

Sustainable Land Use and Nutrition Program:

**Adaptation of Farming Methods on Small Islands
in the Samarai-Murua District of the Milne Bay Province,
Papua New Guinea**

Duration: 3 Years
Start Date: January 2004

Total Budget: USD \$ 318,705.00

Executing Agency: Conservation International
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Acronymns

ANU	Australian National University
APACE	Appropriate Technology for Community and Environment
CBO	Community-Based Organisations
DAL	Department of Agriculture and Lands
IMR	Institute of Medical Research
LEISA	low external input sustainable agriculture
MML	Misima Mines Limited
NARI	National Agricultural Research Institute
NGO	Non-Government Organizations
PNG	Papua New Guinea
PRA	Participatory Rural Appraisal
PTD	Participatory Technology Development
SALT	Sloping Agricultural Land Technology
SMART	Samarai-Murua Agricultural, Research and Training
UPNG	University of Papua New Guinea

Introduction

The Milne Bay Province is located at the eastern extremity of the island of Papua New Guinea (PNG). It is PNG's largest maritime Province with a total population of 196,000, three quarters of which reside on the 210 or so islands which make up only 42% of the total land area. The Samarai-Murua District accounts for approximately half of all islands in the Milne Bay Province.

The Milne Bay Province is an area identified as a globally important storehouse of biodiversity, harbouring a range of tropical marine ecosystems. The species richness of these ecosystems is extremely high. Compared to other coastal and marine ecosystems in Asia and the Pacific, Milne Bay remains in relatively pristine conditions. However, pressures on the marine environment are escalating, and a precautionary approach to conservation is needed to protect conservation values. Conservation International who have had a presence in the Milne Bay Province for several years now is approaching the Global Environment Facility for funds to implement the Milne Bay Community-based Coastal and Marine Conservation Program.

In preliminary assessments throughout the preparatory phase of this Program it was determined that poor agricultural yields, degrading land use practices, a high population growth, an increase in malnutrition and a decline in health indicators was influencing the degradation and overharvesting of marine resources as communities are less able to meet their food needs through home gardening and are more dependent on marine resources for subsistence and income generation. This has implications for community livelihood strategies, and consequently for conservation approaches. Therefore marine conservation efforts in these communities will need to be accompanied by measures to enhance the productivity of smallholder agriculture in order to assure food security. Subsequently, this proposal is put forward to the Human Security Fund to obtain two goals. Whilst significantly improving the well-being of small island communities by improving health, welfare and social values by having secure livelihoods from productive cash and subsistence crops, it will also contribute to protecting a globally representative sample of marine biodiversity.

The Human Security Context

Land availability and food security are seen as the most important future constraint to sustainable economic development on the islands in Samarai-Murua District. Population growth and competing land resource usage in this District is now placing increasing pressure on shifting cultivation beyond ecological sustainability. Signs of these problems include:

- Declining crop yields and poor nutrition being supplied from gardens;
- Greater work effort necessary particularly for women;
- Shortage of building material;
- A greater awareness and tension over land availability;
- Marginal land previously uncultivated, now being brought into cultivation;
- The clearing of traditional food tree and established cash crop areas, for subsistence gardens;
- A spread of kunai grass, weed infested areas and generally degraded land;
- A steady reduction of forested areas; and
- A general reduction in bush fallow length.

If conservation values and food security based on subsistence and increased incomes based on cash cropping are to be achieved, some changes in either agricultural practices or population growth rates will be necessary. Subsequently, there is a need to develop a long-term proactive and integrated approach to strengthen human security based around food security at the island, clan and household level. Strong relationships need to be built that focus on capacity

building of local groups, local government departments (such as agriculture and medical services) and most importantly Community-based Organisations (CBO's). This will be done concurrent and in conjunction with the Milne Bay Community-based Coastal and Marine Conservation Program.

The Land Use and Nutrition Program aims to address these problematic areas in a holistic manner, incorporating work on sustainable gardening, general land resource conservation, and family nutrition. The purpose of this proposal is to get people to better use their renewable resources (land, trees, crops, animals, water, sea etc) and to improve their standard of living and level of well-being, increase self-sufficiency while ensuring these resources continue to be available in the long term.

