

## PACIFIC TELECOMMUNICATIONS COUNCIL FINAL REPORT 2016 – 2017

# PTC TRADITION AND TECHNOLOGY PROJECT

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#### Introduction

While debates continue on the contributors and attempted abatement of climate change, people in the Pacific face a more direct reality, the certainty of a changing environment. An awareness of this change, an ability to monitor it and predict its trajectory will be essential if communities are to adapt and thrive in the face of uncertainty. ICT can be a core tool for the empowerment of youth through self-management and monitoring of the local environment.

Today's youth are the leaders of tomorrow. What is missing is the enabling environment for communities to monitor their local environment in a regional context of climate change. Traditional methods allow communities to make assessment of changes in their local environment. Gradual change in the environment can be difficult to quantify however when communities experience their local environment on a daily basis. Using a combination of scientific method, traditional knowledge and ICT, communities can collect and record the data they need to make informed decisions on changes in their local environment over time and assess the likely future impacts these will have. The community is then in a position to implement appropriate strategies for adaption.

Integrating science, technology and local indigenous knowledge is emerging as a new paradigm for natural resource management. This project seeks to tie rigorous scientific field investigation of pacific island environments with appropriate monitoring and information technology in the context of local community resource management initiatives.

In 2016 PTC provided funding to support a project to investigate the use of cutting edge ICT for use in traditional Fijian settings. In particular we chose to look at aerial robotics, marine robotics and remote environmental sensors to assist on the mapping, monitoring and management of selected environments in Fiji.

The project has realized its goals and opened new opportunities for this work to continue in the South Pacific (Appendix 1). Our next phase is to focus research and development to implement the ICT tools in a sustainable way and snowball our member base by enthusing more youth to join the Technology and Tradition project.

## PTC and USP Geospatial Science

The pathway to preserve traditional methods of environmental management is to complement them with the latest scientific knowledge and technology. ICT can be a core tool in this area PTC provided funding for the new USP Tradition and Technology Project to investigate how cutting edge geospatial technology could work alongside traditional environmental management practices. This project changed the way we use and disseminate technology and in particular geospatial technology for the mapping and analysis of the environment in traditional Fijian settings. USP Geospatial Science has been operated parallel field operations and research in Fijian Village settings with focus on mangrove ecosystems, mountain rainforest and reef and lagoon (Figure 1).

## **Original Concept**

The original concept was that research into ICT's would direct community engagement and

- However, two setbacks
  - o Cyclone Winston
  - Unsuccessful recruitment of Post Graduate students
  - Lack of technical support
- Solution Align community engagement with USP's 300 Level Geospatial Units
  - Lightbulb Moment Our student body are Traditional owners
  - Change direction of project now community engagement drives Research
  - The way it should be, a lesson re-learned

This proved to be the making of the Technology and Tradition Project

## Aims & Objectives

1. Establish long term environmental monitoring plots for pacific environments:

- Mangroves
- Mountain Rainforest
- Reef and lagoon
- 2. Deploy appropriate ICT and geospatial technologies to monitor these environments
- 3. Generate a baseline dataset from which future change can be compared.

4. Implement an information system and online mapping system to database and analyze these data over time.

5. Engage the community in the expectation that this will be a long-term programme



#### Figure 1 PTC Funded Equipment and Activities

#### Locations:

The tradition and Technology project was conducted on the main Island of VitiLevu and other neighboring islands.

We worked in a number of villages, settlements and natural environments based in Suva Peninsula, Colo-i-Suva, Naviyago Village, Naboutini Village, Korova Settlement, Muanivatu settlement, Korotoga Village, Ellington Wharf, Maui Bay, Suva Harbor, sandbank and Gau Island.



Figure 2 Map of Fiji showing Project Site Locations

### **Community Work First Workshop - Gau Household Survey**

Our first community workshop was on the island of Gau (pronounced ['ŋau]), a small island belonging to Lomaiviti Archipelago. The island covers an area of 136.1 square kilometer. The Gau Highlands is home to the critically endangered Fiji Petrel birds.

Our students participated in a workshop spearheaded by Dr Joeli Veitayaki and included carrying out a Household survey in conjunction with with the local community of. Based on the response from the survey, it was noted that the local community suggested that the population of beche de mer (sea cucumber) were diminishing from the previous years.

