

## **MISSION REPORT**

### **ADAPTATION TO CLIMATE CHANGE IN THE PACIFIC ISLANDS REGION SERVICE PACKAGE 2: DEVELOPMENT OF CLIMATE CHANGE DATABASES**

#### **Analysis Phase and Scoping Mission**

#### **Fiji**

Period: 20/09/2010 - 01/10/2010

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October/2010

## **1. Mission Team**

- Makelesi Kora-Gonelevu (Database Expert)
- Marita Manley (GTZ Climate Change Advisor)

## **2. Purpose of the mission**

The purpose of the mission was to conduct a stocktaking exercise of all existing climate change related data and databases and to identify data gaps and user needs.

The analysis phase is intended to define the scope of the national and regional climate change databases through consultations with national and regional stakeholders. Assess existing databases, identify primary and secondary users, data needs and data gaps.

The results of the exercise would enable the development of a climate change related data inventory that would later be used for the conceptual design after the inception workshop. It was also an opportunity to identify potential data sharing partners.

## **3. Activities**

The activities undertaken during the mission included:

- Consultations with the Land Resources Division of the Secretariat of the Pacific Community (SPC) and other regional stakeholders in relation to existing climate change related data/databases.
- Consultations with Fiji government stakeholders in relation to the proposed national climate change database.
- Research and familiarization with climate change related documents and organizations.

#### 4. Results of the mission and further actions

Improving the quality and accessibility of data has been identified as a key issue in terms of identifying how climate change will affect Pacific Island Countries and what adaptation responses are appropriate.

##### **Key messages**

All those consulted expressed a demand for improved data in relation to being able to provide informed advice to their stakeholders. However, in many cases baseline data does not exist or is inaccessible (e.g. some data exists but it is in reports or has not been digitised). This means that assessing how climate change will affect different parameters means filling not only some of the specific climate change related data gaps but also the data gaps that relate to the lack of baseline agricultural, forestry and land data in general.

Existing tools and models do exist that can be used to predict the impact of climatic changes on different sectors (e.g. SIMCLIM) and are being used in several countries.

As climate change is such a cross cutting issue defining the scope of where such databases should start and end is a key consideration. During the course of this consultation we limited ourselves to the sectors currently covered by the SPC/GTZ programme (agriculture, forestry and land) whilst bearing in mind that any database that is produced would need to be able to evolve to include additional data and sectors.

Several respondents also questioned the need for a centralised database where all data are deposited in a single location suggesting that a more effective and sustainable solution might be to have a system that is able to draw on data location in several locations – a sort of meta-database. To sure sustainability the database should also build on existing data management capacity rather than create new functions for institutions.

##### **Institutional issues**

Existing data is available in many formats but at the regional and the national level the question of institution hosting and ongoing support is vital to the success of the project.

In some countries deciding on who hosts the database is straightforward. In others whilst the Department of the Environment has the mandate to lead on climate change they often do not have the necessary technical capacity, and agencies such as agriculture and lands often have the technical capacity and access to the data but lack the mandate for overall climate change related activities.

##### **Data**

It was evident during the stocktaking exercise that there are significant data gaps as identified by stakeholders. Filling these gaps will be one of the main issues discussed during the inception workshop. The workshop will provide a further opportunity to articulate user needs and identify the data required to meet these needs.

Because of the significant number in data sources at a regional and national level there will be a need to automate data flow as much as possible to ensure that data is continuously updated, maintained and accessible to the climate change databases.

The structure of the CC database will need to take into consideration reliable sources of data, data maintenance, capacity building, budget allocations for future maintenance etc. Lessons learnt from previous data related projects suggest that the best way to achieve sustainability is to build on existing systems and technical capacity rather than creating new systems.

Data sharing between regional stakeholders will also need to be looked at in detail.

### **IT infrastructure**

The IT infrastructure at the national offices will need to be explored further to ensure that it is sufficient to enable electronic data sharing between the offices in different locations. This will require a meeting with the Fiji Government ITC.

### **Coordination with other initiatives**

Close cooperation with other national and regional initiatives that are happening in the area of climate change data will be necessary to ensure that the SPC/GTZ programme builds on what is already being developed. We tried to talk to all relevant regional stakeholders during the consultation about their proposed programmes. A full list is available in Annex II.

There are obvious linkages and synergies with projects already in place like the SPREP's Climate Change portal, PCCSP and ADB/WB Hazard Mapping Project. Therefore in order to avoid duplication of activities these will also need to be taken into consideration during the conceptual design phase.

Due to time constraints a number of key stakeholders such as the Fiji Meteorological Office, Fiji Land Information System (FLIS) Office, Bureau of Statistics and the Forestry Department were unavailable. Rescheduled appointments will be held in November 2010 and the inception workshop will provide an opportunity to validate and update the contents of this scoping study.

## Consultation Report

### Land Resources Division

The existing data sets within LRD are managed by the various thematic teams. For example, in terms of predicting climate change impacts on different crops CePaCT is establishing a climate ready collection and screening their collection for certain climate resilient traits.

## LRD data inventory:

### Agriculture

- The existing data in LRD are managed by the Animal Health and Production (AHP), Biosecurity and Trade (BATS), Plant Health (PH), ICE and Genetic Resources (GR) thematic teams. These data include fruit fly surveillance data, animal genetics and waste management data, crop accession, description, evaluation and distribution data, pest occurrence data and factsheets.
- The existing databases in LRD include the Pacific Islands Pest List Database, <http://pld.spc.int/pld/> (PIPLD) which records the distribution of plant pest in the Pacific has a web interface and back-end data is stored on a MySQL database server, the World Animal Health Information Systems, <https://www.oie.int/wahis/> which records animal disease distribution, an Animal Genetics database, <http://www.spc.int/lrd/angr/login.php> used to store all gene banks for animals specimens and the MS Access accession database that records accession details, evaluation, descriptor, passport and distribution data for accessions in the CEPACT collection.

### Forestry

- GTZ Forestry does not keep forestry data sets or manage databases as most of these are done within the support of national counterparts. They do however assist the national forestry departments in their forest inventory and support the land use departments in surveys related to Sustainable Land Management etc. The only data kept is for back-up (for example monitoring data on the Fiji forest research area in Nakavu; Fiji forest cover assessment, land use). Data sharing is informal with most national counterparts.

### Trade Statistics

- LRD also has a Pacific Regional Trade Statistics Database <http://www.pacifictradestatistics.com/> which hosts trade data for export commodities from the Pacific.

### Modelling Software/GIS

- GTZ Forestry have also procured licenses for SimCLIM and have carried out training in Tonga and Vanuatu.
- PacCLIM <http://www.waikato.ac.nz/iqci/projects/pacclim.htm> and PlantGro are known to the Crop Production and Agricultural Policy technical staff for advising PICTs on the suitability for group crops in different areas.
- CLIMEX <http://www.climex.com/> is known the Plant Health and BATs team to be used to predict the potential distribution and relative abundance of species in relation to climate.
- There is no use of GIS in LRD although there is existence of GPS coordinates for the locations of fruit fly traps in the PICTs, pest distribution, location of villages that have pig farms and waste management composting sites. These are all available as MS Excel spreadsheets. But the Forestry and Agricultural Diversification team in collaboration with SOPAC are using GIS/remote sensing for forest inventory and monitoring.

### Information and Knowledge Management

- IKM initiatives are in place and include the existence of a Document Management System which on the Microsoft SharePoint LRD intranet. This will soon contain all their existing key technical documents.

## **LRD user needs:**

Useful applications that technical staff identified as being important products/tools of the climate change database to support their work included

### **Food Security**

- Advising on plant genetic material with suitably climate resilient traits.
- Advising on how CC will affect animal breeds' resources and conservation, animal breed conservation, identification of locality of endemic animal breeds, natural disaster damage assessment and identification of areas prone to natural disasters.