Brief Situation Description

The main targeted islands of the Sustainable Land Use and Nutrition Program are the Deboyne Islands of Panaeati (land area of 30.32 km²) and Panapompom (land area of 7.72 km²), Brooker (land area of 1.08 km²) and Ware (land area of 1.68 km²). Brooker and Ware have high population densities of 369 and 395 persons per square kilometre respectively and are subsequently over-populated. Panaeati and Panapompom are under less pressure with 43 and 51 persons per square kilometre respectively but have less arable land available and suffer from African Snail (*Achatina fulica*) infestations. There is low rural-urban migration. Panaeati and Ware have an annual growth rate at 1.4 %, whilst Panpompom is 1.5% and Brooker is a high 2.4%. Current population for Panaeati is 1318 with 254 households, Panapompom is 392 with 84 households, Brooker is 399 with 74 households and Ware is 663 with 149 households. .

Rural health services are minimal and malnutrition is a major concern throughout the Samarai-Murua District with 1.1 % of the population under five years severely malnourished and the number of deliveries with low birth weight high. Life expectancy has dropped and now stands at around 53 years. In the 1982/83 National Nutritional Survey, Milne Bay Province had five of the worst 15 districts in the country. The targeted communities within the Samarai-Murua District had 62% of its under five population below 80% body weight for their age. The Provincial average at this time was 38.3%. In 1989 a nutritional survey was carried out in the East Calvados with visits to Brooker. Their findings showed that 16% of children were malnourished. In 1999 another survey was conducted at Brooker showing that 21% of children were showing signs of malnutrition.

While in the past nutrition has been dealt with as a separate, stand alone issue, it is felt that to do this is short sighted as it does not take into account the complex relationship that exists between health and land use as a families ability to produce and sustain their own food requirements from their land will conversely determine their nutritional health. Nutrition also has an impact on the use of marine resources which in the current situation is leading to overharvesting as people try to make up for the loss of garden foods.

Land shortage for agriculture has been identified as a critical issue in the Samarai-Murua District. Currently arable land accounts for 31% of all land in the Milne Bay Province. Around 70% of this arable land has a very low ratio of cropping period to fallow period. Reduction of the fallow portion of the shifting cultivation cycle from seven to ten years down to five or even less has been noticed throughout the Samarai-Murua District. As a result productivity is declining, grasslands are expanding, there is poor fallow recovery in some areas, and increasing areas of forest and marginal lands are being bought into shifting cultivation systems. Large areas are, degraded, of poor soil or otherwise inappropriate for shifting agriculture. Indeed the carrying capacity of some land has already been exceeded in some areas. It is highly probable that in the not too distant future women will probably have

to work harder to coax a harvest from exhausted soil or travel even farther in search of new land to clear.

The population density of Ware has now surpassed the sustainable limit for a bush-fallow system of cultivation. There is evidence of soil erosion and depletion and older women are complaining of lower yields from more effort. Unless subsistence agriculture can be intensified while simultaneously soil fertility is maintained, out-migration will be the only option for Ware people in the future. In 1994, Ware islanders estimated that local production accounted for only one third of their food supply. From village surveys conducted in 1996 by the NGO Harmony Ink people in the Deboynes and at Brooker were already concerned and aware of land shortages and the disputes that will arise increasingly. Concern over population growth on Panaeati is high with people considering migrating to smaller atoll islands. At Brooker in 1999 research suggest that crop production may be supplying only half of the necessary nutritional requirements.

Added to this, the Samarai-Murua District agricultural food security is very vulnerable to the climatic extremes of drought and cyclones, but especially susceptible to drought. All islands in the Samarai-Murua District have experienced one complete crop failure every decade since the 1870s, and government food relief has been a regular feature in recent decades. This failure of crops contributes to increased pressure on marine resources. People need to dive for marine resources to trade with more agriculturally well endowed islands or for sale to commercial enterprises in order to acquire cash to purchase tradestore staples such as rice and flour. Poor gardens combined with poor resource management will lead to decreased production affecting both food security and community wealth.