A follow up community workshop will be carried out, where transacts will be undertaken with the underwater drone to carry out a census of the beche de mer population. This will also be creation of a baseline data set which can be used to determine whether the population of the bechede mer is increasing or decreasing. This survey is planned for June 2018.



Plate 1 Village Location on Gau







Plate 2 Gau School Students at USP Workshop

### Working in Fijian Villages

Before working in any Fijian village certain protocols must be observed. A *Sevusevu* must be conducted which a traditional introduction of the people wishing to enter the village to the village



spokesman and Chief. At this ceremony a Yaqona plant is offered. We conducted many *Sevusevu* throughout the project.

Plate 3 Traditional Sevusevu at Naboutini

#### Nouboutini Village, Saqani, Cakaudrove

Nouboutini Village was our first Village site in the Tradition and Technology Project. Cyclone Winston had changed our plans to start work on Gau Island so we split the project objectives over several locations. As the project evolved Naboutini became a regular site for us and is now one of our sites for Village Profiling as stage 2 of the Tradition and Technology Research component. Naboutini is home to about 434 Fijians and is located along the Coral Coast. A traditional *Sevusevu* had to be presented to the village head in order to obtain permission from them to come into the village and conduct field work.



Plate 4 Aerial View of Naboutini Village

#### First field Visit – Mangrove Survey

In the first field visit, a mangrove survey was conducted by the students during the 2016 Summer of Research. Traverses were established every 25 meters and 10 x 10m plots run into the Mangrove Forest to record details such as species, number of stems, leaf area, tallest trees and dbh.



Plate 5 Field Survey of mangrove transects

#### Second Field Visit – Drone Imagery and GPS Ground Control

In the second field visit to Nouboutini, a group of 10 people were taken including 4 undergraduate students and three new postgraduate students one of which is funded under the **Tradition and Technology Project**.

A Phantom 4 Pro was flown to acquire imagery of the whole village and selected mangrove transects, Ground control points were taken using the School's RTK GNSS in order to tie the imagery to the Fiji Map Grid (FMG86).

The imagery acquired from this field visit will be used to create village profiles of the village through pix4d a software product that uses Photogrammetry and computer vision algorithms to transform both RB and multispectral images into 3D maps and models. The mangrove imagery will be using in conjunction with the field data collected on trip 1 for an assessment of the health of the Naboutini Mangrove forests.

This second field visit has also added on to our baseline data which was started in 2016.



Plate 6 Students taking ground control points



Plate 7 Drones were used to capture high resolution imagery

#### Naviyago Village – Lautoka

Naviyago is located 5 minutes away from the Sugar City of Lautoka. It is located very close to the coast and is surrounded by a meandering River system, containing both fresh and sea water marine diversity. It is also home to a large Mangrove ecosystem and other plantation such as sugarcane farmers.

There are approximately 365 villagers residing at this village. Due to its prime location it is prone to flash flooding. This village was one of the most affected by Cyclone Winston 2016, and it currently still recovering from damages and trying to revive from this incident.

UAV imagery was captured by the DJI Phantom 4 Pro, and was tied to Fiji Map Grid by taking respective Ground control Points and Processed through a photogrammetry software, Pix4D. Pix4D can provide orthophoto mosaic and land surface Digital terrain models that can be used for flooding simulations

Now that the Imagery has been retrieved, works on creating hazard maps will continue and once this is done, these maps will be delivered to proper authorities such as Red Cross in order to be used for humanitarian purposes.



Plate 8 Naviyago Village



Plate 9 Field work using DJI Mavic Drone



Plate 8 Village headman (Turaga ni Koro)



Plate 9 Ground Control

#### **Muanivatu Settlement**

In conjunction with South Pacific Flying Labs, Muanivatu settlement was mapped with a DJI Phantom 4 Pro, this was all part of a **Community Workshop**, where the aim was to intrigue the curiosity of high school students towards ICT's such as Geospatial Science and UAV technology, and mostly how such technology could help the traditional society.

Muanivatu is a squatter settlement located 10 minutes away from the Suva City and is built on a mangrove swamp. The villagers are all native *Itaukei* Fijian and were very encouraging towards this project

The second phase of this project will be to go and present the maps that have been created and to give a follow-up workshop with ideas on how to improve the living standard of the community.