### **Sustainable Land Use Management**

- Tools to advise on sustainable land use planning and land management practices to reduce vulnerability and respond to rising sea levels
- Improved monitoring of forestation and deforestation
- Combining climate change scenarios with vegetation mapping to assess how vegetation might change in response to climatic changes and to target vegetation assessments and areas suitable for rehabilitation including replanting forests,
- Improved monitoring of coastal areas through aerial mapping

### **Vulnerability Assessments**

- Tools and information necessary to develop vulnerability assessments,

### **Pest Management**

- Advising on plant pest risks to countries as a result of climate change impacts, plant pest management, monitoring and eradication,

## **Data gaps:**

- Absence of detailed topographical data, digitisation of PICT soil maps and demographic data, vegetation mapping for most PICTs livestock census data, animal genetics information, climate change adaptation and mitigation best practices.

## Fiji National data inventory:

### Agriculture

- The Economic Planning Division of the Ministry of Primary Industries (MPI) has two MS Access databases, the National Agricultural Census Database which records the annual agricultural census (geographical, characteristics, household/economic activity, agricultural task, total land for farmer, crops farmed, land tenure, sugarcane varieties planted, pastures/floriculture/livestock, poultry milk production, aquaculture, employment, apiculture, machinery and farm management). The last census was conducted in October 2010. The second database is the AgriMarket Database which records market survey data.

### Sustainable Land Use Management

- The Fiji Land Information Systems (FLIS) Unit manages main spatial data sets in Fiji such as topographic data and land ownership information.
- The Land and Water Resource Management (LWRM) Section uses ArcGIS databases and EDIS images to illustrate land use, forest cover and grassland. The current data they have are related to land classification sustainability, present landuse, forest cover and grassland.
- Land Use Planning section has soils classification and GIS databases of soils which were developed by Landcare Research using ArcView and ArcGIS. They also have information on crop suitability. All data sets are derived from FLIS except cadastral information on leases which is from the Native Land Trust Board (NLTB).
- The Agriculture Department holds Fiji's latest soil maps and digital spatial and tabular information of potential agricultural areas, available coconut cover and other land based information.

### Forestry

- The Fiji Forestry department has existing tabular and spatial data sets about forest cover.
- The National Land Trust Board (NLTB) manages the tabular and spatial data of leases within Fiji covering all native land.
- Fiji Pine Limited (FPL) holds spatial and tabular data of most asset items of this power utility.
- Fiji Hardwood Corporation holds tabular and spatial data of Fiji's mahogany and other plantations.

### Utility

- The Fiji Electricity Authority (FEA) holds spatial and tabular data of most asset items of this power utility.
- The road section of the Public Works Department hold tabular and spatial data of all public roads which is different to the road information of Lands Department.
- The Water Authority of Fiji (WAF) together with Fiji Weather Bureau and Mineral Resources Department (MRD) holding information of flow gates and rain fall stations, current and historical records.
- At present the Ministry of Primary Industries does not use any modelling software for climate change projections, it had previously used SIMCLIM but the data has proved to be unreliable for Fiji.

## User Needs:

- MPI visualises the tool being used in identification of risk profiles for different sectors for crops, crop production, soil malnutrition, water solubility, health, benchmarking, monitoring

of area/sectors, drainage design criteria, water regression in low lying areas, adaptation models for the Pacific and Tikina (district) profile to see existing land cover, land use planning and sustainable land management.

- At the time of this consultancy the Fiji Climate Change Country Team had not met recently therefore I was not able to gauge the user needs from the Department of Environment but I informed them to prepare this prior to the inception workshop where this will be presented.

### **Data gaps:**

- Land classification from 1-8 classes, soils and climate datasets reside in Landcare but attempts to migrate these to Fiji have been futile. Dave Leslie of Landcare Research has clarified that the Landuse Planning section were given a copy of this.
- Present land use is not complete only exists district by district.
- Conversion of old maps to be digitized. These are in the offices in KRS, West and North.

### **Data sharing:**

- All data sharing will require some formal agreement between the Ministry of Primary Industries and SPC.



## Regional data inventory:

### Socio-demography

- PopGIS  
[http://www.spc.int/sdp/index.php?option=com\\_content&task=blogsection&id=4&Itemid=35](http://www.spc.int/sdp/index.php?option=com_content&task=blogsection&id=4&Itemid=35)  
 developed by the Statistics and Demography <http://www.spc.int/sdp/> section of SPC, is a powerful decision-support tool, as well as a highly effective means to visualise and communicate data and information. The system consists of a comprehensive population database for PICTs containing many customised tables, which are based on the country's most recent population and housing census. This allows users to extract a broad range of basic demographic, social, economic, household and housing statistics across a range of administrative national geographies: starting with census collection districts or enumeration areas as the smallest spatial building blocks, moving to higher-level aggregations, such as districts, islands and regions, provinces or states. The system has a custom-built GIS platform, which was developed using MapInfo technology (MapX). The third component is comprised of national geographic boundary files and digital topographical information, containing information on various levels of administrative geography, roads and rivers, and key infrastructure like airports, health facilities and schools.
- The Pacific Regional Information System or PRISM <http://www.spc.int/prism/index.htm>, another product of the Statistics and Demography Section of SPC, is the central information portal for the Pacific Islands region, collating publications, reports and statistics from 22 countries and territories, and presenting a comprehensive range of indicators through regional data tables. Data collected include: economic, social & demographic, tourism, environment & utility and development indicators. They work closely and have a data sharing agreement with the Bureau of Statistics in the PICTs.

### Oceanography/Disaster Management

- The SOPAC currently<sup>1</sup> has three spatial databases relating to climate change. The GeoNetwork database, <http://geonetwork.sopac.org/geonetwork/srv/en/main.home> which holds a range of ocean data and relevant products, such as regional bathymetry datasets, bathymetric charts, topography and technical reports, seismic data, coastal topography datasets and maps, marine and physio-chemical datasets, maritime boundary information, sea level data (with conjunction from the South Pacific Sea level and Climate Monitoring project), regional marine scientific research cruise, satellite imagery, and scanned aerial photographs. The online information facility is powered by Geonetwork Opensource 2.2 and was developed by FAO, WFP and UNEP.
- The second is the Pacific Disaster Net which is a web portal and database system designed to be the largest and most comprehensive information resource for Disaster Risk Management for the Pacific Island Countries. For more information on the portal and its contents can be found at <http://www.pacificdisaster.net/pdn2008/>. The website is powered by Plone an open source content management system, see <http://plone.org/>.
- The third database keeps all space borne image data ordered for Pacific Island Countries maps and vectorised information Pacific Island Countries store as backup at SOPAC Database runs under SQL Server.

<sup>1</sup> These separate databases are currently linked.

## Forestry

- SPC Forest and Trees together with SOPAC are currently developing a database showing the vegetation cover of low lying islands to document the current stage of vegetation cover and to visualise climate change impact on indicator vegetation such as mangroves. Most islands of Kiribati are mapped.
- SOPAC's EDF 9 Map Server, below is the status of the map servers in the three countries:  
In Tonga the map server is located at the Lands Department. The hard disk was corrupted and all data was lost. The server is currently hosting the Ministry's webmail and there are hopes to revive the map server.  
In Vanuatu the map server is located at the Department of Lands. The map server has not been operational since 2007.
- In Fiji the map server is located at the Mineral Resources Department (MRD). The ESRI ARCGIS server has been out of operation for 2 years. SOPAC is currently liaising with Lands Department regarding the data to be transferred from MRD to the Lands Department.
- The University of the South Pacific has a South Pacific Regional Herbarium [http://ias.fste.usp.ac.fj/index.php?id=ias\\_herbarium](http://ias.fste.usp.ac.fj/index.php?id=ias_herbarium) database which records accession details (locality, collector, collection date etc) of specimens in the herbarium collected from around the Pacific, the online specimen's database is online can be accessed at <http://ias.fste.usp.ac.fj/index.php?id=7549>. This could be used as baseline data for the climate change database.