In 1986 research showed that a mere 0.075 hectares (or less) per head of garden land was required to sustain the population at that time and at the standard of living of that time. Of course, given the agricultural system in place, this also required that between seven and ten times this amount of land per person needed to be in fallow, recovering between rotational cultivations. Thus depending on the length of fallow allowed for, each person would require between 0.525 and 0.75 hectares of land for their sustenance (excluding forest resources). We know the population and the land area but we do not know how much land is suitable for what forms of cultivation.

Aims and Objectives

The Sustainable Land Use and Nutrition Program has the capacity to develop (at various levels and timeframes) an integrated community development program focussed on strengthening household food production while addressing a wide range of issues including health, traditional knowledge, sustainable marine and terrestrial resource and environmental management. As noted earlier this will be linked and portions subsumed within the planned United Nations Development Program's sponsored Milne Bay Community-based Coastal and Marine Conservation Program by Conservation International and the Small Islands Under Pressure Program being augmented by the Australian National University.

The aim of the Sustainable Land Use and Nutrition Program is to have the community explore and understand their own subsistence land use system with links to the use of the marine environment. Taking them through such an active self-analysis process, in order to understand where the problems and issues they currently face stem from, is important if they are to take the next step of actively seeking improvements or solutions to their problems.

The primary objective is to develop and demonstrate systems of food and cash crop production, which will maintain soil fertility and sustain yields. It will thus be necessary to establish trial programs and provide the reseat and extension linkage to ensure the uptake of

innovations by farmers in the Samarai-Murua District. It should be noted that this Program would have applicable replicability in other parts of PNG, Melanesia and the Pacific.

Activities and Outputs

The Sustainable Land Use and Nutrition Program will need to be farmer-based and utilise participatory methodologies that promote farmer experimentation and farmer to farmer dissemination. A central component is the Participatory Technology Development (PTD) and Participatory Rural Appraisal (PRA) approaches using appropriate technologies that require zero or low external input sustainable agriculture (LEISA). The use of this approach is used to facilitate a continuing cycle of analysis, innovation, dissemination and farmer and local level capacity building.

Typical activities of the Sustainable Land Use and Nutrition Program, which would appear potentially applicable, include:

- Research into the interrelationships between agricultural productivity/security and on marine resource use;
- Conduct land use surveys;
- Engage farmers in technical extension activities;
- Continue the development of sustainable agriculture systems via the research and identification of potential alternative cash and subsistence cropping methods;
- Form a food security alliance with the Samarai-Murua Agricultural, Research and Training (SMART) Centre based at Misima and jointly conduct research and extension activities into the development of seed and planting materials production at using appropriate technologies;
- Collaborate and assess current innovations underway or discussed by MML and SMART that could be disseminated in a long term PTD/PRA process include: kitchen gardens, living fences/legume hedgerows, alley cropping fixed site systems, replanting of fruit and nut groves;
- Facilitate the development and strengthening of farmer, NGO and CBOs networks;
- On farm trials and farmer to farmer extension process using PTD/PRA led by women
- Provide capacity building and training to Women's agriculture centre and focus along with gender analysis of agriculture program;
- Development of appropriate training and awareness materials at local level that elucidate the important connections between food security and sustainable land and marine resource use;
- Develop a rural training outreach program;
- Development and investigation of certified organic crops market linkages; and
- Formalise links with the ANU planned SMIP projects and collaborate on areas deemed complimentary.

The Sustainable Land Use and Nutrition Program would make informed and detailed recommendations and would include sample village participatory food security assessments, stakeholder consultation and planning. A wide range of options would be explored identifying the potential role of organisations affiliated with sustainable agriculture networks.

One approach to be taken by the Sustainable Land Use and Nutrition Program is to integrate awareness and education around nutrition, with the broader issues of land use and sustainable gardening. It is important to remember that like the issues and problems surrounding sustainable land use, many of the problems and issues surrounding malnutrition stem from prevalent social and cultural mores and practices. This is to say that the factors limiting progress and improvement in these two areas are not necessarily due to physical limitations (ie. lack of technology), but rather due to limitations imposed by people's accepted behavioural habits, thought patterns and cultural beliefs.

