas.

- III. Freshwater fish - A total of nine species (five families) were documented from the ten sites surveyed. A total of five species from the family *Gobiidae*, two species from the family *Kuhliidae* and one species each from the family *Anguillidae*, *Eleotridae* and *Sygnathidae*. The giant marbled eel *Anguilla marmorata* and gudgeon *Eleotris fusca* were the most abundant fish caught. A total of 78 fish were caught across the ten sites.
- IV. Herpetofauna – The presence of the Fiji ground frog, and the skink *E. trossula* in Tunuloa is of conservation interest and highlights the need for more research and monitoring. There is opportunity for research within the Tunuloa to contribute towards the little-known ecology, phenology, and distribution of herpetofauna in Vanua Levu.
- V. An investigation of the interactions between introduced mammalian predators, introduced herpetofauna species and native herpetofauna populations to devise invasive species management regimes within the Tunuloa catchment will contribute to the value of the area as a biodiversity sanctuary. The presence of the two invasive geckoes at the Tunuloa survey sites questions the quality of the habitat at these sites and flags an assessment into the incursion pathway for the two invasive geckoes. Agricultural activities need to be monitored closely as these could be a pathway for invasive species incursion into upland forests within the Tunuloa catchment.
- VI. Birds - Of the 35 species recorded during the survey, 30 are native species (16 being endemic to Fiji) and five introduced species. Four species recorded are of conservation species with the Natewa Silktail being the most significant species as it is the only bird species endemic to the Natewa-Tunuloa Peninsula and is listed as Vulnerable of becoming extinct (IUCN Red List).

Introduced bird species were also recorded during the survey which signifies the evidence of disturbance and human impacts occurring in the study area. Two of the four introduced species recorded during the survey are regarded as invasive species being listed in the worlds 100 top invasive species.

- VII. Out of the five habitat types that were surveyed the forested habitats showed more diversity and abundance. Introduced bird species showed higher diversity and abundance in highly disturbed habitats. The Vulnerable Natewa Silktail was only recorded in the three forested habitats: secondary, lowland, and upland-cloud forest. However, it was more abundant in the intact forest systems (lowland and upland) with little or no human disturbance. The Friendly Ground-dove on the other hand was recorded from the Littoral-coastal flat forest, secondary forest, and lowland forest.
- VIII. Mammals - The two bat species, the Samoa and Pacific fruitbats or flying foxes, beka and beka vula or beka lulu (*Pteropus samoensis* and *P. tonganus*) were sighted as fly-overs within the study site, but none were observed to be actively roosting nearby. Although *P. samoensis* was sighted over the upland forests flying across to the ridge adjacent to the study site, only two individuals were sighted during the survey. *P. tonganus* was recorded around the edges of the forests and close to the village. The invasive mammals recorded included the two main species of rodents, the Polynesian and black rats (*Rattus exulans* and *R. rattus*), the small Indian Mongoose (*Herpestes auropunctatus*), and The Indian brown mongoose (*Herpestes fuscus*). Feral pigs and feral cats were also recorded.

8.1 Archaeological Survey

Most of the archaeological and cultural sites documented during the Tunuloa biodiversity rapid assessment are clearly intact as most of the sites were thickly covered with foliage of creepers, vines and undergrowth. This indicates that not many people utilize the surrounding forest area for hunting and farms have not extended way up into the mountains. This is most probably due to its elevation and rugged locations. However, archaeological sites that are situated on lower elevations such as the ones near Naqaravutu, Vusasivo, Wailevu and nearby villagers, are prone to agricultural threats.

5.4 Mataqali Consultations

A number of critical issues were raised relating to land tenure and the protected area. One of the critical issues raised was related to the security of the committed land and benefits anticipated as a result of their sacrifice and commitment to protect their land and the unique biodiversity that depend on it. The

protection was also to ensure that the water sources and all the forest ecosystem services provided by their forests for their families and future generations were maintained.

Six of the 11 *mataqalis* raised the issue of iTLTB not recognising the commitment and agreement (signed MOU) and they (iTLTB) were leasing parcels of the same land that was committed for protection through the MOU. This happened despite the *mataqali's* involving iTLTB over the consultation period and through to the signing of the CCA/MOU.

The MOU was an agreement between the parties (11 *Mataqalis* and Birdlife International) with no legal jurisdiction hence the iTLTB had the powers to lease the land to enhance its provincial development. The said land, leased under an agricultural lease is situated outside reserved *mataqali* land and thus legally available for lease by the iTLTB.

