A Report on Climate Change Adaptation Intervention in Pelau Island in the Ontong Java Atoll

An adaptation intervention by PACC focusing on improving resilience of the low-lying communities to the adverse effects of climate change in the agriculture sector and supporting the enhancement of food and water security in the atoll islands through capacity building and community engagement. The work was carried out between 14th November 2012 and 13th December, 2012

A Report for PACC Project, MAL, and SI NSC

Compiled by Jasper Maike Bonie
Team Leader Ontong Java FWSP

December, 2012
Cover page

The top two pictures (L–R) show (i) a newly planted sweet taro at the demonstration/project site; and (ii) one of the wells used for washing.

The bottom four pictures (L–R) show (i) An agriculture extension officer/member of the team with planting materials; (ii) Lead farmers at a training session (iii) Farmers preparing the soil and (iv) Women planting sweet taro.

The pictures were taken by Jasper M. Bonie.
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Acknowledgement

On behalf of the team, I like to thank the Permanent Secretary of the Ministry of Agriculture and Livestock, Mr. Frank Wickham for his strong support for this CCA intervention at Pelau.

Special appreciation goes also to Project Manager for PACC (SI) Mr. Casper S. Supa for his support and facilitation of funds and transport to ensure activities done as planned.

I would like to acknowledge the valuable technical inputs by the Senior Research Officer (SRO) Mr. Jules and the Acting Director of Research Mrs. Helen Tsatsia for support and guidance during the planning stages.

Big thanks to the House of Chiefs of Pelau and Luaniua for accepting the MAL/PACC demonstration team for their support and interest to work closely with Ministry of Agriculture and Livestock (MAL).

Our team would have not succeeded in our plans without the involvement and support of the people from the Pelau and Luaniua communities. Thank you all chiefs, elders and the people of Pelau community for allowing their community to be part of this project. Thanks to all participating farmers for giving their land and time for the project implementation.
Executive Summary

Solomon Islands benefits from funds provided by the Global Environment Facility (GEF) through the Pacific Adaptation to Climate Change (PACC) Project. The PACC project promotes climate change adaptation as a key prerequisite to sustainable development in Pacific island countries. Its objective is to enhance the capacity of the participating countries to adapt to climate change and climate variability in selected development sectors.

The project will deliver improved technical capacity to formulate and implement national and sub-national policies and costing benefit assessment exercises. Pilot demonstration activities will deliver adaptation benefits in the form of practical experiences in the planning and implementation of response measures that reduce vulnerability.

The Solomon Islands component of the project is related to the following PACC Project Outputs: “Guidelines for reducing vulnerability of small isolated island communities’ to the effects of climate change in the food production and food security sector and demonstrating community-based management of climate change risks in agriculture in Ontong Java Island”

The project assists the Ministry of Agriculture and Livestock, and key stakeholders, including communities, to develop technical capacities to design and implement an integrated food security programme that will reduce their vulnerability to the effects of climate change.

According to SIG NAPA 2009 (p. 85), there are among others in Solomon Islands communities living on low-lying coral atolls of Ontong Java and Sikaiana in Malaita, and the Reef Islands in Temotu that are particularly vulnerable to climate change effects and are at most immediate risks.

In this regard, the Solomon Islands PACC project is currently focusing on improving resilience of the low-lying atoll communities to the adverse effects of climate change in the agriculture sector. Ministry of Agriculture & Livestock (MAL) is the Implementing Agency (IA) and Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM) is the focal point.

The Ontong Java Atoll Component

The PACC V&A Assessment report 2011 highlights some of the major adaptation priorities identified for the communities of the Ontong Java atoll (Luaniua and Pelau). The priority areas that has direct impact to climate change effects which PACC Project through Ministry of Agriculture Research should focused on include among others improving food production and crop yield.

PACC Cost Benefit Analysis report highlights two important considerations in designing a food security project for Ontong Java. First, to build on the existing food security project already in place under the auspices of the Anglican Church of Melanesia (ACOM) Second, to enhance the advances in scientific knowledge of improved organic and biological production systems that could be applied in Ontong Java in combination with traditional knowledge. The Ministry of Agriculture and Livestock through PACC Project then will look at building on the current ACOM project. This may need expanding parallel activities from Luaniua to Pelau.
The Approach for Pelau

The team proposed a few food production systems for Pelau in collaboration with PACC and the Research Department of the Ministry of Agriculture and Livestock. We proposed the following models:

**ITTA-ALLEY or Atoll Permaculture farming system**

According to a report by ACOM Climate Change Program, ITTA-ALLEY Farming system is an agro forest initiative and refers to this as “Atoll Permaculture” or “ITTA-ALLEY” farming system. It is a multi-layered system of fruit and nut trees, root crops and vegetables.

“We are creating a farming system that is permanent, self mulching, self sustaining and self regenerating, and that it can provide a good source of food and other livelihoods to the community. We like also to create a system that will demand less time and has low maintenance cost. We imagine a forest of food where food can be collected when required.”

There are ecological and economic interactions between woody and non-woody components in agro-forest systems. They use trees with intension. In agro forest, knowledge, careful selection of species and good management of trees and crops optimize the production and positive effects of the system and minimize negative competitive effects. In some areas, a narrow definition of agro-forestry might simply be ‘trees on farms.’ Hence, it is the commitment of farmers towards the establishment and management of forests and food products on their land.

Recently there has been an increasing interest in using the agro-forest approach for developing more productive, low-input, and sustainable land use technologies. Such a system provides solutions to tree depletion, soil degradation, and declining yields under shifting cultivation. Agro-forestry is a sustainable land management system, which increases the overall yield of the land. It combines the production of trees and the production of crops on the same unit of land, and it applies management practices that are compatible with the cultural practices of the local population.

**Backyard Farming**

Backyard gardening and composting will be an important and effective system approach to make garden at the backyard of homestead. Women usually have much to offer as they have good composting materials at their disposal. Kitchen wastes and wood ash are good sources of mulching materials. Crops planted close to the kitchen can be watered easily with kitchen wastewater as well as grey water.

Composting using poultry manure and kitchen waste is important. Compost is organic matter that has been decomposed to soil -like material. It is used for used as a fertilizer and soil amendment. It is a multi-step process thus takes about 6 to 12 months. It contains macro and micronutrients often absent in synthetic fertilizers and releases nutrients slowly—over months or years, unlike synthetic fertilizers. Composts enriched soil retains fertilizers better. Less fertilizer runs off to pollute waterways. Compost

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1 Bonie, J.M., 2010
buffers the soil, neutralizing both acid & alkaline soils, bringing pH levels to the optimum range for nutrient availability to plants.

*Intercropping under Coconut*

Growing crops under coconuts will involve good planning. It must consider that enough sunlight is coming through and that coconuts needs adequate spacing to allow sunlight. Selection of crops will consider tree crop species, root crop species and vine crop species.

*Pusaraghi (Swamp) Farming Systems*

It will be an important activity to collect as much biomass as could be produced by growing leguminous plant species to mulch the swamp taro pits. Mulching will provide the essential nutrients for the taros.
Acronyms

ACOM Anglican Church of Melanesia
CBA Cost Benefit Assessment
CC Climate Change
FP Focal Point
GEF Global Environment Facility
IA Implementing Agency
IPCC Inter-governmental Panel on Climate Change
GCM General Circulation Model
GHG Green House Gas
ITTA Improve Temotu Traditional Agriculture
MAL Ministry of Agriculture and Livestock
MECDM Ministry of Environment, Climate Change, Disaster Management & Meteorology
NAPA National Adaptation Programme of Action
NGO Non-government organization
OBM Outboard Motor
PACC Pacific Adaptation to Climate Change
SIG Solomon Islands Government
V&A Vulnerability and Adaptation
1.0 INTRODUCTION

Map of the Solomon Islands

Figure 1: A map of Solomon Islands showing the project site
The PACC Project

Solomon Islands is benefiting from funding by the Global Environment Facility (GEF) through the Pacific Adaptation to Climate Change (PACC) Project. The project is designed to promote climate change adaptation as a key prerequisite to sustainable development in Pacific Island Countries. The PACC project objective is to enhance the capacity of the participating countries to adapt to climate change, including climate variability, in selected key development sectors. The Project focuses on barriers identified through the situation analysis: supporting capacity building and mainstreaming of climate change adaptation at the national level; providing tools and guidelines, supplemented by practical demonstration of adaptation as both a process and on the ground activity; and through supporting regional approaches.

More specifically, the project will deliver outcomes and outputs that include improved technical capacity to formulate and implement national and sub-national policies, legislation, and costing/assessment exercises. Climate change risks will be incorporated into relevant governance policies and strategies for achieving food security, water management, and coastal development. At the sub-national level, pilot demonstration activities will deliver adaptation benefits in the form of practical experiences in the planning and implementation of response measures that reduce vulnerability. These benefits will be integral for future replication and up scaling, and to identify larger scale investment opportunities from multilateral banks supporting countries with climate change adaptation. The project will also foster regional collaboration on adaptation.

The Solomon Islands Component

The Solomon Islands component of the project is related to the following PACC Project Outputs:

"Guidelines for reducing vulnerability of small isolated island communities’ to the effects of climate change in the food production and food security sector and Demonstrating community-based management of climate change risks in agriculture in Ontong Java Island"

The project assists the Ministry of Agriculture and Livestock, and key stakeholders, including communities, to develop technical capacities to design and implement an integrated food security programme that will reduce their vulnerability to the effects of climate change. Activities identified during national consultation include identification and evaluation of adaptation technologies to reduce crop yield decline, measures to reduce wave overtopping and inundation, identification and demonstration of salt resistant crops and provision of additional food storage facilities.

This output of PACC will follow activities outlined below. In the course of the project, details of on the ground activities will be identified, evaluated and demonstrated. This will enhance the resilience of government development activities. Specific activities include the following:

- undertaking a vulnerability assessment targeting food production and livelihoods in relation to the impacts of climate change;
- developing guidelines that identify methods for improving food security combining both modern and traditional knowledge and technology;
- training technical staff in the Department of Agriculture and other relevant institutions to apply the guidelines in a pilot situation;
• and demonstrating use of the Guidelines through measures that improve food security in relation to climate change.

The project overall objective is to develop and to strengthen communities through capacity building and community engagement in adaptation to climate change. Based on better understanding of the impacts of climate change and variability the project aims to develop and implement sustainable strategies for community adaptation to climate change. It also aims to establish a network of local, national and regional specialists on climate change who will support communities and governments within the pacific countries involved in the project, non-government organizations (NGO) and regional organizations in their efforts to address the effects of climate change through sustainable approaches.

According to SIG NAPA 2009 (p. 85) there are particular locations in Solomon Islands that are particularly vulnerable in terms of climate change. They include communities living on low-lying coral atolls of Ontong Java and Sikaiana in Malaita Province, and the Reef Islands in Temotu Province. Although there are other parts of the Solomon Islands that are affected by climate change in varying ways it is the low-lying islands that are at most immediate risk. The NAPA process identified the low-lying (and artificially built-up) islands as being the most vulnerable to climate change and sea-level rise.

In this regard, the Solomon Islands PACC project currently focusing on improving resilience of the low-lying communities to the adverse effects of climate change in the agriculture sector. Ministry of Agriculture & Livestock (MAL) is the Implementing Agency (IA) and Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM) is the focal point.