The following areas will be covered by the nutrition component of the Sustainable Land Use and Nutrition Program:

- Awareness on what is nutrition and why should we learn and know about nutrition;
- Situation analysis detailing nutrition why is there malnutrition; who is responsible for family nutrition (which would include gender analysis); what cultural factors effecting nutrition; crop availability and selection; eating habits and food taboos;
- Education on malnutrition; general signs and symptoms; prevention and treatment; what is a nutritious meal; the three food groups for energy, body building and protection; and the need for regular balanced meals; and
- Practical including group presentations and practical cooking demonstrations on preparing a meal, presenting a meal and recipes.

The following areas will be covered by the agricultural component of the Sustainable Land Use and Nutrition Program:

- Land use and how it is connected to community well-being including the exploration of why sustainable land use is important to the economic and cultural well being of Melanesian subsistence land users;
- Exploring the root causes of land use problems - population growth and land pressure as connected with changing fallow period and how it effects land disputes and disagreements in the present and in the future;
- Analysis of the current gardening and land use systems and cycle, its pros and cons. This will involve analyse in the way this system has changed over time and become less and less sustainable, as connected to population growth;
- Current reliance upon store bought goods;
- The importance of traditional food tree areas in general, but also specifically during times of drought or during the seasonal 'hungry time' in between harvests;
- The use of fire and its effect on the land including investigation of the relationships between fire and weeds versus relationship between fire and forest;
- General conservation of trees and forest and analysis of the economic and aesthetic value of trees as compared to blade grass or weeds;
- Basic agricultural principals connected with soil including the investigation of soil fertility and the loss of soil through erosion and the need to control it; and
- General awareness of and uses for legumes.

Implementing Modalities

Conservation International and the UNDP sponsored Milne Bay Community-based Coastal and Marine Conservation Program will be responsible for implementing the Sustainable Land Use and Nutrition Program. The Appropriate Technology for Community and Environment Inc (APACE) will be contracted to actually complete the Sustainable Land Use and Nutrition Program in conjunction with Misima Mines Limited (MML) who have been working on trying to adapt agricultural practices within the mine affected area. Geoff Callister of the Community Development Department has been responsible for the planned Strengthening Clan Food Security on Misima Island, which APACE will be also conducting. This is to be a 10-year program. Of particular concern for the people of Misima and the surrounding Samarai-Murua District is the threat to food self reliance and ecological sustainability due to the closure of the mine in 2004 which will place sudden increased pressure on local food production and land resources. The three years of this Sustainable Land Use and Nutrition Program leading up to the closure will alleviate some of the problems.

A number of positive resources that have considerable potential to strengthen human and food security in the long term have been identified. Below are some of these resources:

- MML and the previous work of Geoff Callister in adapting agricultural practices in mine affected areas;
- APACE and the work they have successfully carried out in the Solomon Islands;
- The SMART demonstration and experimentation centre (with links to National Agriculture Research Institute (NARI), Department of Agriculture and Lands (DAL), and the local community) in developing innovations and on-farm demonstrations. The SMART Centre may be expanded to have a Rural Vocational Training Centre;
- Participatory needs analysis and awareness process facilitated by Harmony Ink and MML in a number of villages throughout the Samarai-Murua District;
- Participation of DAL in the MML agriculture program;
- Nurses in the Samarai-Murua District with experience and interest in primary health care linked with agriculture and nutrition. This includes nutrition education through cooking demonstrations;
- Traditional experiences and local knowledge that can be used as building blocks for intensification and as a basis for beginning farmer to farmer learning processes;
- Local organisations including: United Church, Louisade Women's Association and Resource/Landowners Association like the Deboyne Islands Development Association and the Emel Company;
- The Australian National University (ANU) and the proposed UNDP funded Small Islands Under Pressure Program which is to provide information needed on to ascertain maximum sustainable threshold population for islands and a possible formula developed to understand other smaller islands in the Province, PNG and the Pacific. The ANU also has a vast amount of expertise in agriculture in PNG through the Land Mapping Systems which documented all agricultural systems across PNG; and
- National and international institutions that may be called upon such as the University of Papua New Guinea (UPNG); NARI; the PNG Institute of Medical Research (IMR); and the James Cook University.