## Water Resource Management

- The Pacific Hydrological Cycle Observing System (HYCOS) Web Portal <http://www.pacific-hycos.org/>, Pacific HYCOS is a regional initiative to improve management and protection of Pacific Island Countries' freshwater resources, through the provision of appropriate water resource management systems. The ultimate objective of the WHYCOS programme is to "promote and facilitate the collection, exchange, dissemination and use of water-related information, using modern information technologies". The Pacific HYCOS Project is designed to assist the water agencies in 14 Pacific island countries further develop their knowledge and understanding by strengthening their resources and technical capacity to collect hydrological data and carry out water resource monitoring. The hydrological equipment and training will support the water agencies in the sustainable collection of hydrological data, archived in a functional database facilitating access, analysis and interpretation of the datasets for improved understanding. The Pacific HYCOS will focus on six main objectives : Water resources assessment in major rivers, Groundwater monitoring and assessment, Water quality monitoring and assessment, Water resources databases, Flood forecasting capability and Drought forecasting.  
Due to time limitations I was not able to meet with this project but I do understand from their website that there is an online data sharing facility for member countries to upload their hydrological and water resource monitoring data.
- The Pacific Partnership Initiative on Sustainable Water Management has an online Water Action Matrix Database <http://www.pacificwater.org/pages.cfm/water-resources/pacific-water-action-matrix-overview-search.html> that aims to monitor the implementation of the Pacific Regional Action Plan on Sustainable Water Management by all partner organisations in the Pacific region.

As one of the core functions of the Partnership's Coordination Unit supported by the Asian Development Bank (ADB), information related to projects and activities, is being collected in a central database that is accessible by everyone through a dedicated website.

The website hosts a Search Engine as well as an Insert Form for the Pacific Water Action Matrix. Through the search, information can be retrieved about water related projects and their details, including partner information, donors, timeframe, status and contact persons in tabulated format. The Insert Form is also structured around the six thematic areas of the Pacific RAP.

## Vulnerability Assessment

- SOPAC's Environmental Vulnerability Index (EVI) <http://www.sopac.org/index.php/environmental-vulnerability-index> is among the first of tools now being developed to focus environmental management at the same scales that environmentally significant decisions are made, and focus them on planned outcomes. The scale of entire countries is appropriate because it is the one at which major decisions affecting the environment in terms of policies, economics and social and cultural behaviours are made. Details of the 50 EVI indicators can be viewed here [http://www.vulnerabilityindex.net/EVI\\_Indicators.htm](http://www.vulnerabilityindex.net/EVI_Indicators.htm). The sub indices include the following: Climate Change, Biodiversity, Water, Agriculture and fisheries, Human health aspects, Desertification and Exposure to Natural disasters. The EVI calculator is used [http://www.vulnerabilityindex.net/EVI\\_Calculator.htm](http://www.vulnerabilityindex.net/EVI_Calculator.htm) to determine the EVI for each country using these indicators.

## Meteorology

- The Pacific Climate Change Science Program (PCCSP) <http://www.csiro.au/partnerships/Pacific-Climate-Change-Science-Program.html> is working with 14 PICTs to track recent and current climate trends, investigate regional climate drivers, provide regional climate projections, improve understanding of ocean processes including acidification and sea level rise in the region. The project is using 15 – 18 of Global Climate Models / General Circulation Models (GCMs) from IPCC-AR4 and is undertaking dynamic downscaling to 8-60km to generate climate and ocean projections or the Climate Futures Tool for impact modeling. It is planned that the climate change database prototypes will be installed in the national Meteorological Offices in the Pacific in November 2010. The projections table can be found in Annex V.
- CSIRO is collaborating with the National Institute for Water and Atmospheric Research (NIWA) <http://www.niwa.co.nz/> for the Climate Early Warning System component of the GEF project 'Integrating Climate Change Risks in the Agriculture and Health Sectors in Samoa'. NIWA also has a substantial database in support of their climate change research and scenarios, etc.
- There are plans to develop SPREP's Climate Change portal [http://www.sprep.org/climate\\_change/index.asp](http://www.sprep.org/climate_change/index.asp) which will assist PICTs build their capacity in relation to climate change with the key objective to deliver on the expected outcomes under the following Principles: Implementing adaptation measures; Governance and decision-making; Improving our understanding of climate change; Education, training and awareness; Contributing to global greenhouse gas reduction; and Partnerships and cooperation by centralising and making accessible all climate change related information. The implementation is believed to begin soon. The GTZ Climate Change Advisor met with David Sheppard and Netatua Pelesikoti to discuss the linkages from the regional database to the SPREP portal. SPREP does not see itself getting involved in the technical side of managing sectoral level databases but the CC portal envisaged is one that would hopefully enhance access to such databases wherever they exist.

## Agriculture

- Air World Wide <http://www.air-worldwide.com/> is implementing the ADB/World Bank Crop Classification as part of the Hazard Mapping project with SOPAC. The drafts of the land

cover/ land use (LCLU) maps developed in this project are an extension of the original objective: locating cash crops in the 15 countries of interest including Fiji, Tonga and Vanuatu. While the focus was on cash crops, they have also mapped other classes such as forest, water, sand, settlement, others (barren land) and open/Grass land. The LCLU maps were generated using a multitude of sources but the primary one was remote sensing. Given the extension of the territory covered and the budget available for this task, satellite imagery of different resolution, but mostly low to moderate, was used. However the maps will need to be verified by the Ministries of Agriculture in the PICTs. See Annex VI for the “Compiled list of Country Wise - Utilized Satellite Imageries for crop classification”.

## Fisheries

- The SPC's Oceanic Fisheries Programme <http://www.spc.int/oceanfish/> have a Tuna Fisheries Database Management System (TUFMAN) which is a tool to assist PICs managed their tuna fishery data. The type of data it supports are licensing, port sampling, log sheets, unloading, observer trips, packing lists, vessel activity reports and vessel position reports. TUFMAN is network based with a front-end interface developed in MS Access 2007 and back-end data stored in SQL Server 2008 R2. For mapping it uses MapInfo. Note that inclusion of the Fisheries sector is out of the scope of this mission but there was valuable to learn of best practices in the project.
- The SPC's Coastal Fisheries Programme <http://www.spc.int/coastfish/> is implementing the AusAid funded “Vulnerability and adaptation of coastal fisheries to climate change” project. The project aims to assist Pacific Island countries and territories (PICTs) to design and field-test monitoring pilot projects to determine whether changes are occurring in the productivity of coastal fisheries and, if changes are found, to identify the extent to which such changes are due to climate change as opposed to other cause. Note that inclusion of the Fisheries sector is out of the scope of this mission but there was valuable to learn of best practices in the project.
- SPREP has a Turtle Research and Monitoring Database System (TREDs) <http://www.sprep.org/treds/treds.aspx>.

## Coastal Management

- IUCN's MESCAL section is working with Mangroves for Fiji <http://mangrovesforfiji.com/home/> a GEF funded project who is managing a Mangrove database.

## Adaptation

- The Climate Change Adaptation Project for the Pacific (CLIMAP) <http://www.adb.org/REACH/can-climap.asp> was implemented by ADB in Cook Islands and FSM. The project focused on demonstrating mainstreaming climate adaptation into development and planning in Pacific Developing Member Countries and into ADB Pacific Department operations, on a pilot basis. The goal of the project is to ensure that Pacific developing members countries (PDMCs) of the Asian Development Bank adapt to climate change and variability (CCV). Another objective is to mainstream climate change adaptation through integrated risk reduction (CCAIRR).

## Data sharing:

- SOPAC will be merging with SPC in 2011 therefore the issue can be revisited then.
- CSIRO PCCSP is willing to work with ACCPIR to identify synergies and linkages between the projects.
- Final cash crop classification with Air World-Wide will be completed at the end of 2010. The maps will then be publically available at SPC, SOPAC and PICT governments.

- The South Pacific Regional Herbarium will require a formal data sharing agreement because copyright belongs to the PICT governments.
- There is an existing data sharing agreement between SPC's Statistics and Demography Unit and the Bureau of Statistics in the PICTs.