The Ontong Java Atoll Component

The PACC V&A Assessment report 2011 highlights some of the major adaptation priorities identified by the communities of Ontong Java (Luaniua and Pelau). The priority areas that has direct impact to climate change effects which PACC Project through Ministry of Agriculture Research should focused on include improving food production and crop yield; sustainable harvest of marine resources; climate change awareness and education for local communities; improvement of transport accessibility and improvement of communication.

PACC Cost Benefit Analysis Report highlights two important considerations in designing a food security project for Ontong Java, which was identified through a PACC CBA exercise. First, to build on the existing food security project already in place under the auspices of the Anglican Church of Melanesia (ACOM) and second enhance the advances in scientific knowledge of improved organic and biological production systems for the tropics that could be applied on Ontong Java in combination with traditional knowledge. The Ministry of Agriculture and Livestock through PACC Project then will look at building on the current ACOM project. This may need expanding parallel activities from Luaniua to Pelau.

The Approach for Pelau

The team proposed a few food production systems for Pelau in collaboration with PACC and the Research Department of the Ministry of Agriculture and Livestock. These systems are outlined in detail in the methodology.
2.0 METHODOLOGY

2.1 The Implementing Agency (Al) and Focal Point (FP)

Ministry of Agriculture & Livestock (MAL) is the Implementing Agency (IA) and Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM) is the Focal Point (FP)

2.2 Team Members

Mr. Jasper M. Bonie (PACC Demo team Leader/Supervisor)
Mr. Francis Suiromea (MAL/Research Officer)
Mr. Robert Tate’e (MAL/Research Officer)

2.3 Consultation with PACC and the Ministry of Agriculture and Livestock

The implementation of PACC's adaptation intervention program in Pelau community will focus on improving the resilience of the low-lying communities to the adverse effects of climate change in the agriculture sector. PACC will support and enhance improvement of food and water security in the atoll islands through capacity building and community engagement. Thorough consultations with PACC and the Ministry of Agriculture and Livestock enabled the team to come up with possible production systems. The need for technical advice from the Research Department is important because of the fragile situation of the atolls soils and vegetation. Also the need for quarantine check of planting materials for Pelau was arranged. This is important to avoid introduction of invasive pest and diseases.

With consideration of short, medium and long-term intervention, approaches and the recommendations indentified in the V and A assessment conducted in 2011 a proposal was submitted to the Research Department of the Ministry of Agriculture and Livestock to look at several systems of food production. The Department advised that systems with agro forestry bases are favourable farm models because of mixed cropping structures with many food varieties and sustainability.

2.4 Farm Models for field demonstrations

ITTA-ALLEY or Atoll Permaculture farming system

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be ‘trees on farms.’ Hence, it is the commitment of farmers towards the establishment and management of forests and food products on their land.

Recently there has been an increasing interest in using the agro-forestry approach for developing more productive, low-input, and sustainable land use technologies. Such a system provides solutions to tree depletion, soil degradation, and declining yields under shifting cultivation. Agro-forestry is a sustainable land management system, which increases the overall yield of the land. It combines the production of trees and the production of crops on the same unit of land, and it applies management practices that are compatible with the cultural practices of the local population.

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**Intercropping under Coconut**

Growing crops under coconuts will involve good planning. It must consider that enough sunlight is coming through and that coconuts are spaced out to allow this. Selection of crops will consider tree crop species, root crop species and vine crop species.

**Pusaraghi (Swamp) Farming Systems**

It will be an important activity to collect as much biomass as could be produced by growing leguminous plant species and to heavily mulch the swamp taro pits. Mulching will provide the essential nutrients for the taros.

**2.5 Prior consultations with people of Pelau living in Honiara**

During the preparation of the stage the Pelau community residing at the Lord Howe settlement in Honiara were consulted to inform them about the PACC project. They in turn relayed the message to the Pelau community in the atoll. The House of Chiefs at Pelau was informed about the project and also about the team’s preparation for the implementation of the activities to set up the trial demonstration.
2.6 Pelau Community House of Chiefs Meetings


Chris Keuni (Chairman), Chris Poasi (Vice Chairman), Chris Alenu, Brown Peoa, Mathew Kakivi, Patteson Sionge, David Peoa, John Solo.

Meeting with the House Chiefs for courtesy call is of paramount important. This is the highest authority in the land of the atoll communities. Respecting the protocols is a symbol of honour for the traditional governing body of the communities. As a gesture of welcome food is served followed by a welcome speech by the High Chief. We responded by explaining the purpose and objectives of our coming. The House of Chiefs reconfirmed their decision for the following proposed lead farmers:

- Christopher Papasi 50mx30m Plot 1
- Ian Pasuki 50mx30m Plot 2
- Matthias 50mx30m Plot 3
- Barnabas Mohu 50mx30m Plot 4

We found out during the day that Pelau Community actually has two House of Chiefs. Both have differences about our coming so the other House invited the team to meet them. After we met them, both of them proposed for a public meeting. The tension was high but we managed to put it under control.

2.7 Pelau Community public meeting

Public Meeting 16th November, 2012

Both Houses of Chiefs attended the public meeting. We informed the people about the PACC Project and its objectives. People responded quite positively. The people agreed to the first 4 lead farmers proposed previously. One speaker suggested at the meeting that another four persons should be selected to assist the four lead farmers. Another raised that gender balance is important to consider. So 4 women were selected. They are Wendy Alengu, Miriam Kirikohi, Margaret Mannu and Rosemary.

Demonstration plots and arrangements

At the public meeting, there were comments that the PACC project has good intentions for the people and especially with regard to improving food and water security situation, therefore their coming and assistance should be fairly distributed among the people of the two Houses. The two Houses agreed to the selection of the 4 lead farmers and their 4 assistants. Each lead farmer and an assistant represent a ‘Rest House’ and its grouping. This was a good resolution because it means all people of the two Houses are covered under this arrangement.

A further understanding of this arrangement is that at harvest each lead farmer will be committed to distribute the farm produce and planting materials equally among the people of the ‘Rest House’ he is
responsible for. This ensures that no one is missed out, everyone benefits from the project. In this regard, people from each ‘Rest House’ would help in the work at the plots.

2.8 Farmer training

Training will be vital and will contribute to the sustainability of the food security project. The people of Ontong Java and especially for the people of Pelau for that matter do little or no gardening, however, I believe it is not because people do not want to work, rather, they do like to garden but they would rather spend much of their time fishing and trawling for beche-der-mer. This is their income. This is their livelihood. Therefore, any agricultural system introduced must be permanent and the people must be trained so they can make and manage their gardens.

A short training was facilitated for the 4 lead farmers and their assistants. The purpose of the training is firstly to show and explain to the farmers the design of the plot and the crops used and the reasons for their use. The second is to demonstrate to the farmers, how to handle the plants out in the fields and looking after the plants for its survival.

2.9 Daily activities (14th November, 2012 to 13th December, 2012)

Day 1. Friday 16th November 2012.

We left Honiara on the 14th of November and arrived at Luaniua the next day then sailed on to Pelau on the 15th and arrived at Pelau at about noon. A House of Chiefs welcomed us. We unloaded all the materials. They showed us our accommodation and we settled in.

Day 2. Saturday 17th

Watered seedlings. Met with the other House of Chiefs. Attended public meeting.

Day 3. Sunday 18th

Inspected the site of Plot 1.

Day 4. Monday 19th

We had a short training with the farmers selected. Those at the training were:

Mr. Jasper M. Bonie (Team Leader, trainer)
Mr. Francis Suiromea (MAL/Research Officer)
Mr. Robert Tate’e (MAL/Research Officer)

Four Lead farmers and four assistants selected at the public meeting.

Fig.2.1, 2.2 and 2.3 showing participants at the training
Day 5. Tuesday 20th

Land clearing and subdividing the plot

Fig. 2.4, 2.5 and 2.6 showing land clearing

Day 6. Wednesday 21st

Preparing the soil.

Fig. 2.7, 2.8 and 2.9 showing soil preparation

Day 7. Thursday 22nd

Planting the crops.

Fig. 2.10, 2.11, and 2.12 showing planting of cassava, fruit trees and sweet taro.

Two weeks after planting

Fig. 2.13, 2.14 and 2.15 showing the growth of kumara, sweet taro and peanuts
**Day 8. Friday 23\textsuperscript{rd}**

Visiting backyard-farming activities in the village.

**Day 9 Saturday 24\textsuperscript{th} November to 6\textsuperscript{th} December**

Left on the 9\textsuperscript{th} Nov. for Luaniua to do some work there.

A lead farmer in Luaniua Mrs. Akomu

Another lead farmer in Luaniua Mr. David Aipia
3.0 GEOGRAPHY OF THE ATOLL ISLANDS

3.1 Map of the Ontong Java Atoll

Fig. 3.1. A map Ontong Java Atoll showing Pelau and Luaniua islands (Pelau is the project site)

3.2 Location

Ontong Java atoll also known as Lord Howe Islands is a 50 km attractive boot-shaped atoll made up of 122 islands. The atoll is the most northern islands of the Solomon Islands. The islands are located at latitudes 5 to 12 degrees and distributed between longitudes 143 to 168 degrees. The atoll covers an area of 1400 sq km with 12 sq km of land. The diameter is 50 km making it the largest atoll in the world. No island is higher than three meters above sea level\(^2\) with most islands barely two meters high and composed mostly of coral debris.

3.3 Luaniua

Luaniua Island is located in the south east of the atoll chain and contains the atoll’s largest village. It is the most populated island with a total population of 2057\(^3\) with 278 households. Luaniua Island has 5

\(^2\) Ontong Java High Swells report, NDC, 2008.

\(^3\) Pelau or Luaniu a
tribes and 13 chiefs. There are six trading stores and a main anchorage for ships. The boat trip from Honiara takes two days and one night. Faster ships like the patrol boat take only a night.

### 3.4 Pelau Island

Pelau Island is the second most populated island in the group. It is located in the north east of the atoll. The total population on the island is 800\(^4\) with 116 households. The island has one chief supported by 8 working members. The important marine resources of Ontong Java are trochus shells and beche-de-mer. Kakake is their staple land food.

These two are permanently inhabited. Several others are used by the villagers as temporary homes while they are on fishing trips. Some of the issues affecting the people are relating to sea level rise and intense heating believed to be relating to climate change. It is also believed that impacts of climate change had resulted in damages to food, diminishing of the islands physical geography, and contamination of well water causing issues of general health of the people. Measures are being taken to address these through adaptation strategies.

### 3.5 Ethnicity

The people of Ontong Java are ethnically Polynesian. Long ago Luaniua and Pelau were chosen by the Polynesians because of the fertile soil suitable for gardening providing them plenty of food including fish and coconuts. These were the basis of their food security.

### 3.6 Vulnerability exposure and sensitivity

While there is a wide diversity of social and biophysical environments within Solomon Islands, there are some particular systems throughout the country that are likely to be sensitive to climate change and sea-level rise. NAPA has identified subsistence and commercial agriculture, human health, coastal environments and systems, water resources and marine resources. These sectors are sensitive to the impacts of climate change and sea level rise and are regarded as having high exposure risks due to a number of dimensions which are mainly determined by the geographical and the socio-economic and political context of Solomon Islands.

Ontong Java is located at an area that is not geographically protected hence its high vulnerability to the adverse effects of natural activities such as king tides and high swells. This level of exposure does affect the status of soil fertility and land use. The pressure from a fast growing population exacerbates the situation as resources are exploited and land use increases. Access to basic services such as health and medical services, water and sanitation, education, telecommunication, technology and transportation is difficult. Thus, the degree of vulnerability and sensitivity increases.