Project Budget and Schedule of Activities

The total budget amount requested is USD \$ 318,705.00 (Kina 1,028,080.00) based on exchange rate on the 23/05/2001. Activities are to be conducted over a three year period.

BUDGET AND ACTIVITIES DETAILS

	US\$			
	Year 1	Year 2	Year 3	Total
Land Use survey	<i>10087</i>			10087
Agricultural Productivity determination	<i>7118</i>	<i>7118</i>	<i>7118</i>	21354
Technical extension with farmers	<i>6581</i>	<i>6581</i>	<i>6581</i>	19743
Alliance with SMART centre research	<i>3004</i>	<i>3004</i>	<i>3004</i>	9012
Acquiring planting material	<i>11315</i>	<i>11315</i>	<i>11315</i>	33945
On farm trials	<i>8643</i>	<i>8643</i>	<i>8643</i>	25929
Capacity building women	<i>9108</i>	<i>9108</i>	<i>9108</i>	27324
Extension materials development	<i>3317</i>	<i>3317</i>	<i>3317</i>	9951
Rural Training Outreach Program	<i>10087</i>	<i>10087</i>	<i>10087</i>	30261
Admin Wages recurrent	<i>38688</i>	<i>38688</i>	<i>38688</i>	116064
Admin recurrent	<i>6045</i>	<i>4495</i>	<i>4495</i>	15035
Total	113993	102356	102356	318705

See Annex 1 for a more thorough breakdown of budget and activities details.

Justification to Apply to the Human Security Fund

The Human Security Fund is intended to support activities to ensure human security. The proposal put forward by Conservation International qualifies for assistance under the Human Security Fund by alleviating poverty, environmental degradation, conflict between and in communities, and improving medical and health care. It will also have an impact on addressing natural emergencies such as the periodic droughts and cyclones.

Annex 1: Budget and Activities Details

COMMUNITY-BASED COASTAL AND MARINE CONSERVATION IN MILNE BAY									
SUSTANABLE LAND USE AND NUTRITION PROGRAM									
Note: Currency Exchange Rate PGK1.00=US\$0.31									
Activity	Land Use survey								
DESCRIPTION	Operation								
	No.	Transit			Field (Milne Bay)			Per diem	
	Trips	# Days	K / day	Transit Tot.	# Days	K/day	Field Tot.	TOTAL	
APACE Staff									
Agronomist	3	4	20	80	42	20	840	920	
Land Use Specialist	3	4	20	80	42	20	840	920	
Sub-total								1840	
			TIME	Salary					
			Workdays						
Field Assistants x 5	K15	210	3150						
Dinghy Operator	K20	42	420						
Sub-total			3570						

Type	Account	Cost													
	Mechanical Services/Mapping	200		Topo maps											
	Photographic Services	500													
	Office Supplies	200													
	Field Supplies	2000		Sampling equipment/											
	Dinghy maintenance	500													
	Lodging/Meals and incidentals	8820		42 night x 7 pers x K30											
	Fuel	3000		6 x 200l drum zoom @ K500											
	Incidental field costs	2500													
	Rations	4410		42 days x 7 pers x K 15											
	Lab analysis soil samples	5000		K50/sample x 100											
	Sub-total	27130													
	Total for activity	32540													

Activity		Agricultural Productivity determination							
DESCRIPTION		Operation							
		No.	Transit		Field (Milne Bay)			Per diem	
		Trips	# Days	K / day	Transit Tot.	# Days	K/day	Field Tot.	TOTAL
APACE Staff									
	Agronomist	2	4	20	160	60	20	1200	1360
Sub-total									1360
			TIME	Salary					
			Workdays						
	Dinghy operator	K20	68	1360					
	Field Staff	K20	68	1360					
Sub-total				2720					
Type	Account	Cost							
	Photographic Services	500							
	Office Supplies	200							
	Field Supplies	2000							
	Dinghy maintenance	500							
	Lodging/Meals and incidentals	6120		68 night x 3 pers x K30					
	Fuel	5000		10 x 200l drum zoom @ K500					
	Incidental field costs	1500							
	Rations	3060		68 days x 3 pers x K 15					
Sub-total		18880							
Total for Activity		22960							