### **Data gaps:**

Below are the data gaps identified at the GIS/RS Conference 2009:

- Up to date image data rectified with GPS control points. For low lying areas this is available for Fiji, now.
- Vegetation or land cover maps for most low lying islands (on the way but it will take some time to be complete. The current annual session just has endorsed the task). Mangrove is sensitive to salinity and sea level rise, therefore the current mangrove cover has to be documented as soon as possible.
- Maps of coastline change (in production).
- Digital terrain models at 1:10,000 scale for low lying islands.
- Rainfall data in higher temporal and spatial density.
- Better ocean data including wave height, ocean temperature and surface wind, surface colour, which then allows to predict the current etc

### **Way Forward**

- Considering that the regional database will be maintained by SPC LRD it is only fitting that an LRD staff be involved in the project to ensure that the best interests of LRD are taken into account during development. At present I foresee the IKM team taking on the responsibility of maintaining the regional climate change database but the team currently consists of only one person whose core activities lie within the Animal Health and Production Team. There are risks that the regional database may not be given the attention that it requires. Hence there is a need for a full time position with the mandate of maintaining the regional database.

• **Annexes:**

**Annex I – Abbreviations**

<b>ACCP</b>	Adaptation to Climate Change in the Pacific Islands Region
<b>ADB</b>	Asian Development Bank
<b>AHP</b>	Animal Health and Production
<b>BATS</b>	Biosecurity and Trade Support
<b>CEPACT</b>	Centre for Pacific Crops and Trees
<b>EVI</b>	Environmental Vulnerability Index
<b>FAO</b>	Food and Agriculture Organisation
<b>FLIS</b>	Fiji Land Information Systems
<b>GIS</b>	Geographical Information Systems
<b>GR</b>	Genetic Resources
<b>ITC</b>	Information Technology Centre
<b>IUCN</b>	International Union for Conservation of Nature
<b>KRS</b>	Koronivia Research Station
<b>LCLU</b>	Land Cover Land Use
<b>LRD</b>	Land Resources Division
<b>LWRM</b>	Land and Water Resource Management
<b>MPI</b>	Ministry for Primary Industries
<b>NIWA</b>	National Institute for Water and Atmospheric Research
<b>PCCSP</b>	Pacific Climate Change Science Program
<b>PH</b>	Plant Health
<b>PICT</b>	Pacific Island Countries and Territories
<b>PIPLD</b>	Pacific Islands Pest List Database
<b>PRISM</b>	Pacific Regional Information System
<b>SOPAC</b>	Pacific Islands Applied Geoscience Commission
<b>SPC</b>	Secretariat of the Pacific Community
<b>TREDS</b>	Turtle Research and Monitoring Database System
<b>UNEP</b>	United Nations Environment Programme
<b>WFP</b>	World Food Programme



## Annex II - List of Stakeholders met

	NAME	DESIGNATION	CONTACT
1.	Mr Inoke Ratukalou	Acting LRD Director	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:inoker@spc.int">inoker@spc.int</a>
2.	Mr Siua Halavatau	LRD Crop Production Coordinator	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:siosuah@spc.int">siosuah@spc.int</a>
3.	Dr Wolf Forstreuter	GIS & Remote Sensing Specialist	Secretariat of the Pacific Islands Applied Geoscience Commission (SOPAC) Suva, Fiji  Email: <a href="mailto:wforstreuter@yahoo.co.uk">wforstreuter@yahoo.co.uk</a>
4.	Mr Cenon Pandolina	Regional Forest Genetic Resources Officer	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:cenonp@spc.int">cenonp@spc.int</a>
5.	Mr Roy Masamdu	LRD Biosecurity and Trade Facilitation Officer	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:roym@spc.int">roym@spc.int</a>
6.	Mr Nacanieli Waqa	LRD Biosecurity and Trade Technician	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:nacanieliw@spc.int">nacanieliw@spc.int</a>
7.	Ms Verenaisi Babitu	Librarian	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:verenaisib@spc.int">verenaisib@spc.int</a>
8.	Ms Anju Mangal	LRD Animal Health Training Officer/IKM Coordinator	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:anjum@spc.int">anjum@spc.int</a>
9.	Mr Ken Cokanasiga	LRD Animal Health and Production Advisor	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:kenc@spc.int">kenc@spc.int</a>
10.	Mr Andrew Tukana	PRIPPP Technical Assistant	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:andrewt@spc.int">andrewt@spc.int</a>
11.	Mr Nichol Nonga	LRD Animal Health Officer	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:nicholn@spc.int">nicholn@spc.int</a>
12.	Mr Ilagi Puana	LRD Animal Health	Land Resources Division

		Specialist (FIJI)	Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:ilagip@spc.int">ilagip@spc.int</a>
13.	Ms Merewai Toganivalu	Animal Genetics Technician	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:Merewait@spc.int">Merewait@spc.int</a>
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18.	Mr Stephen Hazelman	LRD ICE Coordinator/Extension Office	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:stephenh@spc.int">stephenh@spc.int</a>
19.	Mr Emil Adams	LRD ICE Publications Officer	Land Resources Division Secretariat of the Pacific Community Suva, Fiji  Email: <a href="mailto:emila@spc.int">emila@spc.int</a>
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24.	Mr Jone Ratuvuki		Economic and Development Division Department of Agriculture Ministry of Primary Industries



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30.	Ms Mandy Hopkins		Pacific Climate Change Science Program CSIRO  Email: <a href="mailto:Mandy.Hopkins@csiro.au">Mandy.Hopkins@csiro.au</a>
31.	Dr Gillian Cambers	Program Manager	Pacific Climate Change Science Program CSIRO  Email: <a href="mailto:Gillian.Cambers@csiro.au">Gillian.Cambers@csiro.au</a>
32.	Ms Jutta May	Information and Database Management Adviser	Community Risk Programme Secretariat of the Pacific Islands Applied Geoscience Commission (SOPAC) Suva, Fiji  Email: <a href="mailto:jutta@sopac.org">jutta@sopac.org</a>
33.	Mr Arthur Web	Manager Ocean & Islands Programme	Secretariat of the Pacific Islands Applied Geoscience Commission (SOPAC) Suva, Fiji Ocean and Islands Programme  Email: <a href="mailto:arthur@sopac.org">arthur@sopac.org</a>
34.	Mr <a href="#">Jens Kruger</a>	Physical Oceanographer	Secretariat of the Pacific Islands Applied Geoscience Commission (SOPAC) Suva, Fiji Ocean and Islands Programme  Email: <a href="mailto:jkruger@sopac.org">jkruger@sopac.org</a>
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36.	Mr Bishwa Pandey		Air World Wide  Email: <a href="mailto:bpandey@air-worldwide.com">bpandey@air-worldwide.com</a>
37.	Mr Brent Poliquin		Air World Wide  Email: <a href="mailto:bpoliquin@air-worldwide.com">bpoliquin@air-worldwide.com</a>
38.	Mr Scott Pontifex	GIS Specialist (Census and Surveys)	Statistics and Demography Secretariat of the Pacific Community

			Noumea Email: <a href="mailto:scottp@spc.int">scottp@spc.int</a>
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44.	Mr Rajhneal Deo		Land Resources Division Secretariat of the Pacific Community Email: <a href="mailto:rajhnaeld@spc.int">rajhnaeld@spc.int</a>
45.	Mr Tim Nolan	MESCAL Project Manager	International Union for Conservation of Nature (IUCN) Suva Email: <a href="mailto:tim.nolan@iucn.org">tim.nolan@iucn.org</a>
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49.	Mr Osea Bolawaqatabu	Director	Department of Agriculture Ministry of Primary Industries Email: <a href="mailto:obolawaqatabu@govnet.gov.fj">obolawaqatabu@govnet.gov.fj</a>

50.	Ms Mereia Lomavatu	Plant Pathologist	Plant Protection Division Department of Agriculture Ministry of Primary Industries  Email: <a href="mailto:mlomavatu@govnet.gov.fj">mlomavatu@govnet.gov.fj</a>
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### Annex III – Meeting Schedule