Plate 11 School Students Presenting their work



Plate 10 Data Processing in USP GIS Lab



Plate 12 Final Vulnerability Maps for Muanivatu

## Maui Bay –Conducting transects with underwater drone

The first training and project focused on the use of marine robotics to study the health of coral reefs. Participants, who were students of Saint Christopher Homes and International School of Suva along with a few 300 level students, learned how to use underwater drones safely and effectively. They captured over an hour of underwater footage from a pier off Maui Bay.

The following day, at the USP GIS Lab, they teamed up into groups and analyzed the footage. The groups learned to identify the different species of fish (particularly butterfly fish) and corals visible in the footage in order to assess the health of the corals. They also learned about how marine life is impacted by human activity including climate change. They subsequently created PowerPoint slides and presented their findings and recommendations to each other.

After their presentations, participants were trained on how to use aerial drones safely and effectively. This training was carried out at an approved field on USP campus. The women who participated in the training and projects ranged from 12 to 18 years in age and all but one were from a local orphanage.



Plate 13 Conducting Marine ROV (Drone) transects



Plate 14 Processing and Interpreting the video footage

### **Suva Foreshore – Underwater Drone transects**

The underwater drone was also taken for reef transects on the Suva foreshore area to a depth of 30m in order to test the potential of this new technology for coral reef monitoring at depth. This work will continue with collaboration from the School of Marine Studies at USP.



Plate 15 Snippet from footage taken by underwater drone

## **Colo-i- Suva - Installation of Environmental Sensors**

Established in 1872, Colo-i-Suva Forest National Park in Fiji is a two and a half square kilometers of verdant rain-forests renowned for tropical flora and birds.



Plate 16 Colo - i - Suva Field site showing long term field plots





Plate 17 Site location for deployment of Environmental

The installation of these environmental sensors will monitor the local micro climate and help answer the question whether the Pinanga Palm plants, an invasive species are causing a change in the local micro climate in this area which in turn favors Pinanga growth.



Plate 18 Environmental Sensor

The sensors when fully operational will collect:

- Air temperature and Humidity
- PAR at 2m
- PAR at ground level
- Soil Temp and moisture at surface
- Soil Temp and moisture at 0.5m depth.

#### **Status of Environmental Sensors**

The sensors are now operational and currently being located to new field locations. The online information system interface is working for real-time streaming of the environmental data.



Figure 3 Relationship showing soil and air temperature

## **Mangrove Forest Structure and Composition**

Mangrove forests in Viti Levu are threatened by infrastructure development activities and increasing population, which increases their vulnerability for further overexploitation. This study was carried out in five different study sites in Viti Levu, Fiji.

An inventory was carried out in the mangrove forests to obtain data using systematic line transect sampling technique with a random start. On each line transect, every 10 m distance was marked with ribbon to mark a subplot of 10 m x 10 m, which acted as a primary plot. Square sub-plots starting at the forest edge were used as primary sampling unit to capture variability along the line transects. Natural regeneration data was recorded in a subplot of size 2 m x 2 m established at the center of each primary plot. A total of 100 plots were distributed in the study areas.

Data were collected on stand structure, diameter and height distribution, stem abundance and quality, standing volume, basal area and natural regeneration among others. Five mangrove species were found in the study sites. The stand characteristics showed that the study areas are disturbed due to human activities. The number of stems per hectare recorded was high in Ellington Wharf site (2,024 N ha-1) while the least number of stems were in Nasese site (670 N ha-1). Importance value index (IVI) findings showed that *Rhizophora stylosa* and *Bruguiera gymnorhiza* are the most abundant species in the study sites.

Three study sites, Suva City Council Park, Nasese and USP Upper Campus had higher mean stem diameters compared to Ellington Wharf and Nouboutini Village. Nouboutini Village showed higher mean height (11.5 m) of trees compared to the other four study sites.

Natural regeneration was present in all the study sites. 87% of the plots were covered by generative regeneration. The findings suggest that *R. stylosa* and *B.gymnorhiza* are the most recommendable species for mangrove restoration programmes in Viti Levu



USP students were involved in assisting our mangrove expert, Mr Ashik Rubaiyat carry out his field work and data collection on the mangroves ecosystem.

#### Plate 19 Mangrove Transects



Figure 4 - Schematic view of research sampling

## **Coastal Profiling - Sandbank**

The Suva Sandbank Island is next to Nukumbuco passage and is located approximately 3 km from the USP Lower campus. Students undertaking GS302: Field Survey of Pacific Island Environments carried out a coastal profiling project where they established Ground control points with a Trimble Total Station and took Imagery from a DJI Phantom 4 Drone. Below are the results of





their project and some pictures.