Activity		Technical extension with farmers													
DESCRIPTION		Operation				Field (Milne Bay)				Per diem					
		No.	Transit												
		Trips	# Days	K / day	Transit Tot.	# Days	K/day	Field Tot.	TOTAL						
Agronomist		6	12	20	240	42	20	840	1080						
Women's agric Extension Officer		6	12	20	240	42	20	840	1080						
Sub-total									2160						
			TIME	Salary											
			Workdays												
Dinghy operator		K20	54	1080											
Sub-total				1080											
Type	Account	Cost													
	Photographic Services	500													
	Office Supplies	200													
	Field Supplies	2000													
	Dinghy maintenance	500													
	Lodging/Meals and incidentals	4860		54 night x 3 pers x K30											
	Fuel	5000		10 x 200l drum zoom @ K500											
	Incidental field costs	2500													
	Rations	2430		54 days x 3 pers x K 15											
	Sub-total	17990													
	Total for Activity	21230													

Activity		Alliance with SMART centre research							
DESCRIPTION		Operation							
		No.	Transit		Field (Milne Bay)			Per diem	
		Trips	# Days	K / day	Transit Tot.	# Days	K/day	Field Tot.	TOTAL
APACE Staff									
	Agronomist	3	4	20	80	42	20	840	920
	Land Use Specialist	3	4	20	80	42	20	840	920
Sub-total									1840
			TIME	Salary					
			Workdays						
	Field Assistant	K15	210	3150					
Sub-total				3150					
Type	Account	Cost							
	Office Supplies	200							
	Field Supplies	2000							
	Incidental field costs	2500							
Sub-total		4700							
Total for activity		9690							

Activity		Acquiring planting material								TRAVEL (AIRFARES)			ACCOMMODATION			
DESCRIPTION		Operation				Travel intra province				Per diem						
		No.	Transit													
		Trips	# Days	K / day	Transit Tot.	# Days	K/day	Travel Tot.	TOTAL	No. Trips	Cost / trip	Total	rate	No. days	TOTAL	
APACE Staff																
	Agronomist	2	4	100	400	16	100	1600	2000	RAB LAE	1250	2500	200	20	4000	
	Land Use Specialist	2	4	100	400	11	100	1100	1500	POM	500	1000	200	15	3000	
	Women's agric Extension Officer	2	4	100	400	16	100	1600	2000	RAB LAE	1250	2500	200	20	4000	
Sub-total															11000	
Type	Account	Cost														
	Office Supplies	500	Photocopies/info													
	Field Supplies	20000	Seeds/seedlings/Nursery materials													
	Freight	2500														
	Incidental field costs	2500														
Sub-total		25500														
Total for activity		36500														

	Activity	On farm trials														
	DESCRIPTION	Operation														
		No.	Transit			Field (Milne Bay)			Per diem							
		Trips	# Days	K / day	Transit Tot.	# Days	K/day	Field Tot.	TOTAL							
	APACE Staff															
	Agronomist	4	12	20	240	52	20	1040	1380							
	Women's agric Extension Officer	4	12	20	240	52	20	1040	1380							
	Sub-total								2760							
				TIME	Salary											
				Workdays												
	Dinghy Operator	K20	64	1280												
	Sub-total			1280												
Type	Account	Cost														
	Mechanical Services/Mapping	200		Topo maps												
	Photographic Services	500														
	Office Supplies	500														
	Field Supplies	5000														
	Dinghy maintenance	500														
	Lodging/Meals and incidentals	5760		64 night x 3 pers x K30												
	Fuel	6000		12 x 200l drum zoom @ K500												
	Incidental field costs	2500														
	Rations	2880		64 days x 3 pers x K 15												
	Sub-total	23840														
	Total for activity	27880														