Time	Organisation	Contact person(s)
Monday 20 <sup>th</sup> September 2010	Acting Director SPC LRD, Land Management and Resources Policy	Inoke Ratukalou
	SPC LRD, Crop Production	Siosiu Halavatau
	SOPAC SPC LRD, Forest and Trees	Wolf Forstreuter Cenon Padolina
Tuesday 21 <sup>st</sup> September 2010	SPC LRD, Plant Health, Biosecurity	Roy Masamadu and Nacanieli Waqa
Wednesday 22 <sup>nd</sup> September 2010	SPC Library	Verenaisi Babitu
	SPC LRD, IKM Team	Anju Mangal
	SPC LRD Plant Health	Warea Orapa
	SPC LRD ICE	Stephen Hazelman
Thursday 23 <sup>rd</sup> September 2010	SPC LRD, Animal Health and Production	Ken Cokanasiga Nichol Nonga, Andrew Tukuna, Merewai Toganivalu, Ilagi Puana
Friday 24 <sup>th</sup> September 2010	Department of Environment, Fiji	Sela, Kirti Chaya,
Monday 27 <sup>th</sup> September 2010	SPC LRD, Genetic Resources	Dr Mary Taylor
	LRD-ICE	Stephen Hazelman
	Ministry of Primary Industries, Economic Planning	Waisiki Gonemaituba
Tuesday 28 <sup>th</sup> September 2010	USP	Leone Limalevu
	USP	Marika Tuiwawa, Alivereti Naikatini
	SPC Noumea, Coastal Fisheries, Oceanic Fisheries	Johann Bell, Franck Magron
Wednesday 29 <sup>th</sup> September 2010	GOPA/GTZ	Hermann Fickinger, Felix Ries
	AusAID / CSIRO	Gillian Chambers, Martin Sharp, Ryan Medrana
	SOPAC	Arthur Webb, Jutta May
Thursday 30 <sup>th</sup> September 2010	Ministry of Primary Industries, Land and Water Resource Management	Collin Simmons, Asesela Cokanacagi
Friday 1 <sup>st</sup> October 2010	LRD Pacific Regional Trade Statistics Database Administrator	Rajhneal Deo
	IUCN	Tim Nolan
Tuesday 5 <sup>th</sup> October 2010	Ministry of Primary Industries, Lands	Osea Bolawaqatabu
	Plant Protection Koronivia	Ms Losalini Toganivalu

## **Annex IV - List of information gathered**

- List of Climate Change related online information sources
- The land cover/ land use (LCLU) maps for 14 PICTs
- PCCSP Projection table
- SOPAC input satellite scenewise
- Monitoring the Vulnerability and Adaptation of Pacific Coastal Fisheries to Climate Change
- Survey design and methodologies for long term climate change monitoring
- Pacific Climate Change Portal Terms of Reference for Initial Scoping Study
- Climate Change Adaptation: National Risk Management Strategies for the Agricultural Sector
- Strengthening Disaster Information Management Systems for Disaster Risk Management for the Republic of Fiji 2 – 4 September 2009, Suva, Fiji

## Annex V – Projections Table

### Pacific Climate Change Science Program Climate and Ocean Projection Outputs by December 2011

Countries	Projection technique	Variables	Time slices (10 year periods around the following years)	Emission scenarios (A2 = high A1B = medium B1 = low)
14 Pacific island countries and East Timor	Review the 24 Global Climate Models (GCMs) from IPCC-AR4; and after rejecting the least reliable models, prepare projections based on the remaining models.	Air temperature, rainfall, wind speed, humidity, sunshine, evaporation and extreme weather events; ocean temperature and salinity	2030, 2055, 2090	A2, A1B, B1
14 Pacific island countries and East Timor	Based on 6 GCMs undertake dynamical downscaling to 60 km	Air temperature, rainfall, wind speed, humidity, sunshine, evaporation and extreme weather events	2030, 2055, 2090	A2
East Timor, Federated States of Micronesia, Fiji, Papua New Guinea, Samoa, Solomon Islands, Vanuatu	Based on 3 GCMs Undertake dynamical downscaling to 8 km	Air temperature, rainfall, wind speed, humidity, sunshine, evaporation and extreme weather events	2055, 2090	A2
16 locations in 6 countries: Cook Islands, Fiji, Marshall Islands, Palau, Samoa and Vanuatu	Statistically downscale for each station consistent with dynamical downscaling and based on the 3 GCMs used for 8 km downscaling	Rainfall and temperature	2030	A2
Regional pattern (not necessarily country specific)	Based on a selection of the AR4 models	Sea level rise	Decadal average over 21 <sup>st</sup> century	A1B
14 Pacific	Based on a	Aragonite	Decadal	A1B

<b>Countries</b>	<b>Projection technique</b>	<b>Variables</b>	<b>Time slices (10 year periods around the following years)</b>	<b>Emission scenarios (A2 = high A1B = medium B1 = low)</b>
island countries and East Timor	minimum of 3 models, preparation of offline projection of changes in ocean acidification in response to rising atmospheric CO <sub>2</sub> levels and physical changes	saturation state and pH	average over 21 <sup>st</sup> century	

## Annex VI - Compiled list of Country Wise - Utilized Satellite Imageries for crop classification

The drafts of the land cover/ land use (LCLU) maps developed in this project are an extension of the original objective: locating cash crops in the 15 countries of interest. While the focus was on cash crops, we have mapped other classes such as forest, water, sand, settlement, others (barren land) and open/Grass land. The LCLU maps were generated using a multitude of sources but the primary one was remote sensing. Given the extension of the territory covered and the budget available for this task, satellite imagery of different resolution, but mostly low to moderate, was used. The table below outlines the essence of the procedure.

Compiled list of Country Wise - Utilized Satellite Imageries for crop classification							
Sno		Phase I	Remarks	Phase II	Remarks	Phase III	Remarks
1	Fiji	X	Started with Land sat ETM 30m for initial crop classification	X	Correction made based on High resolution imagery (Quick Bird/Ikonos) with us /Google Earth data (manual Digitization & supersede on the classified data).	X	Used latest <b>Aerial photos (DIGO – for PG, SB, and TL only)</b> , Topo-sheets, <b>Spot, ALI E01-10m</b> data; for further correction like cloud cover, new crops digitization etc.
2	Papua New Guinea	X		X		X	
3	Solomon Islands	X		X		X	
4	Western Samoa	X		X		X	
5	Vanuatu	X		X		X	
6	Tonga	X		X		X	
7	Timor Leste	X		X		X	
8	Nauru	X	Started with ALI E01-10m for initial crop classification	X	Correction made based on High resolution imagery (Quick Bird/Ikonos) with us /Google Earth data (manual Digitization & supersede on the classified data).		Done in two phases
9	Niue	X		X			
10	Palau	X		X			
11	Marshall Islands	X		X			
12	Kiribati	X		X			
13	Cook Islands	X		X			
14	Federal states of Micronesia	X		X			
15	Tuvalu	X		X			

The drafts of the LCLU maps are circulated to elicit some constructive feedback. The reviewers of these maps should be aware that the accuracy of the land classifications may sometime be affected by the inherent limitations of the approach used. The main limitations are listed below:

1. Vintage of the satellite imagery - Some information about the vintage of the satellite imagery for each country is given in the table below. The attached Excel file provides more details, namely the vintage by scene by country.