Plate 20 Project Site- Sandbank

Plate 21 Project Site- Sandbank



Plate 22 Map of established control points on Sandbank



Plate 23 Field Work Pictures of setting up control on Lower campus Jetty



Plate 24 Coastal Profiling of Sandbank through ArcSence



Plate 25 Output of Coastal Profile of Sandbank - 2017

#### Flood Risk Model of Korova Village

This project was carried out in Korova which is less than 10 minutes walking distance from lower campus. This settlement is occupied by descendants of Moce Island who are well known as descendants of traditional navigators. This project was done through the use of UAV Drone (DJI Phantom 4, A Trimble total station and a level reflector. Upon completion of the field work, the data was processed with PIX4D and the respective results were achieved.



Plate 26 Data Collection with a Trimble Total Station



Plate 27 Overlay of Cross section elevation over ortho-mosaic model over DTM



Plate 28 Simulation Model of flood model

#### Korotoga Village – Flood Risk and Assessment of Food Resources

Korotoga is a village located in Nausori bounded by the Rewa River and one of its tributaries. The village frequently faces the danger of flooding during heavy rainfall events such as Tropical cyclones exacerbated by high tides particularly spring tides.

This project was significant as the idea was generated by students based on their earlier experiences in the technology and Tradition project. This clearly demonstrates the empowerment within the Fijian youths to identify problems and implement solutions using ICT in a traditional setting.

The students involved in the project took part in assessing flood risk based on Digital terrain models derived from drone digital surface model tied to the Fiji height datum

They concluded that flooding in their area was inevitable and the solutions to flooding would require significant engineering works.

Students also identified the tributaries was blocked and hence acted as a reservoir for rain water breaching the mouth of the tributary to elevating the impact of flooding

The project further identified threats to food resources in the village and hence developed the concept of Village profiling which is a new direction of research for Geospatial Science Unit at The University of the South Pacific.



Plate 29 3d View of Korotoga generated in PIX4D



Plate 30 – Site location of Korotoga in conjunction to the River

A flood simulation video can be viewed using this link: https://youtu.be/Cqa8g\_S68Qo

## **Estimating Mean Sea Level – Vertical Datum**

Oyster is an important species whereby it has ability to maintain their position relative to rising sea level via vertical growth.

The two factors of overarching of the oyster growth response:

- Salinity
- Aerial exposure

Students of GS302 utilized the growth and distribution of sea oysters based on the intertidal zone to determine the vertical height of the tide markings. This was done through Levels. The data was then used to generate a digital terrain model for the study site covering from the lawn to the low water mark



Plate 31 Levelling field work to establish a local vertical datum



Plate 32 Oyster growth is a reliable indicator of mean sea level



Figure 5 – Cross Section showing elevation data with respect to local vertical datum

### Spectral analysis of mangroves using Multispectral Sequoia drone imagery

Part of the PTC funding was for the purchase of a multispectral imaging system to fly on our drone. The sequoia sensor images in the green, red, red edge and NIR which are portions of the light spectrum. The multispectral sensor is proving to be useful in discriminating mangrove species and health with the red edge proving useful. Subsequent work undertaken during the summer of research also showed that standard RGB imagery can be used for selected species mapping.



Plate 33 Imagery acquired by sequoia drone imagery



Plate 34 Sequoia being mounted onto the drone before flight

### Leaf Porometer – Mangrove Health

The leaf Porometer is an instrument which measures the stomatal conductance of leaves in plants. We use stomatal conductance as an indicator to plant health and productivity. Students monitored mangrove plantations of two species in two different environments, one being a coastal area open to tide and wave action and one in a creek of brackish water. It was notably seen that the mangrove plantation near the coast exhibited higher stomatal conductance than that that was found near brackish water. It is supposed that this is due to changes in salinity and hence environmental wellbeing of the mangroves. It was further concluded that the two main species have different stomatal conductances.



Plate 35 Siteri undertaking data collection with the leaf porometer



Figure 6: Graph showing relationship with mangrove Species in relation to location and time



Figure 7 early Days but Preliminary Data suggests stomatal conductance might be monitored remotely using hyperspectral imagery.