The second critical issue raised by six of the 11 *Mataqali's* consulted was that they were not aware of the community conservation agreement through a signed MOU. The *Turaga ni Mataqali* (Head of the Clan or land owning units) and the village elders that did sign the MOU did not communicate the agreement with the *mataqali* members. As such, *mataqali* members were not aware of the protected area boundaries within their own land. This had implications on the ability of the *mataqali* members to observe the “tabu” (protection) on the land/forest committed by the head of the 11 *Mataqalis* (elders).

Other critical issues raised (by 27% of the *mataqalis* consulted) that also affected the ability of *mataqali* members to observe the PA was related to governance issues within their respective *Mataqalis* as well as the indistinct direction on the next steps of the protection and commitment of their land. For some *mataqalis*, the *mataqali* leadership had changed during the 10-year period of the agreement and the new clan leaders were unable to observe the MOU because most were not involved in the agreement process.

6 Discussion

9.1 Vegetation Survey

The Bio RAP identified the vegetation types present in the Natewa-Tunuloa Peninsula area based on Mueller-Dombois (1998). Five main vegetation types are identified – Cloud (>650m asl), Upland (>450m<650 asl), Lowland (>20m <450m asl), Coastal-Littoral (<20m asl) and Mangrove vegetation. The Cloud and Upland Vegetation only cover 0.5% and 5% of the total area but they are the most critical systems in terms of the R2R project that needs to be protected. The Lowland Vegetation is the most dominant vegetation type covering 59% of the total area but this includes the intact primary rainforest, dry forest, hardwood plantation, softwood plantation and secondary forest systems. Non-forest vegetation is the second dominant with 28% coverage.

9.2 Multi-taxa Biodiversity Assessment

- i. Terrestrial insects - The diversity of focal taxa within the Coleopteran families is very low (i.e. 8 families recorded) and suggests that the system is quite disturbed. Usually a good diversity of coleopteran families within a forest system provides a good indication of ecosystem services being supported such as soil processing, pollination, herbivory, decomposition, seed dispersal etc. Opportunistic surveys along the riparian systems focusing on the Order Odonata (dragonflies and damselflies) also suggested a disturbed system and the fauna sampled were common species associated with human settlements having a wide distribution e.g. *Orthetrum serapia*.
- ii. Freshwater macroinvertebrates and flora - Species of particular conservation significance that were identified included: endemic damselflies, *Nesobasis* spp.; gastropod spring snails, *Fluviopupa* spp; and an endemic shrimp *Caridina devaneyi*. The submerged curly pondweed, *Potamogeton crispus* is a useful wetland plant native to Fiji and Australia. It has been observed to provide habitat for native dragonfly and damselfly naiads, shrimps, mayflies and snails.
- iii. Freshwater fish - Fish abundance and diversity was highest at the lower reaches of the catchments

Two native fish species are relatively abundant at all sampling sites:

Giant marbled eel (*Anguilla marmorata*)

Brown gudgeon (*Eleotris fusca*)

- iv. Herpetofauna – The presence of the Fiji ground frog, and the skink *E. trossula* in Tunuloa is of conservation interest and highlights the need for more research and monitoring. There is opportunity for research within the Tunuloa to contribute towards the little-known ecology, phenology, and distribution of herpetofauna in Vanua Levu.

An investigation of the interactions between introduced mammalian predators, introduced herpetofauna species and native herpetofauna populations to devise invasive species management regimes within the Tunuloa catchment will contribute to the value of the area as a biodiversity sanctuary. The presence of the two invasive geckoes at the Tunuloa survey sites questions the quality of the habitat at these sites and flags an assessment into the incursion pathway for the two invasive geckoes. Agricultural activities need to be monitored closely as these could be a pathway for invasive species incursion into upland forests within the Tunuloa catchment.