Activity		Capacity building of women												
			TIME	Salary										
			Workdays											
	Dinghy Operator	K20	24	480										
	Sub-total			480										
	DIRECT COSTS													
Type	Account	Cost												
	Office Supplies	1000												
	Vessel hire	9600		16 days x K600										
	Lodging/Meals and incidentals	7200		12 participants 5 days x 4 x K30										
	Fuel	5000		10 x 200l drum zoom @ K500										
	Incidental field costs	2500												
	Rations	3600		20 days x 12 pers x K 15										
	Sub-total	28900												
	Total for activity	29380												

Activity		Extension materials development												
DIRECT COSTS														
Type	Account	Cost												
	Mechanical Services/Mapping	200		Topo maps										
	Photographic Services	500												
	Office Supplies	10000												
	Sub-total	10700												
	Total for activity	10700												

Activity		Rural Training Outreach Program							
DESCRIPTION	Operation								
	No.	Transit			Field (Milne Bay)			Per diem	
	Trips	# Days	K / day	Transit Tot.	# Days	K/day	Field Tot.	TOTAL	
APACE Staff									
Agronomist	3	4	20	80	42	20	840	920	
Land Use Specialist	3	4	20	80	42	20	840	920	
Sub-total								1840	
		TIME	Salary						
		Workdays							
Field Assistants x 5	K15	210	3150						
Dinghy Operator	K20	42	420						
Sub-total			3570						
Type	Account	Cost							
	Mechanical Services/Mapping	200	Topo maps						
	Photographic Services	500							
	Office Supplies	200							
	Field Supplies	2000	Sampling equipment/						
	Dinghy maintenance	500							
	Lodging/Meals and incidentals	8820	42 night x 7 pers x K30						
	Fuel	3000	6 x 200l drum zoom @ K500						
	Incidental field costs	2500							
	Rations	4410	42 days x 7 pers x K 15						
	Lab analysis soil samples	5000	K50/sample x 100						
	Sub-total	27130							
	Total for activity	32540							

Activity		Admin Wages recurrent												
			TIME	Salary										
			Workdays											
	Agronomist team Leader	230.00	260	59800										
	Women's Agric Extension Officer	125.00	260	32500										
	Land Use	125.00	260	32500										
	Sub-total			124800										
Activity		Admin recurrent												
Type	Account	Cost												
	Utilities	2500		Phone fax, electricity, water										
	Office rental	12000												
	Office equipment establishment	5000												
	Sub-total	19500												
	Total for activity	144300												
	TOTAL year 1	367720		year 1										
	TOTAL year 2	330180		year 2										
	TOTAL year 3	330180		year 3										
	PROGRAMME COST	1028080												

Annex 2: SMART Centre

The set-up of the SMART Centre models the real life situation of farmers, whose customary land is put to various uses including bush gardens, kitchen gardens, traditional cash cropping (coconut and cocoa), experimental cash cropping and providing for small scale animal production (pigs and chickens). The different components of the Centre are detailed below.

Hybrid Coconut Seed Garden

- Produce seed nuts of the latest hybrid coconuts for farmers to rehabilitate their holdings.
- A cover crop of Pueraria will be used underneath the coconuts, which will provide a small source of income will be derived from the sale of Pueraria seed.

Cocoa Clone Trial

- Existing trees will be rehabilitated through budding suitable hybrid materials onto them.

Cash Crop Diversification Sub-block

- This will be modelled on a design seen at the Lowlands Agricultural Research Station at Kerevat, East New Britain. Cocoa rows are interspersed with rows of vegetables (sweet potato, yam, corn, peanut, bean etc), and rows of legume trees (ie *Gliricidia*, *Erythrina*, *Crotalaria*, *Tephrosia*), grown and kept in the form of thick hedges.
- The hedgerows are regularly trimmed and the leaves placed as mulch around the cocoa trees or on the vegetable gardens. Another use of these legumes will be to tie in with the Land Use sub-block by providing fodder for rabbits and pigs.
- There is already pressure on land due largely to population growth. With land shortage comes a sacrificing of cash earning export crops in favour of using land for subsistence farming. This technique will allow both cash cropping and subsistence farming to coexist.