### 3.7 Climate and Sea-Level Scenarios

Generally there is lack of detailed information or knowledge regarding possible future changes in climate and sea level in Solomon Islands and especially for the atolls for that matter. Although there is a lot of publicity about climate change on global scale, there is little knowledge about possible weather and climate change on regional or national scales\(^5\). Given this lack of information, the climate and sea level

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\(^3\) Solomon Islands National Population Census Estimate for 2009.

\(^4\) Ibid

\(^5\) Climate change and sea level rise in the South Pacific Region, 1992
scenarios estimates are based on the projections released by the Inter-governmental Panel on Climate Change (IPCC) in combination with the output from a number of general circulation models (GCMs).

3.8 Temperature scenarios

The years 2050 and 2100 were chosen for projecting the scenarios for a decade. These are based on the IPCC best guess greenhouse gas (GHG) emissions scenario (IS92a), assuming a climate sensitivity of 2.5°C, and patterns of change from three GCMs (BMRC, CSIRO9M2, and ECHAM3TR). Some studies have indicated that there were only minor variations among the different GCM patterns, with a temperature increase of 0.7°C to 1.1°C by 2050 and 1.2°C to 2.0°C by 2100. Other studies projected an annual mean trend of 0.14 to 0.28 °C per decade. This designates an average change of 0.2 °C per decade, which is consistent with the temperature trend, projected by the IPCC studies.

3.9 Rainfall Distribution

Lack of specific data on rainfall for Ontong Java Atolls has made it quite difficult to make analytical observations of rainfall distribution. However, by talking to the people on the atolls and analyzing data that is available for the whole of Solomon Islands and especially nearby regions, particularly Auki in Malaita rainfall distribution varies throughout the year. The annual average rainfall is always high, with a lot of rain coming around the months of January, February, March, April, May, October, November and December. The months of March, June, July and August usually have a moderate average temperature. On average, the warmest month is January and the coolest month is August. March is the wettest month, while August is the driest month.

3.10 Land

There are two land systems in Ontong Java. They are Lomousa and Pusaraghi. The Lomousa land system consists of deep freely drained beached sand from coral and mineral sand soils. Sustainability and potentiality of this soil type is moderate in agricultural use in relation to food production without soil improvement. The common limiting factors are soil salinity, rockiness, and coarse textured soils. Only coconuts thrive well and in abundance. The Pusaraghi Land system consists of poorly drained peat and alluvium, which are found mostly at the back of the islands barely 15 metres from the shoreline. These depressions are suspected to be contaminated with salt due to infiltration of salt water, which is currently causing harm to the swamp taro crop.

Land Degradation

A recent survey revealed that soil fertility is a major issue in Ontong Java. This is because the land has been extensively used to make gardens. Gardening had been going on since the time the islands were inhabited. An elder on Luaniua recalled that the gardens are on the same areas since their fore fathers inhabited the islands many years ago adding that soil in the past was very dark and the water in the swamp was good to drink. Today the soil has lost its colour; water is brackish in most areas and the soil mostly sandy. The elder relates that the loss of soil fertility was due to loss of traditional knowledge by the younger generations.

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6 Hansel and Wall, 1976.
**Sandy soil at garden sites**

The other causes of land degradation are due to the impact of cyclones which sometimes induces coastal flooding and beach erosion. From observation it is clear that coastal erosion had been affecting the Atoll for quite a long time and it is continuing. One area was used to be their cemetery and is still today, but it is evident from the gravestones that have been eroded away that it had been badly affected by coastal inundation. Here the impact of sea level rise compound with storm surges is evident.

Sea level rise may also result in salt-water intrusion, which would compromise the quality of groundwater in atolls and low-lying areas\(^7\) while high intensity rainfall events cause turbidity and contamination and flooding can often damage infrastructure\(^8\).

In Ontong Java atoll sea level rise has contributed to the degradation of land but also recent changes people noticed are that swamp soil is slowly losing its darker colour and the water in the area is changing both in colour and taste. In the early 1990s the communities began noticing changes to the tuber sizes and the plant growth. The *kakake* plants are not as high and green and the tubers are getting smaller in size. Today water in the area has turned brownish and brackish. The changes were first noticed in the main swamp or gardening area which is located in the centre of the island. But today that has spread all over to other gardens on the islands.

**Salt-water intrusion**

It has been suspected recently that salt water intrusion has increased, contaminating the swamp taro growing creeks due to sea level rise and occasional sea surges during bad weather. A 2008 Ministerial report described after high swells were experienced that:

> "The waves of the high swells have caused much damage to the agriculture of the atoll people. Severe in Luaniuia, moderate in Pelau. High waves drives through the coast and into the planting fields that are located very close to the coast. The inner *kakake* fields were affected by salt-water intrusion. Due to the high waters that came with the waves, salt water intrude in to the water table as a result that the *kakake* fields were flooded with *ltwater. Because of those *kakake*, plants went brackish, wilt then die after. *Kakake* fields or gardens were flooded from waves and upwelling."

Although swamp taro has improved since the high swells in 2008, there is continuing evidence that immature swamp taro tubers are found rotting at the base. In normal gardening areas the soil is characterised by freely drained sandy soils which usually have high pH levels meaning that they have high salt content.

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**Nutrient Deficiency**

The obvious one is the yellowing of the foliage which is the sign of lack of nitrogen. Some of the crops have been adversely affected by severe heat of the sun and the sand. It is believed that when the canopy of the tree structure is established it will provide the micro-niche environment for the crops. This will give the coolness and shading that the crops need. Such conditions could be improved if the ground can be covered with cover crops such as legume plants. Several species have been tried without any good signs. Pueru, Centro, and Siratro were tried. Only Siratro has survived but not promising. The importance of raised beds underlain by commercial plastic is now inevitable.

**3.11 Vegetation**

**Forestry**

The status of forest cover is very fragile. No longer, there is a forest cover. The vegetation is mainly consists of coconuts growing throughout the islands with sporadic patches of pandanus and shrub undergrowth mixed with ferns. Along the shoreline is isolated pine trees layered below with beach shrubs. The lack of forest cover makes the communities to be vulnerable to adverse heat of the sun and the sand. In addition, the forest can provide protection from strong winds and is the source of fuel wood but because Ontong Java forest depleted the people are vulnerable to impacts of strong winds.

**Biodiversity**

The vulnerability of biodiversity to climate change has been evident for some time. Many species of plants have become extinct. Tree density and floristic richness is decreasing. Rarely are new species of plants and animals showing up in the ecosystems. A rich biodiversity corresponds to the health and richness of the forest in both flora and fauna. Vulnerability of the people of Ontong Java is worsened because of the weak biodiversity where people derive their livelihoods.

**3.12 Land Use**

The land is mainly used for coconuts. One village is located at Pelau and another one on Luaniua. In the villages there are growing at the back yards crops like bananas, stem taro, kongkong taro, few cut nuts, aibika, and pumpkin. Pigs can be seen tethered under the coconuts near the villages. Of course, there is only one main crop and that is the kakake (the swamp taro) which is the islands most important staple. This crop accounts for the family food need. A family of 6 to 7 members has an average of 150 square metres. The swamp taro in this area can last the family for at least 6 months. Some of the larger families might use up their swamp taro within a shorter time especially at times when they are not getting alternative food like rice.

**Food Crops**

The range of suitable food crops available for use is very limited because of the poor soil condition and lack of knowledge about or access to suitable crops. This situation has increased the vulnerability of the communities to food insecurity. With only one staple food crop, the swamp taro, the communities are highly vulnerable to food shortages and thus hunger. With only this one staple food crop, the people have said that when the beach-der-mer trawling is closed (the peoples’ income earner), they cannot buy
other food supplements like rice and flour. This means they would depend entirely on the swamp taro. When this happens, the taro would run out within 3 to 6 months then people would resort to coconuts to provide food and drink. When there are food shortages, people often rely entirely on the cash economy as their source of food in exchange for rice and other imported food products. Beche-de-mer is the main commercial produce apart from copra.

**Agricultural issues**

There are agricultural issues, which should be considered when planning to encourage the people to improve their gardening. Moderate to poor soil conditions for food production; increasing soil salinity; very few crop stock materials; fragile vegetation and lack of biomass for manuring; and adverse effects of salt-water intrusion causing taro bases to rot at some swamps especially those close to the shoreline.

**Attitudinal issues**

The people of the atolls are fishermen and therefore spend much of their time fishing; people want to do gardening but they are not acquainted to gardening techniques and systems appropriate for the soils that they have but also as has been mentioned earlier any new system of gardening must be systemically desirable (truly relevant) and culturally feasible (meaningful).

**A Gardening Effort by the Agriculture Department**

A taro plot was set up by a contact farmer to help produce suckers for interested farmers. The taro seems to perform fairly well with the use of a legume tree and heavy mulching. The objective was good but then the effort was eventually phased out.

**3.13 Sea and water**

**Sea**

Approximately 2850 square kilometres of lagoon, Ontong Java is the largest in the Solomon Sea. Ontong Java Atoll is blessed with sea resources. Fish is harvested and is part of the daily diet of the people. Fish stock is sufficient to survive the people for many more years to come. Beach-der-mer is also a source of income for the people. Currently there is a ban on the product imposed by the National Fisheries Department as a mitigation measure to over harvesting.

**Water**

There are 13 wells and 68 water tanks on Luaniua and 17 wells and 55 water tanks on Pelau. The average size of the tanks is 800 gallons. Well water has been contaminated with salt making it brackish and unfit for drinking. However, when there is dry spells well water is used for washing. Tank water is used for cooking and drinking.

Coastal Environments and Systems

Based on very few quantitative studies on coastal environments and systems within the country the following effects had been observed:

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Flooding and inundation due to combined effects of sea level rise with storms and cyclones causing damages to properties and infrastructure as most communities and developments are situated along the coast. The effects of inundation and flooding will be mostly felt in the low-lying islands and atolls throughout the country where inhabitation of these areas is possible in extreme cases.

Coastal erosion is already evident in many parts of the country and is observed to be increasing in its rate destroying many properties and infrastructure.

Coral bleaching was evident in some parts of the country (mainly in Western Province) during the 1997/98 El Nino as the sea surface temperature exceeded the temperature tolerance of coral species (25°C – 29°C).

Possible effects of sea level rise on mangrove systems are still poorly understood in Solomon Islands. Nevertheless, coastal mangroves had been notoriously killed as communities clear them away to get access to sea fronts. Others clear them for fire wood and building materials.

3.14 Food Security Status

The food security status of Ontong Java needs to be improved. It is in a grey situation. This means as far as sea resources are concerned Ontong Java is blessed with abundance of sea resources and earns a lucrative income at times when beche-der-mer is not banned. Ontong Java is short of staple food. With one staple crop, swamp taro, only capable to provide food for 3 to 6 months the people could be without food for 6 to 9 months. If Ontong Java can be able to grow additional staple crops to fill in the 9 or 12 months period, it would have achieved a good food production. Pelau has enough water from rain tank catchments. However, Luaniua needs 15538 gallons to fulfil its water needs. This is equivalent to 20 tanks of 800 gallons each. When all the requirements are addressed, Ontong Java would have achieved an improved food security.