S.No	Country	No of Scenes	Sensor Type	vintage
1	Fiji	6	Land sat ETM 30 m Resolution	2001/2003**
2	Papua New Guinea	46	Land sat ETM 30 m Resolution	2000/2002**
3	Solomon Islands	13	Land sat ETM 30 m Resolution	2001/2003**
4	Samoa	3	Land sat ETM 30 m Resolution	1999/2002**
5	Tonga	2	Land sat ETM 30 m Resolution	1999/2000**
6	Marshall Islands	7	ALI	EO-1 (Latest)
7	Cook Islands	5	ALI	EO-1 (Latest)
8	Tuvalu	3	ALI	EO-1 (Latest)
9	Nauru	1	ALI	EO-1 (Latest)
10	Niue	1	ALI	EO-1 (Latest)
11	Palau	2	ALI	EO-1 (Latest)
12	Timor Leste	5	Land sat ETM 30 m Resolution	1999/2001**
13	Vanuatu	13	Land sat ETM 30 m Resolution	1999/2001**
14	Federated States of Micronesia	2	ALI	EO-1 (Latest)
15	Kiribati	2	ALI	EO-1 (Latest)

2. Resolution of the imagery - Most of the imagery scenes used had a resolution of 10m or 30m (see excel file for details). Some high resolution imagery was used in selected areas
3. Cloud cover in the imagery, which is non-negligible in some areas of these countries
4. Limited ground truthing – Most of the truthing was done via Virtual truthing using high resolution satellite imagery where available
5. Difficulty in categorizing particular crop when there is mixed land use.
6. Difficulty in categorizing particular crop using low and moderate resolution satellite imagery
7. Seasonality of crops vis-à-vis no continuous coverage of satellite imagery . The signature on satellite imagery of some crops (e.g., sugar cane) may be different in different seasons of the year. For example, certain crops, such as sugar cane, are in a fallow state in some parts of the year.
8. Unavailability of existing maps and other information there may be in possession of local governments and organizations.

## Annex VII – Data Inventory List for LRD

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
<b>LRD Crop Production &amp; Agricultural Policy and Support</b>	Landcare research (David Leslie, James Barringer) have supported countries in developing crop suitability assessments combining information on Pacific crops with soil data.		1) PacCLIM - climate change simulation model developed by Waikato University, University of Hawaii and CSIRO.	1) Advice on crops that best suit differing environmental conditions in member countries based on their current environmental conditions (soil type, rainfall patterns, temperature) and future changes in environmental conditions.	Topographical information is not detailed enough – 5m intervals – so simulating how sea level rise will impact areas cannot be done accurately.	Dr Siua Halavatau & Mr Inoke Ratukalou
	CSIRO – Global soil map. This will try and bring together at the global level different soil information for different countries. Will rely on PICs having this data to enable them to link up to the system.		2) Plant Gro - software programme that uses 3 files (Climate File, Soil File and Plant File) to combine country data to produce predictions of how changing environmental conditions will assess the type of crops that can be grown in different areas	2) Ability to better identify areas of food insecurity (resulting from population pressures, poor land etc) and how vulnerability might change as a result of future climate change. Work needed to identify these vulnerable areas might occur as a result of implementation of the Pacific Food Security Framework – in particular the component on food information systems.		
	Sources of data for food security assessment- Household Income and Expenditure Surveys, identification of food security hotspots. Siua has developed a questionnaire with FSM on baseline food data necessary to manage			3) CC database to be linked to other initiatives to enable assessment of changes in areas vulnerability and highlighting areas particularly vulnerable to CC impacts can be made. Land resettlement may be necessary as a result of sea level rise. LRD needs to be able to better identify areas that are particularly vulnerable to		

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
<b>LRD Forestry</b>	decisions relating to climate change.			sea level rise and the populations affected in order to work with countries to manage any necessary changes and minimise potential for land-related conflicts. [detailed topographical data a constraint to providing this advice]		
	PopGIS and SOPAC are currently in Samoa surveying and recording image and this will be presented during the GIS/Remote Sensing Workshop on the week of the 25th of November. They are using satellite imagery from Geo Eye which is based in the USA.			1) Vegetation mapping and target vegetation assessment.	Maps are with Australia, New Zealand and Koronivia Research Station (KRS) they need to be scanned, converted and geo referenced. There is a need to create digital soil layers. These maps are sitting in libraries.	Mr Wolf Foresteur & Mr Cenon Pangelian
	EDF 9 Map servers have the largest spatial databases in the Pacific.			2) Document current status and monitoring vegetation indicator and mangrove.	Vegetation mapping still to be done for Solomon Islands and Vanuatu.	
	Soil data can be used to identify areas of drought. There are soil information on SIMCLIM maps that can be converted. The ideal scale for soil maps and digital maps is 1:10,000. However the climate data has a scale of 1:500,000 which is not a good format.			3) Mapping change in coast line through aerial photographs (there is a project in Tonga that could be integrated) and creation of digital models to show coastal low lying areas to illustrate the impact of digital drain models. Tuvalu and the Marshall Islands have space borne image data and Samoa 2 meter contour lines.	All demographic data needs to be digitised.	

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
	Laser range and detection is very expensive therefore 90% of the image data is bought through SOPAC which has a 10-20% discount. There is a data sharing agreement between PICTs, Pacific Disaster Centre (PDC), SPC and SOPAC by image data on single user data.			4) This tool can be given to decision makers on restoration of vegetation and for existing vegetation to make use of existing species and use that for restoration.		
	Data is bought from MDA (Macdonalds, Dettweiler and Associates Ltd) - <a href="http://gs.mdacorporati on.com/">http://gs.mdacorporati on.com/</a> . These are very high resolution (VHR) images which are used in the Autocad Land Development Software (ALDS). All this is recorded as metadata and more information can be seen on the SOPAC/PICISOC website.			5) Forest monitoring different years to see reforestation and deforestation is occurring.		
	John Hewitt simulates soil data. The minimum scale for a soil map should be 1:10,000, the ones here in Fiji are on the scale of 1:50,000.			6) All climate change data needs to be centralised so that the countries can share data.		

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
<b>LRD</b> <b>Biosecurity &amp; Trade Support</b>	<p>Fruit fly surveillance data as recent at 2006 and includes the host list. This is available from the Biosecurity Technician, Nacanieli Waqa in the form of excel spreadsheets. All other information relating to surveillance and monitoring information can be found on the Fruit fly website <a href="http://www.spc.int/pacificfly/">http://www.spc.int/pacificfly/</a>.</p>	<p>Pest list database - <a href="http://pld.spc.int/pld/">http://pld.spc.int/pld/</a></p>	<p>CLIMEX predicts the potential distribution and relative abundance of species in relation to climate. Climex is currently used in over twenty countries to examine the distribution of insects, plants, pathogens and vertebrates for a variety of purposes, including biogeography, quarantine, biological control and impacts of changes in climate and climate variability. <a href="http://www.climatemodel.com/index.html">http://www.climatemodel.com/index.html</a></p>	<p>1) Risk analysis, environment assessment, to assess the multiply and spread movement of plants and animals, likely effect of the environment, changes in rainfall, sunshine, temperature, wind velocity, cyclones in area, cool, hot, dry related to vegetation type and climate.</p>		<p>Mr Roy Masamdu &amp; Mr Nacanieli Waqa</p>
	<p>There are GPS coordinates to plot fruit fly and ants distribution. These have been done for Fiji, Niue, Pitcairn, Tuvalu, French Polynesia, Samoa and Vanuatu. There is also data available on fruit fly trap sites. These sites have been georeferenced.</p>			<p>2) Mitigation of pests on the border or out on the field. Understanding of climate change issues to assist in the development of relevant and realistic mitigation.</p>		
				<p>3) Mitigation of pest management e.g termite prevalence in Labasa and Lautoka is attributed to the weather pattern.</p>		

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
SPC Library				4) Mutation of pests due to weather conditions. For example what was not a pest 10 years ago has now become a pest for example Nasutitermes now in Labasa is now regarded as a pest compared to 10 years ago. This can also determine the change of a secondary pest to primary pest.		
				5) Introduction of biocontrol agents will require the use of climate data to ensure its effectiveness. And weather conditions in the pilot sites can then ensure its effectiveness in similar weather conditions in the Pacific region.		
				6) Commodity crop production in Pacific Island countries.		
				7) Remote sensing can be used to determine the likely spread of the pest through damage done to the vegetation through aerial photographs.		
	All climate change data have been catalogued into the SPC Library cataloguing system called KOHA. All climate change information that has been entered into the catalogue is now available online via the SPC Library site. There are plans also to link to WorldCat which			1) There is a need to centralize all existing climate change information or documents. At present information is all over the place and searching for information can be quite cumbersome. The portal or database can somehow link to existing data sources in other libraries or institutions. It should have a search facility where users can search using		Ms Verenaissi Babbitu