## Mangrove (re-growth) My Suva Park

The Suva foreshore is home to a lot of mangrove suburbs, most of which have been deforested. An initiative from the Primary school students to replant mangrove seedlings in this area was taken in 2012 and students from USP took the initiative to monitor the regrowth of the mangrove seedlings since 2015



#### Plate 36 Mangrove re growth at Suva Foreshore



This is the output from the 40m altitude flight for the same area (My Suva re-growth)



Plate 37 Drone acquired image of Suva foreshore mangrove

## **Canopy Mapping for Species**

The study site is located in My Suva Park, Queen Elizabeth Drive (latitude 18 <sup>o</sup> 09 '28.7" - 18 <sup>o</sup> 09 '25.4" S, Longitude 178 <sup>o</sup> 26 '41.0" - 178<sup>o</sup> 26 '44.0"E. This area is referred to as the MSP Area 3 and has a mangrove coverage area of 8211 m<sup>2</sup>. For the purpose of ground truthing, four 50 m long transects were selected along the mangrove area to identify and relate the observations to the orthophoto and DSM imagery. For each transect, inspection of mangroves were made for about 3 meter distance on both sides of the transect. The species present at the location were identified using Mangrove Field ID guide.



Plate 38 Ground Truthing along transects



R. Stylosa

B. Gymnorhiza

R. Samoensis

#### Plate 39 Different Species identified along different Transects



Plate 40 Orthophoto and DSM of MSP Area 3

The othophoto and DSM imagery provide useful information on the species composition of the MSP area 3. The three species identified at the location were R.Stylosa, R.Samoensis and B. Gymnorhiza which correlated to the color and texture on the orthophoto.

#### Summer of Research

A research and capacity building initiative was carried out over the course of 6 weeks where experts from fields apart from geospatial science came together to combine different set skills in order to carry out projects. Some of the people involved from other fields included the field physics, chemistry and information system.

Projects such as supervised classification was undertaken using high resolution UAV Images for mangrove species.

Field surveys of the My Suva Park mangrove area was conducted for the summer of research in December 2017 to January 2018. The mangrove species name, its height and spatial location data were collected. While there were about 4 species of mangrove within this area only 3 species dominated the area. The field data of the three species; Red Mangroves -Spotted Mangrove (Rhizophora stylosa), Samoan Mangrove (Rhizophora samoensis) and Black Mangrove- Large-leafed Mangrove (Bruguiera gymnorhiza) were acquired using the Trimble JunoSB outdoor handheld GPS GIS mapping data collector. This project is currently at publication stage.



Plate 41 Map of study area



Plate 42 Ground truthing along transects number

#### **Current Status on Projects**

- Follow up field work at Nouboutini and an intensive field programme at Gau
- Field campaign to Gau including follow up workshop to Implement in the "ridge to reef" concept
- Mangrove species mapping
- Soil Carbon Store Estimation
- Mangrove methane estimates
- Mangrove canopy Biomass Estimation
- Continuation of Leaf Porometer Analysis
- Continuation of UAV Imagery
- Photogrammetry Digital Surface model of canopy
- Multispectral Imagery with sequoia
- Hyperspectral Imagery using BaySpec Instrument
- Final Community Workshops

#### **Masters Research**

- Ashik- University of Gottingen
- Edward University of South Africa

#### **Publications**

#### **Papers in Press**

- Structure and forest composition of mangrove in VitiLevu, Fiji
- Segmenting Mangrove Ecosystems Drone Images Using SLIC Superpixels

#### **Papers in Prep**

- 1. Fiji Mangrove Species Mapping using high resolution UAV imagery a return to photogrammetry and traditional air photo interpretation
- 2. Pigment Analysis of Six Fiji Mangrove Species of the Suva Peninsula with reference to their visible NIR spectral properties
- 3. Methane production of Fiji Mangrove Forests by species and location
- 4. Mangrove Health and Productivity Assessment using stomatal conductance by leaf porometer with reference to spectral signatures
- 5. Precision of UAV derived Digital Surface Models in x,y,z and their application to estimating tree heights in Fiji Mangrove Forests
- 6. Fiji Mangrove Canopy Morphology from UAV Digital Surface Models as an aid to species and health modelling.
- 7. Flood simulation modelling of coastal inundation of several Fiji Villages based on UAV derived Digital Terrain Models
- 8. Mangrove regeneration survival and growth rates over three years using geospatial technologies.