4.0 ESTABLISHMENT OF DEMONSTRATION PLOT

4.1 ITTA-ALLEY Farming System

The ITTA-ALLEY Farming System approach was employed. We completed the farm designs for plots 1, 2, 3, and 4. Although this kind of agriculture is not expected for Ontong Java recent situational conditions experienced due to saline infiltration in their fragile Lomousa and Pusaraghi land systems have dictated the employment of new approaches. We need a gardening system that would survive this new condition induced by poor soil forms and the recent salt contamination of the soil imposed by the adverse effects of climate change. Permaculture is sustainable land use design as defined by Bill Mollison. This is based on ecological and biological principles, often using patterns that occur in nature to maximise effect and minimise work. Permaculture aims to create stable, productive systems that

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provide for human needs, harmoniously integrating the land with its inhabitants including livestock and wild life.

The ecological processes of plants, animals, their nutrient cycles, climatic factors and weather cycles are all part of the picture. Inhabitants’ needs are provided for using proven technologies for food. Elements in a system are viewed in relationship to other elements, where the outputs of one element become the inputs of another. Within a Permaculture system, work is minimised, “wastes” become resources, productivity and yields increase, and environments are restored and costs are lower. Permaculture principles could be applied to any environment at any scale.

For the Climate Change Project we hope to establish plots designed to demonstrate this alternative form of agriculture at minimal level only to suit the situation of the Atoll islands as part of mitigation measures. We shall call this Atoll Permaculture. It considers the physical conditions of the soils and uses selected salt tolerant crops. It is a permanent agriculture system enhancing a permanent people’s culture.

Our Atoll Permaculture gardening system will be a multi-storey structure using fruit trees, root crops and vegetables. We would like to create a farming system that is permanent, self mulching, self sustaining and self regenerating and that it can provide a good source of food. We would also like to create a system that will demand less time and has low maintenance cost. We can imagine a forest of food where food can be collected when required.

**Gardening system is systematically desirable and culturally feasible**

Ontong Java agricultural land is limited and moderately sustainable and potential in relation to food production. However, with the intention of introducing the ITTA-ALLEY or Atoll Permaculture farming system it is hoped that the people will adapt to this approach because of its viability. The system is said to be systemically desirable (truly relevant in the current situation) and culturally feasible (meaningful in the prevailing culture of the people).

In the light of the prevailing cultures of Pelau community, the people must accept even a slight change in the agricultural practice in order to invest in the projects future sustenance. It should be noted that the people of the Ontong Java Atolls spend much of their time fishing and so a gardening system to be imposed should consider crops that are more permanent with increased food production. This will consequently demand less time for tilling the garden when they should be out fishing or trawling for Beach-der-mer.

According to a report by ACOM Climate Change Program, this Permaculture initiative, the “Atoll Permaculture” or “ITTA-ALLEY” farming system is an agro-forest gardening system. It will be a multi-layered system of fruit and nut trees, vegetables and root crops.

“We are creating a farming system that is permanent, self mulching, self sustaining and self regenerating, and that it can provide a good source of food to the community. The system is systemically desirable (truly relevant) and culturally feasible (meaningful). We would also like to create a system that will demand less time and has low maintenance cost. We can imagine a forest of food where food can be collected when required.”
Plot design of ITTA-ALLEY

“ITTA-ALLEY Farming System”: A 50m long x 30m wide Plot Design, belonging to Christopher Papasi in Pelau Island.

Fig. 4.1. Showing the plot design of Plot 1 in Pelau
An artist’s expression (a supposed front view of the ITTA-ALLEY or Atoll Permaculture)

![Artist's expression of ITTA-ALLEY farming system](image)

**Fig. 4.2. An artist’s imaginative expression of the ITTA-ALLEY farming system**

**Salt tolerant crops selected for use in Pelau Ontong Java.**

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Botanical Name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alite</td>
<td>Terminalia catapa</td>
<td>BT</td>
</tr>
<tr>
<td>Polynesian Chestnut</td>
<td>Inocarpus fagiferus</td>
<td>BI</td>
</tr>
<tr>
<td>Breadfruit</td>
<td>Artocarpus altilis</td>
<td>MA</td>
</tr>
<tr>
<td>Funny face</td>
<td>Spondias cyathera</td>
<td>MS</td>
</tr>
<tr>
<td>Local avocado</td>
<td>Burkella obovata</td>
<td>SB</td>
</tr>
<tr>
<td>Malay apple</td>
<td>Eugenia malascensis</td>
<td>SE</td>
</tr>
<tr>
<td>Cut nut (round)</td>
<td>Barringtonia procera</td>
<td>IBE</td>
</tr>
<tr>
<td>Kingtree</td>
<td>Gnetum gnemon</td>
<td>IG</td>
</tr>
<tr>
<td>Swamp taro</td>
<td>Cyrtosperma chamissonis</td>
<td></td>
</tr>
<tr>
<td>Giant Taro (Stem taro)</td>
<td>Alocasia</td>
<td></td>
</tr>
<tr>
<td>Kongkong Taro</td>
<td>Xanthosoma</td>
<td></td>
</tr>
<tr>
<td>Sweet taro (Santa Cruz Taro)</td>
<td>Colocasia esculentum</td>
<td></td>
</tr>
<tr>
<td>Elephant Yam</td>
<td>Amophophallus campanulatus</td>
<td></td>
</tr>
<tr>
<td>Pacific Yam</td>
<td>Dioscoria numularia</td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td>Musa sp (some varieties)</td>
<td>B</td>
</tr>
<tr>
<td>Pawpaw</td>
<td>Carica papaya</td>
<td></td>
</tr>
<tr>
<td>Pumpkin</td>
<td>Cucurbita pepo</td>
<td></td>
</tr>
<tr>
<td>Coconut</td>
<td>Cocos nucifera</td>
<td></td>
</tr>
<tr>
<td>Cassava (some varieties)</td>
<td>Manihot esculenta</td>
<td>C</td>
</tr>
<tr>
<td>Kumara (some varieties)</td>
<td>Ipomoea batatas</td>
<td>K</td>
</tr>
<tr>
<td>Lusina</td>
<td>Leucaea leucocephala</td>
<td>*</td>
</tr>
</tbody>
</table>

*Other vegetables are being tried*

**Table 4.1 Salt tolerant crops**
List is prepared and submitted to PACC for Pelau in Ontong Java.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Botanical Name</th>
<th>Symbol</th>
<th>Amount</th>
<th>Unit Cost($)</th>
<th>Subtotal cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alite</td>
<td>Terminalia catapa</td>
<td>BT</td>
<td>70</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>Poly. Chestnut</td>
<td>Inocarpus fagiferus</td>
<td>BI</td>
<td>10</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>Breadfruit</td>
<td>Artocarpus altulis</td>
<td>MA</td>
<td>30</td>
<td>10</td>
<td>300</td>
</tr>
<tr>
<td>Funny face</td>
<td>Spondius cyathera</td>
<td>MS</td>
<td>20</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Local avocado</td>
<td>Burkella obovata</td>
<td>SB</td>
<td>20</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Malay apple</td>
<td>Eugenia malascensis</td>
<td>SE</td>
<td>20</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Cut nut (round)</td>
<td>Barringtonia procera</td>
<td>IBE</td>
<td>120</td>
<td>3</td>
<td>360</td>
</tr>
<tr>
<td>Giant Taro</td>
<td>Alocasia</td>
<td></td>
<td>500</td>
<td>3</td>
<td>1500</td>
</tr>
<tr>
<td>Santa Cruz Taro</td>
<td>Colocasia esculentum</td>
<td></td>
<td>500</td>
<td>4</td>
<td>2000</td>
</tr>
<tr>
<td>Banana</td>
<td>Musa sp</td>
<td></td>
<td>200</td>
<td>3</td>
<td>600</td>
</tr>
</tbody>
</table>

$5100.00

Table 4.2 showing the amount of crops and the cost.

Planting materials that were actually planted in Plot 1 at Pelau

**KEY: ITTA Component**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Amount</th>
<th>Symbol</th>
<th>Name</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>Polynesian Chestnut</td>
<td>4</td>
<td></td>
<td>Giant taro</td>
<td>100</td>
</tr>
<tr>
<td>BT</td>
<td>Alite</td>
<td>2</td>
<td></td>
<td>Sweet taro</td>
<td>300</td>
</tr>
<tr>
<td>MA</td>
<td>Breadfruit</td>
<td>12</td>
<td></td>
<td>Cassava</td>
<td>As required</td>
</tr>
<tr>
<td>MS</td>
<td>Funny face</td>
<td>2</td>
<td></td>
<td>Kumara</td>
<td>As required</td>
</tr>
<tr>
<td>SC</td>
<td>Ngali nut</td>
<td>-</td>
<td></td>
<td>Peanut</td>
<td>50</td>
</tr>
<tr>
<td>SB</td>
<td>Local avocado</td>
<td>2</td>
<td></td>
<td>Banana</td>
<td>40</td>
</tr>
<tr>
<td>SE</td>
<td>Malay apple</td>
<td>2</td>
<td></td>
<td>Pumpkin</td>
<td>As required</td>
</tr>
<tr>
<td>IG</td>
<td>Kingtree</td>
<td>12</td>
<td>*</td>
<td>Lusina(legume)</td>
<td>50</td>
</tr>
<tr>
<td>IBN</td>
<td>Cut nut (S)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBE</td>
<td>Cut nut (R)</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**KEY: ALLEY Component**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Amount</th>
<th>Symbol</th>
<th>Name</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sweet taro</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cassava</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Kumara</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Peanut</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Banana</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pumpkin</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>Lusina(legume)</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 4.3 showing the types of crops for the ITTA component and for the ALLEY component
**Land preparation**

**Pegging**

As from today plots 1 is pegged using a 10mx9m space base. By using the 10mx9m space base it would then be easier for the plots to be pegged so that the crop species could be allocated a position. Once this frame is completed the farmer will not have any difficulty to map out his plot and find the crop positions as he goes about doing his plantings.

**Legume**

Legume is a vital plant. It must begin with the farms. The sandy soil must be covered with mulch either plant debris and or green mulch. Peanut is a good green manure because it grows fast and can cover the ground quickly. Peanut can later be harvested for peanut and use the trash for mulching.

The other very good legume is the Lusina plant. It strives very well in the sandy soils of Ontong Java. The plant is planted in three rows along the ALLEY. This plant will provide immediate cooling microclimate for the crops. It will also be a source of the needed biomass to be used as green manure for composting and for mulching. The legume will provide much of the needed nitrogen for the growing plants. Nitrogen seems to be lacking in the soil as can be seen in the yellowing leaves of kumara and cassava plants.

**Composting**

It is essential that this technique is taught and demonstrated to the farmers. Besides, fast growing plants should be introduced which must include legume and grass species. Some identified species include Lusina and vetiver grass.

**Mulching**

The four lead farmers are well versed with the process of doing mulching as they have been doing this activity in their swamp taro plots. Now they were advised to use the plant debris accumulated in their plots while doing the clearing. Later they will do mulching with the legume pruning when they are ready.

Mulching is essential once the plants are planted. If the soil is not covered, weeds will grow back quickly. One way of preventing this from happening is by using deep mulch onto the soil. Mulch keeps the soil temperature constant; it adds organic matter and nutrients to the soil over time and conserves soil moisture. Be careful that the mulch does not touch the stem of the growing plants otherwise; they might be encouraged to rot as the mulch itself decays.

The type of soil found in Pelau is most vulnerable to both sun and rain extremes. When there is a long period of sun, the soil water evaporates quickly and dries up the soil giving unfavourable stresses to plants. But when it rains the water sinks very quickly washing away all plant foods sitting in the surface of the soil. The answer to this is to put heavy litter on the ground so that it holds the moisture in dry periods but also holds plants foods from being leached when it rains.