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
<b>LRD Animal Health &amp; Production</b>	is the central bank for catalogues from all over the world.			the basic metadata fields like abstract, title, author, publication date and get from the database information like the bibliographic entries that include pagination, publication place, publication date and number of pages.		
	SPREP also has a more comprehensive collection on climate change information.			2) The users should also be able to see where the electronic copy is available online or in hardcopy and if its available in full text.		
	USP Library also has a climate change collection and it is worth checking out PIMRIS on their climate change information as well.					
	<p>Animal genetics</p> <ul style="list-style-type: none"> <li>• have data on location, feed, numbers etc all in spreadsheet format.</li> </ul> <p>Also the results of DNA analysis from ILI</p> <ul style="list-style-type: none"> <li>• There was data collected by FAO.</li> <li>• Pacific breeds of chicken and pigs have GPS points for villages and farms that have pigs. This is available in spreadsheet format. Though the figures need verification.</li> </ul>	Animal Genetics Database		1) Breeds at risk and currently in use. The database can aid with conservation methods also aid in analysis and distribution.	There is no data on livestock census therefore countries are now requesting livestock census.	Mr Ken Cokanasiga

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
LRD Genetic Resources	DNA characterization studies collection on diseases and the environment they exist in. Very little data exists.	Pacific Animal Health Information System (PAHIS) – this includes animal disease distribution		2) The database should show hot spots for endemic breeds. At present mapping has not been done.	Animal genetics there is a lack of information as the data sheets were not designed to go beyond the project.	
	Population data report from FAO with Nic in xls format.	Vanuatu also has an animal database – Contact Benueal Taralongi.		3) There will be a need to show the change in distribution of insects so that a surveillance system can be established for these vectors. Information on this can be found with DAFF and ACIAR, Australia. – Contact Mike Nunn.		
	Waste management composting sites also have GPS coordinates.					
	Some data is also with Tim Pickering in Aquaculture.					
	1) There is a climate ready collection in CEPACT.	CEPACT Database - which records accession, details, evaluation, descriptor, passport and distribution data.		It can be utilised in Genetic resources and conservation.	1) No spatial data.	Ms Mary Taylor
	2) Evaluation data, RGC data, passport data, descriptor data, distribution data and accession data.			For PNG the climate change database could be used for defining the climate, assumptions about diversity for relevance in climate models, GIS and mapping.	2) Turnaround time of publications hence not all the publications are online.	
	3) All CEPACT publications are the LRD website			There is a need for a central system to predict the varieties of crops to be ready for different scenarios		



Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
<b>LRD Plant Health</b>				The CC database can be used as a tool to enable users i.e research organisations etc..to feed information into the systems so that other organisation will be able to use this information online.		
				The climate change database could be used during cyclones and funds to assess and situation and response.		
	Distribution of invasive plant and pests with GPS coordinates of the distribution but no work has been done on impacts on the increase in temperature and salinity.	Pacific Islands Pest List database	CLIMEX developed by CSIRO and UQ – used to predict species distribution using rainfall, soil inundation, topography, solar radiation and geology.	1) Pest List Database does show the distribution and the CC database could build on that and link to other CC parameters like temperature, location of countries, difference in altitude and compare that to flat low lying islands. 2) Importance of having different varieties to deal with salinity and temperature of crops. Change in temperature and CO2 levels and the impact on weeds and other crops.	CLIMEX, CSIRO and UQ – used to predict species distribution using rainfall, soil inundation, topography, solar radiation and geology.	Mr Warea Orapa
	There is an AusAid funded project, Karluruwin Chalapan on climate change with SPREP and PIFS which has data on sea level temperature and monitoring stations.			3) Sea level rise and the immediate impact on species composition in the long term. 4) Eradication – it can be used to predict the pest distribution and find effective management strategies		

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
<b>LRD Information, Communication &amp; Extension</b>				5) Introduction of biocontrol agents in the eradication process – climate conditions will need to be assessed to ensure that it is appropriate for the biocontrol agent to be effective.		
				6) The CC database should have prediction models to determine the extinction or survival of a species if there was to be an increase in temperature. Also to illustrate its effect on particular pests or crops.		
	1) IPSI factsheets and pest alerts.			1) Identify hot spots of places that will be affected by natural disasters as a result of an increase in temperature.	CC adaptation and mitigation best practices will need a consultant to collate.	Mr Stephen Hazelman
	2) Link to POETCOM website.			ICE have setup an information centre and currently has a pilot site in Tonga managed by Mr Kamilo Ali an extension officer from the Ministry of Agriculture. They are hoping that this information centre could be linked the CC database so that they can advise farmers of the best areas to plant in relation to soil salinity, sea level rise, humidity and sunshine. Which pesticide/fertilisers to use etc. Organic ways of planting. Pest and diseases, pest control methods, market information. Contour planting and agroforestry.		

Stakeholder	Existing data	Existing databases	Existing Modelling Software	User Needs	Data Gaps	Contact person(s)
	3) Knowledge on best practices					
	4) CC related agriculture production methods in agroforestry and mulching.					
	5) Documentation of Pacific best practices.					

## Annex VI – Data Inventory List for National Stakeholders

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data Sharing Agreements	Contact person(s)
<b>Department of Environment</b>	At present for the NCCD data is currently being sourced from NGOs and other sectors. They have also tried PIPA but the response is slow. They are also using a list of policies and strategies from the Department of Energy to supplement climate change.....MGM management plan and DRR.			SIMCLIM has been used – contact Ravin Kumar, Met Office and Acting Director Alipate ?	1) The identification of risk profiles for the different sectors for crops flooding.			Mr Sele N Tagivuni & Ms Kirti Chaya
	Information is also provided by Koronivia Research Station on areas relating to pest management and crop production.				2) All existing data and information needs to be centralised.			
	Data does exist on GHG from forestry, water authority, waste management but needs to be integrated.							

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data Sharing Agreements	Contact person(s)
<b>MPI - Economic Planning Division</b>	UNDP assisted for two cyclones for disaster management. A unit was set up for disaster management and a software to capture the data. But this is all in the pipeline and how to implement. Results of the feasibility study will show areas to look into in the future. Disaster unit for quick assessment.	National Agricultural Census - MS Access database that records the following categories, Geographical, Characteristics, House/Economic Activity, Agricultural Tasks, Total land for farmer, crops farmed on farm land, land tenure, sugarcane varieties planted, g. Pastures/ Floriculture/ Livestock Breeds (Beef), Poultry/ Milk production/ Aquaculture, Employment, Other livestock, Apiculture, Machinery – farm implements, equipment, transport, Farm management.		ACIAR project to collate data for analysis small hold policy will need to incorporate this into the model which looks at impact. This was developed by Deacon University has been running since 2007. Ralph Holme and Henry Simon Hearn are the main contact people. This also looks at economic shocks, natural disaster management and 20% tariffs. At present climate information has not been incorporated into the project. VORSIM Model uses household income/consumption survey this is done in excel.			The EPD is willing to share their data with SPC.	Mr Waisiki Gonenaitaba
		FAO software called Agrimarket which is an MS Access database is						

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data Sharing Agreements	Contact person(s)
		used for market surveys collected from the 12-14 municipal markets. It includes weights and prices.						
<b>Land and Water Resource Management, MPI</b>			Land Classification System - used to illustrate present land use, forest cover and grassland.	SIMCLIM – data unreliable for Fiji, there is a need for modeling software in Agriculture.	Negative impact, crop production, soil malnutrition, water solubility and health.	Land classification from 1-8 classes are baseline data, soils and climate datasets reside in Landcare but attempts to migrate to Fiji have been futile.	Agreement for data sharing and uses of SPC and Ministry of Agriculture.	Mr Collin Simmons
					Tools for bench marking, monitoring of area/sectors.			
					Drainage design criteria, 100 ml of rainfall in 24 hours, review with change in climate, rainfall intensity, sea level rise, focussing on low lying areas, avoid salt water regression into low lying areas. Little data is			