- v. Birds - The Natewa Silktail bird is threatened of becoming extinct. It is probably the only species compared to other species from other taxa that is well known for being endemic to this peninsula alone. The awareness campaign carried out by Birdlife-Fiji and the local non-government organization Nature Fiji Mareqeti Viti in the area in the last 20 years has made the Natewa Silktail an iconic species to the people of the Natewa and Tunuloa district. However little research has been carried out to better understand the status and ecology of this species and to date the Natewa IBA is not under any legal protection nor has the Fiji Government set aside a Nature Reserve in this area to ensure the long-term conservation and protection of this species. After carrying out the survey we have proposed an area be set aside as a Nature Reserve to ensure the protection of the Natewa Silktail and other native bird species and unique biodiversity of the Natewa-Tunuloa peninsula. The proposed area includes the highest mountain ranges and remaining intact cloud, upland and lowland forest ecosystems in the peninsula. For future monitoring we recommended to continue the point count method and carry out at least five transects (10 points per transects). We recommend a 10-minute count per station. The transects should cover the three habitats surveyed in this study that confirmed presence of the Natewa Silktail bird— Primary Lowland Rainforest, Secondary Lowland Rainforest and Upland-Cloud Forest. The Natewa Silktail bird should be the focus species as the other threatened species present in native and present on other parts of Vanua Levu, Fiji and even other South Pacific islands.
- vi. Mammals - The loss of roosts for both fruitbats (*Pteropus tonganus* and *Pteropus samoensis*) is of concern given the ecological role that they play in seed dispersal and pollination and the restoration of biodiversity. Also, the invasion of ecosystems by invasive species, particularly invasive mammals, is viewed as one of the most serious causes of biodiversity loss. The impacts by feral pigs, rats and cats can be felt by native skinks and ground frogs from habitat destruction and direct mortality. The Small Indian mongoose (*H. auropunctatus*) has been implicated for the loss of many of Fiji's ground dwelling birds in Viti Levu and Vanua Levu. Its presence and the high encounter rates around the village and edges of the forest indicate it is well established. For the forests of Natewa and Tunuloa to be protected or conserved, invasive species control and management needs to be a priority.

9.3 Archaeological Survey

The archaeological assessment revealed valuable information pertaining to the different mataqali landowners within the area of study and neighbouring communities historically linked to the land.

Various findings of cultural assets were able to ascertain that these ancestral sites conveyed immeasurable knowledge and understanding of the history pertaining to traditional and cultural developments, linked closely to the identity of its people. It depicts the movement and settlement patterns of their ancestors and the forms of survival which defined their everyday lives. Such history must be preserved whether tangible or Intangible, however, various threats and disturbances of these cultural sites have, to an extent, altered important aspects of material history of the vanua of Tunuloa. All the sites identified are protected in Fiji under the Preservation of Objects of Archaeological and Palaeontological Interest Act (1940).

7 Conclusion

The Natewa-Tunuloa Peninsula is an important bird area for Fiji. The Natewa Silktail is the most significant out of the four significant species recorded in the area. It is endemic to this peninsula alone and its habitat is now threatened, from the high rate of forest clearance for agriculture purpose and increasing population. The Fiji Government should seriously consider setting aside a Nature Reserve in the area to protect the iconic Natewa Silktail, other unique terrestrial biodiversity and the remaining intact forest habitats.

The Natewa Peninsula is of conservation significance and is an important site for insect conservation. Entomological surveys within the area suggests that upland forest systems are intact due to: the high diversity of Coleoptera families recorded (21) which are key elements in the driving of forest ecosystem functions especially within the upland intact forest systems of the Buca catchment area; some significant finds are Fiji's endemic and rare insects such as: the stick insects *Cotylosoma dipneusticum* and *Nisyurus spinulosus*; the previously recorded swallowtail butterfly *Papilio natewa* (newly described, Tennent *et al.* 2018) and Fiji's endemic damselfly genus, *Nesobasis* with some new records for Vanua Levu. Absence of the recent invasive white-footed ant species, *Technomyrmex albipes* on both forested areas of the Natewa Peninsular and Rabi Island.

The peninsula is an important refugium for biodiversity, especially for Fiji's riverine fish. Despite the low abundance (78 total) and diversity (10 species), the catchments are nonetheless important for Fiji's biodiversity. The low abundance and diversity is attributed to the number of catchments surveyed. Other factors physical factors such as geology and ocean current can also factor in to the low abundance of native fish. The bulk of the assessment was carried out in catchments draining into Natewa bay.

Furthermore, the archaeological assessment revealed valuable information pertaining to the different mataqali landowners within the study area and neighbouring communities that are historically linked to the land. Various findings of cultural assets were able to ascertain that these ancestral sites conveyed immeasurable knowledge and understanding of the history pertaining to traditional and cultural developments, linked closely to the identity of its people. It depicts the movement and settlement patterns of their ancestors and the forms of survival which defined their everyday lives. Such history must be preserved, whether tangible or intangible, to safeguard these important aspects of material history of the vanua of the Tunuloa catchment.

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