For the ITTA-ALLEY or Atoll Permaculture there are tree food plants selected to be planted throughout the farm which will later become the main source for the production of the needed biomass.
They produce heavy litter so that it will cover the ground and protect it from the two adverse extremes. When the litter decays plant foods will be released and made available to the crops. All plant debris will not be burned. They will be spread over the plots and logs stacked along the crop edges leaving them to rot.

**Planting**

**Crop Planting**

There were 1390 seedlings delivered per MV Arnavon. They include Breadfruit 30; Chestnut 10; Alite 70; Selfish taro (sweet taro)500; Stem taro 500; Local avocado 20; Cut nut 120; Lusina 160; Funny face 20; Malay apple 20; Giant taro 500; Banana50. These crops were equally shared among the four plots.

**Crop Positions**

In the farm each plot is designed so that the crop species and the amount of each are given their positions throughout the farm. This makes planting easier to trace and to maintain. The total amount of crop seedlings that will be needed to complete planting of the plots is shown in table 4.3.

**Crop Spacing**

All tree crops are spaced out throughout the farm at 5 to 10 metres apart. These crops will provide the top canopy adequately spaced so that optimum sunlight can still come through for the lower canopy crops. At a later stage this canopy will provide a desirable micro-climate needed to enhance crop growth at the lower canopy.

Below this canopy there will be crops such as bananas and pawpaw which will be spaced at 5m apart; and egg plants, cassava, stem taro, kongkong taro and topia are spaced at 2mx2m apart; all within their own selected positions. Two other varieties of taros will be spaced at 1.5mx1.5m. below the canopy of the bananas and pawpaw. At the ground level there will be Pacific yam spaced at 3mx3m apart however they will be train onto live trellises (Kingtree, cut nut and Lusina trees).

In the first instance the ground will be covered with peanuts and pumpkin to help with the control of weeds and to provide green mulch. Lusina will be planted in their selected positions at 3mx6m spacing.

**Amount of Crops**

The total amounts of crops that will be needed to fill up the 4 plots according to the respective designs are 2384 of the various species as shown in Table 4.3. Of this total 596 is already available to the farm plot. There are 1788 seedlings need to be prepared for the three remaining plots. In this trip 1490 seedlings were transported to Pelau. There were 596 planted in plot one. The rest which is 894 seedlings of various species were distributed to other community members of the two Houses of Chiefs since the other 3 plots have not been cleared.
Commitments

Land clearing

Plot 1 was cleared. So far, the following commitments/costs have been made:

Amount spent for work done $920.00. We took two youth groups to help us clear the area and planting of crops.

Damages

There were 62 mature coconut trees cut. Other building materials were damaged. Negotiating with the land owner of plot 1 he agreed and accepted a flat rate of $4000.00 as a good will payment for all the damages incurred. In my opinion this claim is only a third of a price if it was to be valued according to SI compensation rate.

Accommodation

We paid $500.00 for the accommodation for one week.

We spent 14 days at Luaniua @ $80.00/day $1120.00 (this has not been paid yet).

There is need for the Climate Change Officer to spend time with the people so he could lead the setting up of the Station. It is proposed that a small house made of pandanus thatch roof be constructed. Such a house could be constructed for a sum of $2000.00. We propose that it should be built at Plot 1. May be in future a permanent house would be built.

Water Tanks

We recommended that a water tank is placed in each of the plots. The idea is that these tanks will not only provide water for the crops but also for the families of the land owning tribes who are prepared to move from the village to the plots so they could look after the crops when the Climate Change Officer leaves. A 600-gallon size is adequate. We already shared the tanks and associated materials required for their construction.

Garden Tools

The need for garden tools is great. This asset will ensure that implementation is not hampered and the objectives achieved. Tools were shared out to each of the lead farmer.

Boat and OBM

This equipment is essential for the fast movement of planting materials. There is a keen interest in the project and some land owning groups have come forward requesting if their land can be developed. Many of these lands are located on other islands within the Ontong Java Atolls including Luaniua. If this is not possible then provision for hiring is proposed. This will make it easier to collect planting materials from neighbouring Luaniua community.

For this trip, we have incurred some expenses that has not been paid for. They are shown below:
19/20th November, 2012. The boat brought seedlings from Luaniua. The boat went back the next day.

- Boat hire 2 days @ $500/day $1000.00
- Petrol (mixed) 8 gals. @ $85.00/gal. $640.00

24th November, 2012. We used two boats to take us to Luaniua.

- 2 x Boat hire 2 days @ $500/day $2000.00
- Petrol (mixed) 24 gals. @ $85.00/gal. $2040.00

7th December, 2012. We used two boats again to take us back to Pelau.

- 2 x Boat hire 2 days @ $500/day $2000.00
- Petrol (mixed) 24 gals. @ $85.00/gal. $2040.00

The total for transport cost that needs to be paid is $9720.00

Radiophone

This is an important piece of equipment for communication especially between Honiara and the Atolls. Ontong Java is a very remote place and can only be contacted through the radiophone or when a ship arrives about once a month or more at times.

There talk that a telecommunication company will put a tower so mobile phones are used.

Next steps (Program of Action)

### Clearing and land preparation

- **Plots 2,3,4**
  - Clearing
  - February to April 2013

- **Plots 2,3,4**
  - Windrowing
  - February to April 2013

- **Plots 2,3,4**
  - Soil preparation
  - March to April 2013

### Nursery raising

- March to April 2013

### Crop plantings

- **Plots 2,3,4**
  - Planting of Seedlings
  - during April to May 2013
The following crops will be required to be raised and transported to Pelau:

Planting materials that will be prepared for Plot 2, 3 and 4 at Pelau (Total: 2004 seedlings)

**KEY: ITTA Component**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Amount</th>
<th><strong>KEY: ALLEY Component</strong></th>
<th>Name</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>Polynesian Chestnut</td>
<td>12</td>
<td>GI</td>
<td>Giant taro</td>
<td>300</td>
</tr>
<tr>
<td>BT</td>
<td>Alite</td>
<td>6</td>
<td>BT</td>
<td>Sweet taro</td>
<td>900</td>
</tr>
<tr>
<td>MA</td>
<td>Breadfruit</td>
<td>144</td>
<td>C</td>
<td>Cassava</td>
<td>As required</td>
</tr>
<tr>
<td>MS</td>
<td>Funny face</td>
<td>6</td>
<td>K</td>
<td>Kumara</td>
<td>As required</td>
</tr>
<tr>
<td>SC</td>
<td>Ngali nut</td>
<td>-</td>
<td>P</td>
<td>Peanut</td>
<td>150</td>
</tr>
<tr>
<td>SB</td>
<td>Local avocado</td>
<td>6</td>
<td>B</td>
<td>Banana</td>
<td>120</td>
</tr>
<tr>
<td>SE</td>
<td>Malay apple</td>
<td>6</td>
<td>P</td>
<td>Pumpkin</td>
<td>As required</td>
</tr>
<tr>
<td>IG</td>
<td>Kingtree</td>
<td>144</td>
<td>Lusina(legume)</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>IBN</td>
<td>Cut nut (S)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBE</td>
<td>Cut nut (R)</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.4 showing the types of crops for the ITTA component and for the ALLEY component

Transportation of planting materials

Transportation of all planting materials will take place as soon as the next ship to Ontong Java is available in the months that are proposed. It will be desirable if this could be done during April when all the planting materials are ready. It must be noted that there will be more planting materials needed to be collected. It is shown in the table above that there are a lot more planting materials to be purchased and collected presumably from Guadalcanal and Temotu Provinces.

4.2. Backyard gardening

Backyard farming is practiced by most peoples in Luaniua and Pelau. It will be an important and effective system to make garden. Women usually have much to offer as they have good composting materials at their disposal. Kitchen wastes and wood ash are good sources of mulching materials. Crops are planted close to the kitchen and can be watered easily with kitchen wastewater as well as grey water (washing).

**Composting using poultry manure**

- is organic matter that has been decomposed to soil-like material and used as a fertilizer and soil amendment. It's a multi-step process thus takes about 6 to 12 months
- Compost contains macro and micronutrients often absent in synthetic fertilizers.
- Compost releases nutrients slowly—over months or years, unlike synthetic fertilizers
- Compost enriched soil retains fertilizers better. Less fertilizer runs off to pollute waterways.
• Compost buffers the soil, neutralizing both acid & alkaline soils, bringing pH levels to the optimum range for nutrient availability to plants.

Fig. 4.3, 4.4 and 4.5 showing crops at backyard farming in Pelau

5.0 LESSONS LEARNED

5.1 More Interests

More people would like to participate in the project. It was explained that only the 4 plots will be assisted now until crops are ready to be harvested when surplus planting materials will be shared out to the others. In this particular phase of the project, only four plots will be assisted.

5.2 Challenges

There are challenges, which continue to influence how the activities are going to be implemented:

• Transport to the islands continues to be difficult because of unreliable shipping. Shipping to the atoll goes to the islands on ad hoc basis. It is more or less greatly influenced by the harvesting of Beach-der-mer. Shipping is more frequent to the islands when beach-der-mer harvesting is open. At present, it is closed indefinitely.
• Supply of planting materials is a great need. For the kind of agriculture system as ITTA-ALLEY or Atoll Permaculture the total amount of crop species and the number of planting materials for each species are greatly increased.
• There is a need to identify plants to help with the production of biomass to improve the soil. Identification of plant species to help with the production of biomass to help with the improvement of the soil cannot be overlooked. Soils of Ontong Java are mostly sandy and therefore efforts to assist the soil must identify and introduce leguminous and non-leguminous plants.
• Lack of nitrogen fixing Bacteria is one of the major cause of plants not growing well. This can be seen on the plant leaves and stems.
• The need to erect water tanks to help to provide water for the plants. Water is a scarce resource because atolls have neither rivers nor streams. Wells have become brackish due to salt-water intrusion. This area has been achieved.
• It would be necessary to stay alert for any crop pest and disease outbreaks. The need to stay alert is more necessary because of the introduction of new crops. However, it is believed that
this will not cause a great fear, as there is only one staple crop that is the swamp taro. This crop is quite hardy and naturally resistant to many crop pests and diseases.

- Community issues need to address by the House of Chiefs and it would impact project activities
- Lack of water to maintain the growth of crops that have been planted
- Lead farmers do not have the background knowledge on agriculture
- Strong wind and rough seas is quite dangerous to travel within the lagoon
- Limitation of land for agricultures purposes

5.3 Findings

- Backyard farming is practiced by most peoples in Luaniua and Pelau
- Most people are interested and committed to be part of the demonstration activities
- Supply of more water tank is essential for plant watering and household use. This is because of water scarcity and saline of underground water which they depend much on. House of Chiefs must be informed when proposing plans for communicated
- More awareness on the introduced farming systems that was introduced so that people in the communities are aware of the benefits of it.
- Not only the agriculture areas have been affected by the impact of climate change impacts, coastal erosion have also destroyed part of the agriculture areas as well
- Need a full-time Agriculture Officer on the ground to provide close support to the local farmers
- Traditional methods of drying of sea-foods such as fish and shellfish should be improved since they depend much on it for daily foods. At the moment the equipments they use are not up to health standards

5.4 Lessons Learned

- There are more people interested and who would like to give up there pieces of land for the program to assist with the supply and planting of crops.
- A network of NGO’s and government agencies may be advantageous to be partners so they can assist each other in various ways, as they may need.
- Atoll Permaculture is a new concept to the people of Pelau so it would take some time to work out its structure, form and to realise the short, medium and long-term benefits. Training will be an essential part to convey the information, which the people need to acquire.