## **Value Added Outcomes**

#### Postgraduate studies

In 2019 two masters' students will start research on Village Profiling for Vulnerability Assessment and Resilience Planning.

#### South Pacific Flying Labs

Following PTC funding our capacity in the use of Geospatial ITC's advanced rapidly and afforded new opportunities for the Geospatial Science Programme. We were able to attract further funding with the help of WeRobotics, DFAT and Atlassian Foundation for the introduction of the South **Pacific Flying Labs.** The Lab is currently in startup phase but will provide a focal point for the deployment of geospatial technologies throughout the region and will have a strong focus on empowering youth to participate and enter careers in STEM.

#### Projects

- Settlement Mapping
- Village Profiling and Flood Risk Assessment
- Biodiversity and Coral Reef Health Assessment A Comparison between Marine Protected Area and Normal Coral Reef System.
- Garbage and Debris Concentration Survey
- Food Security
- Finalizing API Keys for Mangrove Species Mapping
- Continue Work on health indicators
- Leaf Porometer
- Thermal Imager
- Hyperspectral Imager
- Proposed Postgraduate Research
  - Physical Canopy Models PhD
  - Ecosystem Services MSc
  - Develop field protocols for underwater drone
- USP Drone Movement in collaboration with School of Engineering
- Realistic Visualization of Flood Impacts

## Challenges

Project was hampered by the effects of TC Winston in 2015. This made travel around Fiji difficult but also afforded a unique opportunity to monitor the recovery of damaged ecosystems using ITC which is a blessing in disguise. We also underestimated the level of technical expertise required to deploy some of the technologies. It has been a long learning curve but we are better positioned now to make use of real-time sensors, underwater robotics and marine robotics. In this sense the Tradition and technology project has been immensely successful in self-generated capacity building for our students from Fiji and the wider region.

## **Conclusion PTC Funding of the Tradition & Technology Project**

The funding provided by PTC has fast tracked the use of state of the art ICT including the use of UAV in Undergraduate Programs. It has also enabled high level research into Pacific Island environments in traditional settings by traditional owners of the land and sea. This has inspired a real paradigm shift away from aid-driven, project based and ad-hoc response to real needs, towards genuine capacity building and increased capability from the ground up.

While problematic, the project also pioneered the use of real time environmental sensors in the study of invasive plants into Mountain forests in Fiji. This remains the subject of ongoing research.

The PTC tradition and Technology project has shown us the direction for aligning ICT with traditional environmental management and has empowered our graduates to look for solutions from within. **This is a key outcome for the PTC project**.

The PTC project has also snowballed other opportunities including development of the South Pacific Flying Labs and new collaborative opportunities from international universities in Germany, Portugal, Japan, Australia and New Zealand.

## **Project Website**

Ongoing developments can be followed at <u>www.geospatialscience.org</u>

## Appendix 1 - Milestone Summary

Milestones	Status	Comments
Written confirmation of USP funds	Completed	Part of installment 1
Project Deliverables confirmed	Completed	Part of installment 1
Installation and commissioning of environmental sensors	Completed but failed	Sensors were deployed but failed soon after due to tampering. Sensors are now operational again and we are in the process of selecting new, more secure sites.
First three months data collected	Not completed	Sensors are operational but only limited data has been collected.
Field data plots in place and first field data collection completed	Completed	Field data collected for Ellington Wharf, Suva Foreshore, Naboutini and Rakiraki areas.
First community workshop conducted	Completed	First workshop on Gau with smaller workshops held at Muani Vatu, Naboutini and Naviyago
Field plot imaging completed	Completed	Imaging complete for Ellington Wharf, Suva foreshore, Lami, Naboutini, Naviyago and Muani Vatu Settlement
Lagoon Transect complete	Completed	Lagoon Transect competed at Maui Bay and Laucala Bay
Beta information system online	Completed	The online system for displaying the environmental sensor data in real time is complete and operational
Second community workshop conducted	Completed	Second workshops conducted at Naboutini, Naviyago and Muani Vatu. One day mini- conference also held in conjunction with South Pacific Flying Labs. This allowed several youth groups to present and highlight their work with both the Settlements and environment.
Final Report Delivered and presented at PTC '18	Completed	Final report delivered and project presented at PTC '18