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data Sharing Agreements	Contact person(s)
<b>Fiji Landuse Planning, MPI</b>					available.			
					Meteorological office – key stakeholder set up weather station in projection area to collect data. Determine crops suitable for area.			
					Adaptation models to the Pacific focusing on a specific area.			
					Tikina profile to see existing land cover.			
	All data sets are from FLIS except cadastral information on leases.	Soils database, all fiscal and chemical composition of soils already in save files and hardcopy where it was published.	Fiji Landuse System - records topographical and cadastral data.		1) Need to have climate data, temperature and rainfall, point data from Meteorological stations, not suitable for Lands purpose far apart not spaced evenly. 2) Climate data update and spatial data created. Difference in rainfall, changes in landuse and the effect of	Present land use not complete only district by district.		Mr Osea Bolawaqatabu
			ARCVIEW and ARCGIS			Conversion of old maps to be digitised. Office in KRS, West and North – contact Osea		

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data Sharing Agreements	Contact person(s)
<b>Plant Protection Section, Department of Agriculture, MPI</b>					temperature on landuse and the effect of temperature on land use.	Bolawaqatabu.		
					3) Agriculture requires for crops, rainfall, humidity, sunshine, fertility requirements. Optimum and minimum of agriculture.			
					4) Land use planning work, sustainable land management.			
	All pathogen records are in the disease register these include #, date, host, disease, locality and remarks.				Assist in determining pest outbreak in relation to temperature, humidity and sunlight.	Need for GPS		Mrs Losalini Toganivalu
	Traps - # of insects collected in traps, fortnight/month - Hardcopies and excel spreadsheets  - Host survey of fruits							



Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data Sharing Agreements	Contact person(s)
	<ul style="list-style-type: none"> <li>- Collect fruit, incubate and fruit fly</li> <li>- There are GPS waypoints, but these need to be converted</li> </ul>							

## Annex VII – Data Inventory List for Regional Stakeholders

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data sharing agreements	Contact person(s)
<b>PACE, USP</b>	KRS soil and crop model, crop classification model, soil correlation.			PACLIM and VANDACLIM are useful if there is information otherwise can only be used in theory. Depending on which sector you are looking at, sea level topography, hydrology (good hydrology data), contour level 5-10m.	Linking of soil classification with crop. Important crops, taro, sugarcane, maize, rice, cassava. Importance agrometeorological parameters brought down to district level.	Soil maps of PICTs need to be digitised.		Mr Leone Limalevu
	Irrigation and drought talk to hydrology, Fiji Water and Water Authority of Fiji – talk to Vinesh in Water Resources Management.			FIJICLIM which is currently with the Department of Environment and is controlled remotely by Waikato University.	Major met regions of country, dry, wet and intermediate practical solutions for now.	Research stations to have weather stations relevant parameters being monitored.		
					National statistics used anecdotal data, el nino, sugarcane accurate, drying, drought, irrigation, project future scenarios.			
<b>South Pacific Regional</b>	Distribution, location and photographs of native and endemic species,	Herbarium MS Access database developed by IT Support, USP - records accession					Data sharing agreement – there will need to be a formal request	Mr Marika Tuiwawa

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data sharing agreements	Contact person(s)
<b>Herbarium</b>	weeds, timber and ferns.	details					because copyright belongs to the governments.	
		The specimens database can be accessed via the following link: <a href="http://ias.fste.usp.ac.fj/index.php?id=7549">http://ias.fste.usp.ac.fj/index.php?id=7549</a> .						
<b>Pacific Climate Change Science Program</b>	Climate data from the meteorological offices.	Climate database management system created in open access software	Not used	Climate Futures Tool - used for impact modelling			Willing to work with SPC to find linkages and synergies.	Dr Gillian Cambers & Ms Mandy Hopkins
				15-18 projection models based on AR4 of the IPCC				
<b>SOPAC</b>	Marine, oceanographic, Themetry, topographical maps of the sea, Bureau of meteorology, Australia, Docs, tide calendars, actual datasets, Analysis of temperature and climate, Used for surveys, Ariel photograph, Satellite images	GeoNetwork database - <a href="http://geonetwork.sopac.org/geonetwork/srv/en/main.home">http://geonetwork.sopac.org/geonetwork/srv/en/main.home</a>						Mr Arthur Web

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data sharing agreements	Contact person(s)
	for viewing not downloading, Topography, geological maps							
		The Pacific Disaster Net ( <a href="http://www.pacificdisaster.net/">http://www.pacificdisaster.net/</a> ). The Web Portal and Database System is designed to be the largest and most comprehensive information resource for Disaster Risk Management for the Pacific Island Countries.						Ms Jutta May
<b>SOPAC</b>		PACIFIC HYDROLOGICAL CYCLE OBSERVING SYSTEM (HYCOS) WEB PORTAL						
		Pacific Water Action Matrix Overview & Search						

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data sharing agreements	Contact person(s)
<b>Air World Wide</b>	Satellite imagery for crop classification project. Done for 14 PICTs including Fiji, Tonga and Vanuatu.						Final cash crop classification will be done at the end of 2010. The maps will then be publically available at SPC, SOPAC and PICT governments.	Mr Paolo Bazzurro
<b>IUCN</b>	Mangrove and marine data with the Department of Environment.	Temperature logging database at USP.				Build on existing systems technical aspect to be determined at inception workshop.		Mr Tim Nolan
	Marine Resources Inventory Survey - Department of Environment.	Turtle database - SPREP						
	FLAMA - Monitoring database at each of the sites - IAS, Ron Vave - Problems of using data for	Mangroves for the Future which is a GEF funded project on mangroves have a database containing all the data.						

Stakeholder	Existing data	Existing databases	Existing GIS	Existing Modelling Software	User Needs	Data Gaps	Data sharing agreements	Contact person(s)
	other purposes - Catch access database - Survey data access database - Not periodically available due to data collection processes							

## Annex VIII – Pacific Island Resources

1. SPC Library CC Collection - <http://opac.spc.int/cgi-bin/koha/opac-shelves.pl?viewshelf=53>
2. GTZ – <http://www.gtz.de/en/weltweit/asien-pazifik/27718.htm>
3. Intergovernmental Panel on Climate Change, Fourth Assessment, Working Group 2 Report – <http://www.ipcc.ch>
4. International Union for Conservation of Nature – <http://www.iucn.org/oceania>
5. Locally Managed Marine Area Network – <http://www.lmmanetwork.org/>
6. Pacific Adaptation to Climate Change Project – [http://www.sprep.org/climate\\_change/PACC/index.asp](http://www.sprep.org/climate_change/PACC/index.asp)
7. SOPAC - <http://www.sopac.org>
8. Pacific Disaster Net – <http://www.PacificDisaster.Net>
9. SPC – <http://www.spc.int>
10. SPREP – [http://www.sprep.org/climate\\_change/index.asp](http://www.sprep.org/climate_change/index.asp)
11. Small Island Developing States Network – <http://www.sidsnet.org>
12. UN Framework Convention on Climate Change – <http://www.unfccc.int>
13. Pacific Institute – <http://www.pacinst.org/>
14. IFAD – <http://www.ifad.org>
15. UNDPPC – <http://www.undppc.org.fj>
16. WWF - [http://www.wwfpacific.org.fj/what\\_we\\_do/climatechange/](http://www.wwfpacific.org.fj/what_we_do/climatechange/)
17. Asia Pacific Network on Climate Change (AP-Net) - <http://www.climateanddevelopment.org/ap-net/>
18. World Bank Data Bank - <http://beta.worldbank.org/climatechange/regions>
19. USP
20. Red cross
21. Other donors (AUSAID...)
22. CSIRO
23. Bureaus of meteorology in the countries
24. NIWA
25. East West Centre Hawaii

26. NOAA pacific climate change library (not much on there at the moment)

[http://piccos.soest.hawaii.edu/piccp/joomla/index.php?option=com\\_content&view=frontpage&Itemid=1](http://piccos.soest.hawaii.edu/piccp/joomla/index.php?option=com_content&view=frontpage&Itemid=1)

### **Metadata and Dublin Core**

1. <http://www.libraries.rutgers.edu/rul/events/metadata/MetadataWorkshopWeberBerger/sld001.htm>
2. <http://www.niso.org/publications/press/UnderstandingMetadata.pdf>