5.5 Recommendations

- MAL need to recruit fulltime field officers to assist the farmers
- Senior MAL/Research Officers to accompany teams who will be travelling to the atoll communities
- Field officers in Malaita Province to conduct monitoring visit to the low lying atolls.
- PACC-MAL needs to recruit 1 field staff especially, a person from Pelau to do the monitoring and assessment of the project for future purposes
- Need frequent monitoring to ensure the demonstrations are closely monitored and get feed backs from the lead farmers
• Other Ministry’s should also accompany on such missions as it is not only climate change issue that affects the communities of the low lying atolls
• Other government projects within the Ministry of Agriculture should also focus the implementation on the low lying communities to ensure cost are shared equally.
• That the Lead Ministry to provide co-financial support with PACC Project to support MAL intervention on the low lying communities
• Build a temporary house for MAL/Climate Change Officers to use when doing work at Ontong Java.
• There is a need for PACC PMU to recruit 4 casual workers to assist with farm work in the 4 plots.
• MAL PACC Project to support other remaining farmers who are interested to set-up their plots on the next field visit

6.0 CONCLUSION

To conclude, the field visit to conduct the demonstration and set up of plots funded under PACC Projects has gave us some insights of what is really important that the PACC Project and the Ministry of Agriculture should focus on to support these peoples. And finally, there is a need to do frequent monitoring visits to support the farmers with involvement of senior agriculture officers.

On the whole the Ontong Java Climate Change Program is well received by the House of Chiefs and the people. The people’s interest is a sign of acceptance. While this is seen as good we should not fail them in implementing the proposed activities for Pelau.

End of Report
Appendix 1

PACC/MAL-ONTONG JAVA

CLIMATE CHANGE ADAPTATION INTERVENTION PACKAGE

"Demonstrating Sustainable Food and Water Management Practices in Ontong Java"

Jointly prepared by Agriculture Research and Development, Ministry of Agriculture and Livestock, and Climate Change Program of the Anglican Church of Melanesia
Honiara
Solomon Islands

Compiled by Jasper M. Bonie, Ontong Java Food and Water Security Project Team

INTRODUCTION

Natural environment- Ontong Java atoll also known as Lord Howe atoll is a 50 kilometre long attractive boot-shaped atoll made up of 122 islands lying just 5 degrees south of the equator and 258 kilometres north of Santa Isabel. No island is higher than three meters above sea level with most islands barely two meters high and composed mostly of coral debris. The two permanently inhabited islands are Luaniua and Pelau. Luaniua has a population of about 2057 people and Pelau has about 800 people. It is believed that impacts of climate change had resulted in damages to food, diminishing of the islands physical geography, and contamination of well water causing issues of general health of the people. Some of the issues affecting the people are relating to sea level rise and intense heating believed to be relating to climate change. Measures have been taken to address these through adaptation strategies.

The impacts of climate change in the low lying islands in the Solomon islands like Ontong Java (also known as Lord Howe) and Sikaiana to name a few was very obvious.

Obviously, it became known that impacts of climate change had resulted to; damages to food, diminishing of the islands physical geography, and contamination of waters and general health of the people. Some of the issues affecting the people are relating to Climate Change through sea level rise and intense heating. Such include rotten kakake (swamp taro) tubers and vanishing away of taro, contaminated waters and diminishing sizes of islands exacerbated. These finding has made atoll islands become a climate change ‘hot spot’ in Solomon Islands.

12 Hansel and Wall, 1976.
Ontong Java, a remote atoll north of the main group of the Solomon Islands, with about 2,000 people live in two villages on the atoll. People make their living through subsistence agriculture. Trade is difficult because of the distance and unreliable shipping between Honiara and the atoll. The main crops are coconut and taro root, a plant that grows well in wet or flooded soil. However, even though taro grows well in wet conditions, not all varieties are saline resistant. A few years ago, people in Ontong Java started noticing changes in their coastline – then they realized that in certain areas, the ground was saturated with water and crops weren’t growing as well as they used to. While the rise of sea levels may not be noticeable in many countries, in Ontong Java the islands are small and relatively flat, so even a few inches of extra water can make a surprising difference. When salt water invaded the atoll, the amount of fertile land decreased sharply, this makes the farmers start to look for solutions. The Anglican Church of Melanesia has already done some work in the communities in the area of food and water security. Work in Luaniuua community is about to be completed. Project activities will be extended to Pelau community in November 2012.

People

Population density

Land and marine resources-soil type, water lens

Transport considering the whole issue of food security

Some features of atoll soils

Limited land size

Soils are mostly shallow with thin vulnerable lens of fresh water

High alkalinity (average pH 7 – 8) – Consists mainly of calcium & magnesium carbonates

Highly sandy – soil size is extremely large

Highly permeable with low water holding capacity

Deficient in Nitrogen, Potassium and trace elements especially Iron, Manganese, Zinc and Copper

Soils are expose to increase salinity due to storm surges, king tides and sea level rise

BACKGROUND

_Vulnerability & Adaptation Assessment Recommendations_

Short Term Intervention

Establishment of a climate change adaptation committee for Ontong Java atolls.
Supply of support facilities like water tanks to address salt water intrusion into fresh water lenses/catchments and inundation of agricultural areas.

Sustainable water management practices, initiatives and technologies for both farming and household usage

Agricultural adaptation and improvement to identify new farming methods and crop species suitable for changing climatic conditions.

Medium Term Intervention

Comprehensive study on the vulnerability of Water and Agricultural Resources

Advocacy and civic education awareness on climate change variability and its adverse effects

Traditional practices of agro forestry, harvesting practices and food preservation practices must be maintained for sustainability

Financial Literacy workshop and Trainings for better management of finances.

Long Term Intervention

Commencing studies and planning for relocation to bigger islands. This must be done in consultation with the people of Ontong Java for a place of their choice to avoid fear of what the future may bring.

Other V&A Recommendations

Establishment of CC Committee in Ontong Java

Comprehensive Study on the vulnerability of Agriculture Resources (Soil, Water, Vegetation, Livestock, Pest & Disease)

Supply of support facilities such as water tank

Sustainable water management – Agriculture & Household use

Environment impact Assessment – Preconditions for other sector projects

Agriculture Adaptation Strategies – Improve farming practices & tolerant crop varieties

Improve information & communication technology

Improve small business entrepreneurial skills – enhancing human capacity

Traditional practices to agro forestry, harvesting & food processing

Encourage inter marriage

Identify trade alternatives other than bech-de-mer harvesting
Alternative shipping routes to boost inter island trade esp. Foodstuff

**V&A Recommendations - Identified Research Areas**

**Bullet point 2 (Short/Medium Term)**
Comprehensive study on the vulnerability of Water and Agricultural Resources

**Bullet point 3 (Short Term)**
Supply of support facilities like water tanks to address salt water intrusion into fresh water lenses/catchments and inundation of agricultural sites

**Bullet point 4 (Short/Medium Term)**
Sustainable water management practices, initiatives and technologies for both farming and household usage

**Bullet point 7 (Short/Medium Term)**
Advocacy and civic education awareness on climate change variability and its adverse effects

**Bullet point 8 (Short/Medium Term)**
Agricultural adaptation and improvement to identify new farming methods and crop species suitable for changing climatic conditions

**Bullet point 12 (Short/Medium Term)**
Traditional practices of agro forestry, harvesting practices and food preservation practices must be maintained for sustainability

**FARM MODELS**

The following are proposed Farming Systems Approaches

**1. Backyard Farming and Composting**

Backyard gardening and composting will be an important and effective system approach to make garden at the backyard of homestead. Women usually have much to offer as they have good composting materials at their disposal. Kitchen wastes and wood ash are good sources of mulching materials. Crops planted close to the kitchen and can be watered easily with kitchen wastewater as well as grey water (washing).

Composting using poultry manure
is organic matter that has been decomposed to soil-like material and used as a fertilizer and soil amendment. It’s a multi-step process thus takes about 6 to 12 months.

Compost contains macro and micronutrients often absent in synthetic fertilizers.

Compost releases nutrients slowly—over months or years, unlike synthetic fertilizers.

Compost enriched soil retains fertilizers better. Less fertilizer runs off to pollute waterways.

Compost buffers the soil, neutralizing both acid & alkaline soils, bringing pH levels to the optimum range for nutrient availability to plants.

2. Agro-forest Farming Systems

According to the World Agro-forestry Centre, Agro-forestry is a collective name for land use systems and practices. Woody perennials are deliberately integrated with crops and/or animals on the same land management unit. There are ecological and economic interactions between woody and non-woody components in agro-forestry. In agro-forestry systems, trees are intentionally used within agricultural systems, or non-timber forest products are cultured in forest settings.

Knowledge, careful selection of species and good management of trees and crops are needed to optimize the production and positive effects within the system and to minimize negative competitive effects. In some areas, a narrow definition of agro-forestry might simply be "trees on farms."

Hence, agro-forestry, farm forestry and family forestry can be broadly understood as the commitment of farmers, alone or in partnerships, towards the establishment and management of forests on their land. Where many landholders are involved, the result is a diversity of activity that reflects the diversity of aspirations and interests within the community.

During the past two decades, there has been an increasing interest in using the agro-forestry approach for developing more productive, low-input, and sustainable land use technologies. Such a system has been widely acclaimed as a solution to tree depletion, soil degradation, and declining yields under shifting cultivation. Agro-forestry is a sustainable land management system, which increases the overall yield of the land. It combines the production of trees and the production of crops on the same unit of land, and it applies management practices that are compatible with the cultural practices of the local population.

(i) ITTA-ALLEY Farming system

According to a report by ACOM Climate Change Program, this Permaculture initiative, the “Atoll Permaculture” or “ITTA-ALLEY” farming system is an agro-forest gardening system. It will be a multi-layered system of fruit and nut trees, vegetables and root crops.

“We are creating a farming system that is permanent, self mulching, self sustaining and self regenerating, and that it can provide a good source of food to the community. The system is systemically desirable (truly relevant) and culturally feasible (meaningful)”. 
“We would also like to create a system that will demand less time and has low maintenance cost. We can imagine a forest of food where food can be collected when required.”

(ii) **Intercropping under Coconut (to remain to utilize banana under coconuts)**

Growing crops under coconuts will involve good planning. It must consider that enough sunlight is coming through and that coconuts are spaced out to allow this. Selection of crops will consider tree crop species, root crop species and vine crop species.

3. **Pusaraghi (Swamp) Farming Systems (swamp taro and sweet taro)**

It will be an important activity to collect as much biomass as could be produced by growing leguminous plant species and to heavily mulch the swamp taro pits. Mulching will provide the essential nutrients for the taros.

**TRAINING**

1. **Workshop Training**

On-farm training of the lead farmers will be important to introduce them to the farming systems we are offering to them. The topics will include all the systems on offer such as: An introduction to Atoll Permaculture or ITTA-ALLEY, Backyard Farming and Composting, Intercropping under Coconut (to utilize banana under coconuts), and Pusaraghi Farming Systems (swamp taro and sweet taro).

Training that is more technical will be conducted for the lead farmers both at the project site and at Honiara when the need comes. The training will give the farmers the opportunity to visit gardening practices around the plains. At the end of the course, certificates will be given to certify their attendance.

It is important that the community is made aware of climate change effects and their impacts on peoples livelihoods through participatory training and then lead the community to form a climate change committee.

2. **Prior to establishing the On-Farm Demonstrations**

Prior to establishing the on-farm demonstrations for sustainable soil management the following set of activities will be pursued:

To educate the community about sustainable soil management

To train the community so that they understand the practical aspects of soil management

The approaches outlined take time to yield the expected outcomes therefore continuous assessment and monitoring are important
A soil analysis kit will be procured by the Soils/Farming System section. This will be used to establish realistic pH results.

A detail study on the pilot site’s farming system is highly recommended to establish a benchmark for all atoll and coastal farming systems for the country.

PROPOSED SOIL IMPROVEMENT APPROACHES

1. Agro-forest systems and their potential to improve degraded lands and poor soils

Full utilization of available land, conserve indigenous crops, revive the ecology and the environment, protect the soil from adverse sun and rain, protect soil from erosion, increase food production, provide nutritional balance, socio-economic benefit, local medicine, promote wild life.

To discourage shifting cultivation or "slash-and-burn".

To shorten the duration of the fallow period, and improve the nature and density of the fallow vegetation in the alley component.

use fertilizer from natural cycles because chemical fertilizer has not been a viable option in the Solomon Islands because of its high cost and unavailability to smallholder farmers.

The crops environmental and agronomic requirements dictate their placement in their positions in the farm. Their placement enables the system to fully utilize all available ground and air space, sunlight and canopy shade, ground water and soil nutrients, and, carbon air and humus.

Placement of leguminous tree species in selected positions throughout the farm enhances crop synergism providing nitrogen to associate non-leguminous crop species because of their ability to fix nitrogen.

The whole farm system operates holistically and consequently achieves sustainable nutrient cycle. It is systemically feasible.

Realizing the potential of leguminous hedgerows in particular as a source of browse for livestock.

Currently alley farming techniques and similar approaches are being researched and tested, or are already used in farmers fields, in various parts of the humid tropics.

The land use patterns associated with traditional cultivation systems are extensive, and disturb more land than actually required for farming. In many areas, the high rate of population growth and the consequent land pressure have sharply reduced restorative fallow periods.

The land is no longer allowed to rest adequately for the soil to be reconditioned for subsequent cropping. These factors and inappropriate farming methods have resulted in increased rates of deforestation, soil erosion, and land degradation.

The practice of repeated and frequent burning in the traditional systems, ‘slash and burn’ further adds to the problem of land degradation. There is considerable evidence that repeated flash burning of vegetation causes increased degraded lands.
It is widely recognized that the biggest challenge facing agricultural research in the tropics is the development of farming systems capable of ensuring increased and sustained productivity with minimum degradation of the soil resource base.

Reversing the trend of declining food production in Solomon Islands therefore, does not depend solely on the development of improved and high-yielding crop varieties. Development of sustainable production systems is necessary to foster and maintain advantages derived from such improved varieties.

Systems are needed that incorporate the biological stability and nutrient balance characteristic of the traditional shifting cultivation system, while allowing intensification of production over the long-term.

Thus to increase the productivity and income of small-scale farmers it is important to provide them with appropriate technologies and systems that will enable them to intensify their production. They should be:

- technically and environmentally sound,
- socially desirable,
- economically affordable, and
- ecologically sustainable.

In the tropics, trees have long been recognized as essential both for the stability of the environment and for maintenance of soil fertility for crop production.

Trees have been recognized as major elements in soil fertility regeneration and conservation, as reflected by their prominence in traditional farming systems.

One agro-forestry system that has received a good deal of research attention and has shown great promise for sustainability is alley farming.

We want to do this with a vision:

“We are creating a farming system that is permanent, self mulching, self sustaining and self regenerating, and that it can provide a good source of food to the community. The system is systemically desirable (truly relevant) and culturally feasible (meaningful)”.

“We like to create a farming system that is permanent, utilizing both shade and sunlight so that all shade tolerant and full sunlight crops are used to provide a good source of nutritious food. We would also like to create a system that has ‘low input high output’ and is low cost. We can imagine a forest of food where food can be collected when required.”

2. Legume tree shrubs and cover crops

Legume is a vital plant. It must begin with the farms. The sandy soil must be covered with mulch either plant debris and or green mulch. Peanut is a good green manure because it grows fast and can cover the ground quickly. Peanut can later be harvested for peanut and use the trash for mulching.
We will use other legumes as Centrosema and Siratro. These legumes will be trained on trellises around the farms.

The other very good legume is the Lusina plant. It strives very well in the sandy soils of Ontong Java. The plant will be planted throughout the farms at selected points. This plant will provide immediate cooling microclimate for the crops. It will also be a source of the needed biomass to be used as green manure for composting and for mulching.

The legume will provide much of the needed nitrogen for the growing plants. Nitrogen seems to be lacking in the soil as can be seen in the yellowing leaves of banana and pawpaw plants.

These plants are able to fix $\text{(N}_2\text{)}$ i.e. unavailable for plants use

Choice of Legume trees & scrubs selected must be tolerant to excessive soil alkalinity and salinity. These include; - *Acacia auriculiformis*, *Calliandra calothyrsus*, *Casuarina esquisetifolia*, *Glyricidia sepium* and *Sesbania sesban*.

The popular Mucuna/velvet bean with pH 5 – 8 is a target cover crop to be used including the common

All parts of these legume plants are a good green material source for compost, which is lacking in the atolls.

Most legume plants are tolerant to adverse environmental conditions such as soil alkalinity and droughts.

Legume trees can be periodically pruned as they can easily re grow.

Spacing of these legumes should be critically considered as competition for the precious ground water is a possible problem.

3. **Cover cropping and mulching**

The four field assistants are well versed with the process of doing mulching as they have been doing this activity in their swamp taro plots. Now they were advised to use the plant debris accumulated in their plots while doing the clearing. Later they will do mulching with the legume pruning when they are ready.

Mulching is essential once the plants are planted. If the soil is not covered, weeds will grow back quickly. One way of preventing this from happening is by using deep mulch onto the soil. Mulch keeps the soil temperature constant; it adds organic matter and nutrients to the soil over time and conserves soil moisture. Be careful that the mulch does not touch the stem of the growing plants otherwise; they might be encouraged to rot as the mulch itself decays.

The type of soil found in Luaniua is most vulnerable to both sun and rain extremes. When there is a long period of sun, the soil water evaporates quickly and dries up the soil giving unfavorable stresses to plants. However, when it rains the water sinks very quickly washing away all plant foods sitting in the surface of the soil. The answer to this is to put heavy litter on the ground so that it holds the moisture in dry periods but also holds plants foods from being leached when it rains.
For the Atoll Permaculture there are tree food plants selected to be planted throughout the farm which will later become the main source for the production of the needed biomass. They produce heavy litter so that it will cover the ground and protect it from the two adverse extremes. When the litter decays plant foods will be released and made available to the crops. No plant debris will be burned. They will be spread over the plots and logs stacked along the crop edges leaving them to rot.

Improves soil fertility – also known as green manure. They use to manage a range of macro and micro nutrients. (Mostly legumes)

Improves soil quality - by increasing soil OM levels through the input of cover crop biomass over time.

Enhances water management – reduces soil erosion thus reduces rate/quantity of water runs off the field

Thick crop cover often compete well with weeds during the cover crop growth

Disease and pest management

Protecting soil from erosion is the first step toward a sustainable soil management and a sustainable agriculture

4. Soil and Rain Water Management

Improving rainwater collection for human, livestock and crop productions

Optimum use of available water for crop production and livestock

Useful technologies include; - bucket and drip irrigation should be adopted.

Avoid at all cost polluting the thin lens of ground water available – use of inorganic fertilizers

Use of farming practices that minimize water loss through evaporation and infiltration – cover crop, mulching and OM
Appendix 2.

PROGRAM OF ACTION

Period for PACC/MAL Implementation for the month of October, November and December 2012.

<table>
<thead>
<tr>
<th>Time period</th>
<th>Activity</th>
<th>Budget</th>
<th>Responsible Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st to 31st October</td>
<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>2. Week Two 8 – 13th</td>
<td>Collection of required materials: Convene a Meeting for the team-one day (this will be moved to Week Three) Purchase and collect planting materials (Temotu and Guadalcanal plains) and raise in the nursery) – submit cost to PACC Purchase saw dust, chicken manure, polybags – submit proforma invoices to PACC Budgets for the above activities will be worked out and submitted to PACC Monitoring and Evaluation</td>
<td>PACC</td>
<td>Casper, PACC Jasper, ACOM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week Three 15 – 19th</td>
<td>Shipping arrangement (liaise with PACC) Collect all required materials and equipment – submit proforma invoices to PACC Quarantine all planting materials, soils,</td>
<td>PACC</td>
<td>Casper, PACC Jasper, ACOM</td>
</tr>
<tr>
<td>Date Range</td>
<td>Activity Description</td>
<td>Team</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Week Four 22 – 26&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Loading and sail for Ontong Java</td>
<td>PACC Casper, PACC Jasper, ACOM</td>
<td></td>
</tr>
<tr>
<td>29&lt;sup&gt;th&lt;/sup&gt; to 31&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Report write up and submit to PACC. Submit report to PACC.</td>
<td>PACC Jasper, ACOM</td>
<td></td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; to 30&lt;sup&gt;th&lt;/sup&gt; November</td>
<td>Collection of planting materials continues</td>
<td>Jasper, ACOM</td>
<td></td>
</tr>
<tr>
<td>Week 1&lt;sup&gt;st&lt;/sup&gt; to 4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Collection of planting materials continues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5&lt;sup&gt;th&lt;/sup&gt; to 11&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Collection of planting materials continues. Loading of ship, and sail for Ontong Java, unload.</td>
<td>Team</td>
<td></td>
</tr>
<tr>
<td>Week 12&lt;sup&gt;th&lt;/sup&gt; to 18&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Courtesy call to the House of Chiefs of Pelau community. Identify project sites and confirm:</td>
<td>PACC Team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 plots for ITTA-ALLEY farming system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Backyard gardens</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Intercropping under coconut</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 ALLEY farming system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Pit mulching</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pegging</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Planting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>On Farm training</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Installing of rain water tanks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 19&lt;sup&gt;th&lt;/sup&gt; to 29&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Pegging continues</td>
<td>PACC Team</td>
<td></td>
</tr>
<tr>
<td>Week 26th to 30th</td>
<td>Move to Luaniua</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check work in Luaniua:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visit and observation of existing plots</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Take photos</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crop growth and performances</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crop harvest – taros, veges,.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measure yields</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Talk with farmers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Make call for shipping.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1st to 31st December</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd to 9th</td>
<td>Board ship to go back to Honiara</td>
</tr>
<tr>
<td>10th to 16th</td>
<td>Report write up and Submit to PACC/MAL</td>
</tr>
<tr>
<td>17th to 21st</td>
<td>Presentation of Report</td>
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<table>
<thead>
<tr>
<th></th>
<th>PACC</th>
<th>Team</th>
</tr>
</thead>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Team</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAL officers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Appendix 3.

**RESOURCES**

#### Salt Tolerant Crops to be Collected

<table>
<thead>
<tr>
<th>Crop</th>
<th>Botanical name</th>
<th>Symbol</th>
<th>Amount (No.)</th>
<th>Unit cost ($)</th>
<th>Subtotal cost ($)</th>
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<tbody>
<tr>
<td>Alite</td>
<td></td>
<td>BT</td>
<td>20</td>
<td>3</td>
<td>60</td>
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<tr>
<td>Polynesian chestnut</td>
<td></td>
<td>BI</td>
<td>10</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>Breadfruit</td>
<td></td>
<td>MA</td>
<td>30</td>
<td>10</td>
<td>300</td>
</tr>
<tr>
<td>Funny face</td>
<td></td>
<td>MS</td>
<td>20</td>
<td>4</td>
<td>80</td>
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<tr>
<td>Malay apple</td>
<td></td>
<td>SE</td>
<td>20</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Local avocado</td>
<td></td>
<td>SB</td>
<td>20</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Cut nut (round)</td>
<td></td>
<td>IBE</td>
<td>120</td>
<td>3</td>
<td>360</td>
</tr>
<tr>
<td>Stem taro</td>
<td></td>
<td></td>
<td>500</td>
<td>3</td>
<td>1500</td>
</tr>
<tr>
<td>Sweet taro</td>
<td></td>
<td></td>
<td>500</td>
<td>4</td>
<td>2000</td>
</tr>
<tr>
<td>Topia</td>
<td></td>
<td></td>
<td>25</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Banana</td>
<td></td>
<td></td>
<td>100</td>
<td>5</td>
<td>500</td>
</tr>
<tr>
<td>Cassava cuttings</td>
<td></td>
<td>As req.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kumara cuttings</td>
<td></td>
<td>As req.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td>As req.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>1365</td>
<td></td>
<td>$5100.00</td>
</tr>
</tbody>
</table>

#### Tools, Equipment and Materials:

PACC has prepared such materials for Pelau Community

ACOM Climate Change Program prepared remaining materials for Luaniua.

#### Manpower:

Team Leader- Jasper Maike Bonie, CCP, ACOM.
Mr. Francis Suromea, ARD, MAL

Mr. Robert, ARD, MAL

A carpenter, MAL

*Administration:*

Shipping

SDA

Food and water support

Transport (fuel, Boat hires)
Appendix 4.

ITTA-ALLEY Farming System

Introduction

Definition

History

Objective

Structure

How the system works

Improvement

Character

Benefit

Definition

According to a report by ACOM Climate Change Program, this Permaculture initiative, the “Atoll Permaculture” or “ITTA-ALLEY” farming system is an agro-forest gardening system. It will be a multi-layered system of fruit and nut trees, vegetables and root crops.

“We are creating a farming system that is permanent, self mulching, self sustaining and self regenerating, and that it can provide a good source of food to the community. The system is systemically desirable (truly relevant) and culturally feasible (meaningful)”.

“We would also like to create a system that will demand less time and has low maintenance cost. We can imagine a forest of food where food can be collected when required.”

“ITTA-ALLEY” was designed using the principles of ITTA system which is the Improved Temotu Traditional Agriculture and the Alley farming system.

It is an intensive agro-forest garden system that uses both forest-like gardens and full sunlight crops. The system utilizes shade and sunlight conditions

It uses just about any crop. It accommodate all the crops that are used in both ITTA and Alley farming systems (fruit and nut trees, root crops, vegetables)

It can be used in any situation in high islands, atoll islands, plains or along coastal regions.

History

ITTA-ALLEY farming system is being piloted in a atoll situation in Ontong Java by the Anglican Church of Melanesia with assistance from the Episcopal Relief and Development of the USA.
The project began in 2010. Four plots were designed and are being established in Luaniua two measuring 60m square and measuring 40m square.

Currently it is being observed. Progress in 2012 is quite satisfactory. This year another plot will be set up in Pelau Island.

**Objective**

The diverse objectives of ITTA and Alley systems are taken onboard. The overall objective is to produce sufficient food to meet the food demand of our communities.

Other primary objectives include full utilization of available land, conserve indigenous crops, revive the ecology and the environment, protect the soil from adverse sun and rain, protect soil from erosion, increase food production, provide nutritional balance, socio-economic benefit, local medicine, promote wild life.

to discourage shifting cultivation or "slash-and-burn".

to shorten the duration of the fallow period, and improve the nature and density of the fallow vegetation in the alley component.

use fertilizer from natural cycles because chemical fertilizer has not been a viable option in the Solomon Islands because of its high cost and unavailability to smallholder farmers

We want to do this with a vision:

“We like to create a farming system that is permanent, utilizing both shade and sunlight so that all shade tolerant and full sunlight crops are used to provide a good source of nutritious food for our rural communities. We would also like to create a system that has ‘low input high output’ and is low cost. We can imagine a forest of food where food can be collected when required.”

**Structure**

The ITTA component:

uses fruit and nut crops arranged in a multi-storey structure, the upper storey containing the tallest tree crops and also containing crops that need initial shading in its early establishment. At bearing these crops benefit from their light shading because they bear fruits on the inside of the tree structure and their exposure to full sunlight may reduce their ability to produce. The upper lower storey crops grow below the tallest trees

They are medium height trees suited to light shading. Shade tolerant root crops are propagated in the ground below the canopy and are trained on kingtrees of the lower storey of the canopy. Shade tolerant dry land taro are placed throughout the farm as required by the farmer. Vine crop species are secured to host trees by their tendrils.

The ALLEY component:
is designed and placed between two ITTA components with a length-end facing east. All alley operation attributes are intact. The woody hedgerow component of the alley farming system retains the basic features of the bush-fallow for soil protection, nutrient recycling, weed suppression, and for provision of browse, staking material, and firewood.

When the farm matures it is assumed that they ALLEY component will benefit from the biomass production in the ITTA component. Decaying mulch from the ITTA areas could be collected and used as mulching material for the alleys.

It is always recommended that the length end always faces eastward where the sun rises. This will ensure that crops grown in the alleys benefit from full sunlight periods.

“ITTA-ALLEY Farming System”

*an imaginary structure*

an agro-forest Garden being developed in Ontong Java atoll

by ACOM Climate Change Program

*Fig.1 An imaginary structure of the ITTA-ALLEY farming system*
**Plot design (example)**

```
<table>
<thead>
<tr>
<th></th>
<th>BT</th>
<th>MA</th>
<th></th>
<th>MA</th>
<th></th>
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<td>SE</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>MA</td>
<td>MS</td>
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<td></td>
<td>SB</td>
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<td>SB</td>
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<td>MA</td>
<td>MS</td>
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<tr>
<td></td>
<td>SB</td>
<td></td>
<td></td>
<td>SB</td>
<td></td>
<td>15m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BT</td>
<td>MA</td>
<td></td>
</tr>
</tbody>
</table>
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←15m →6 6 6 6 6 15M
In the table below are crops required for the design above.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Amount</th>
<th>Symbol</th>
<th>Name</th>
<th>Amount</th>
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<tbody>
<tr>
<td>MA</td>
<td>Breadfruit</td>
<td>12</td>
<td>Cassava</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>Funny face</td>
<td>4</td>
<td>Kumara</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td>Ngali nut</td>
<td>-</td>
<td>Taro(s)</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>SB</td>
<td>Local avocado</td>
<td>4</td>
<td>Pana</td>
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<td></td>
</tr>
<tr>
<td>SE</td>
<td>Malay apple</td>
<td>4</td>
<td>Yams</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>IG</td>
<td>Kingtree</td>
<td>-</td>
<td>Corn</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>IBN</td>
<td>Cut nut (S)</td>
<td>-</td>
<td>Cabbages</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>IBE</td>
<td>Cut nut (R)</td>
<td>26</td>
<td>Bananas</td>
<td>As required</td>
<td></td>
</tr>
</tbody>
</table>

**How the system works**

At maturity the two subcomponents operate simultaneously to create a single holistic system functioning in a manner that resembles both forest shade gardening and sunlight gardening.

The crops environmental and agronomic requirements dictate their placement in their positions in the two components in the farm. Their placement enables the system to fully utilize all available ground and air space, sunlight and canopy shade, ground water and soil nutrients, and, carbon air and humus.

Placement of leguminous tree species in selected positions throughout the farm enhances crop synergism providing nitrogen to associate non-leguminous crop species because of their ability to fix nitrogen.
Preferable fast-growing leguminous species are established in hedgerows spaced 6 meters apart in the alley component. The trees are periodically pruned and managed during the cropping phase to prevent shading of the companion crops. The prunings of foliage and young stems are incorporated into the soil as green manure or used as mulch. Some portion of the tree foliage can be harvested and fed to livestock, particularly small ruminants.

Alley farming parallels bush-fallow systems in the sense that tree foliage is used to maintain and improve soil fertility. However, land-use efficiency is higher in the ALLEY because cropping and fallow are carried out on the same plot of land, at the same time.

The whole ITTA-ALLEY farm system operates holistically and consequently achieves sustainable nutrient cycle. It is systemically desirable and culturally feasible.

**Improvement**

Spacing: ITTA 15m x 15m baseline, all other crop positions are based on midpoints.

Spacing: ALLEY 6m between hedgerows and 3m between hedges of legume trees.

All crops are arranged in straight rows within the two subsystems.

The use of legume plants in the hedgerows improves the soil fertility for the adjacent crops.

The greatest improvement is the ability of the system to accommodate both shade tolerant crops and those that need full sunlight. This means that virtually all crops can be used in the system.

The integration of the two improved versions (ITTA and ALLEY) into one whole workable system is an improvement over both of them and the two traditional systems (the age-old Temotu traditional agriculture and the age-old shifting cultivation methods).

**Characters**

As a synthesis or marriage or combination of two improved versions of traditional gardening systems ('Temotu traditional agriculture' and the 'Shifting cultivation') respectively, the 'ITTA-ALLEY' agro-forest gardening has all the characters of the two systems.

**ITTA Component:**

Intensive agro-forest garden, permanent, low cost high output, resistant to local pests and diseases, systemically desirable (truly relevant and technically possible), culturally feasible (meaningful-culturally accepted and environmentally sound, ecologically friendly), sustainable (its forest-like condition stimulate nutrient cycle), self-regenerating (its root crops grows back without the need to replant), self-mulching (the production of biomass enhances accumulation of organic matter creating favourable conditions for soil micro-organisms whose activities help to decompose plant debris into humus thus helping to revive degraded soils).

**ALLEY component:**
An agro-forestry system in which food or forage crops are grown in the "alleys" between hedgerows of trees or shrubs.

The trees or shrubs – preferable nitrogen-fixing and fast-growing, leguminous species - are established in hedgerows usually spaced 4-8 meters apart (for our case it is 6m).

The trees are periodically pruned and managed during the cropping phase to prevent shading of the companion crops. The prunings of foliage and young stems are incorporated into the soil as green manure or used as mulch.

Some portion of the tree foliage can be harvested and fed to livestock, particularly small ruminants.

Alley farming is a scale-neutral system; though initially developed for smallholders, it can also be adapted for mechanized large-scale farming.

The system has been tested successfully with the use of appropriate woody species and crop combinations under on-farm conditions in other parts of the world.

**Benefits**

- Recreates forest conditions and revives degraded soils.
- Prevents soil erosion and leaching.
- Recreates environment for wild life.
- Increases food production.
- Saves time and labour.
- Opportunity for processing.
- Complete nutritional balance.
- Revives degraded lands.
- Slows down soil nutrient leaching.
- Improves nutritional status.
- Opportunity for processing and trading.
- Carbon sink-stores CO2.

As an improved system, alley farming has various advantages over the bush fallow system, but also requires more labor and management inputs.

Alley farming may be most attractive in places where farmers feel a need to intensify crop production but face soil fertility and/or soil erosion problems.
A low-input, improved bush-fallow system can be sustained even under conditions of land scarcity.

As a substitute for traditional slash-and-burn systems, it offers the opportunity to reduce deforestation and land degradation.