Spices Trial Sub-block

- This sub-block is aimed at exploring alternate cash crops which may be suited to the area and which have a high value per unit of weight as the greatest problem faced by farmers is transport.
- Species proposed for trialing at this stage include Vanilla, Nutmeg, Pepper, and Chilli. These will be planted in rows or blocks according to their planting requirements and density specifications.

Land Use sub-block

- This will be modelled on a traditional kitchen garden. It will aim to demonstrate how a permanent plot can be maintained through various techniques, which revitalise the soil. These include green manuring, growing legumes amongst food crops, using legume trees and hedgerows, composting, and incorporating animals into a gardening system.
- This sub-block will tie in with work and research being conducted by the University of Technology, Lae and the NZ Baptist Mission around the use of caged rabbits fed on a predominantly legume based diet, in subsistence gardening systems. Exploration into sustainable small semi-intensive poultry runs and piggeries will also occur.

Nursery

- The nursery will be used extensively in the development stage of the SMART block, to germinate cocoa, coconut, spices and where relevant, vegetables. After this, it will continue to be used for supplying block planting materials, for supplying farmers with cocoa and coconut seedling, and for producing seedlings of a wide range of local species.

Annex 3: Exploring Alternatives

Two broad approaches can be taken when approaching how the current subsistence land use system can be improved to make it more sustainable.

The first approach is for villagers to work within their existing system of agriculture (ie. shifting slash and burn), making simple modifications and additions, in order to make it more sustainable. Where and how they make the modifications is up to them and is not as important as ensuring that they are equipped with the 'tools' they need to make these modifications. These 'tools' are a thorough understanding of the underlying concepts and practices behind sustainable land use and agriculture.

These modifications are practical and simple techniques or concepts, which can be applied without completely changing the existing system. The sustainability is improved because some of these changes will help sustain a decreased fallow period, while still maintaining fertility, hence taking pressure off existing bush area which continues to be cleared. Other changes will help combat some of the negative land use practices such as whole scale clearing of bush, clearing of food trees and burning of grassland areas.

This is different from exploring completely new systems of gardening. The advantages of initially exploring small changes as apposed to large ones are:

- They are more likely to be accepted and utilised. Subsistence farmers are conservative, and a complete change of gardening system is likely to be to big an initial leap.
- The existing shifting agricultural system is important in the role it plays in influencing and regulating social and cultural aspects Melanesian society. Rapid and wholesale change from this system to a permanent agricultural system is likely to have negative social and cultural ramifications.

This analysis can be seen as the necessary groundwork before a widespread move can be made to a permanent form of agriculture. The aim should be to encourage current awareness and use of general sustainable land use and gardening techniques and concepts, *within* the existing system, as a base from which to explore and trial completely new gardening systems.

The second approach is to introduce completely new systems, systems based upon a permanent agricultural form. The two can go hand in hand; however, emphasis should initially be placed upon the first approach while encouraging the experimentation on the second.

Modifying and Adding to the Existing Gardening and Land Use System

Improvements in broader land resource use

- Broad and practical ways in which people can better conserve and sustain all aspects of their natural resources. Many are things that were traditionally enforced and practiced in the past but are currently not practiced due to a break down in traditional clan and village leadership.

Understanding nutrient flow and how it applies to subsistence gardens

- Explore how there are basic ways to improve the sustainability of gardening systems and soil

Specific modifications to current slash and burn cycle

- Analyse the current gardening cycle step by step (ie clearing, burning, fencing, contouring, ground preparation etc) and getting participants to make simple suggestions as to how in each step improvements can be made that will either reduce outputs or increase inputs.

Sustainable gardening techniques

- Techniques based upon organic agriculture or permaculture, which can practically be used and applied in the existing gardens. These include: deep mulching; green manuring; crop rotation; inter-cropping using food legumes (peanuts, beans etc) or shrub legumes in between major crops such as yams; slash and carry mulching; improved or legume fallowing; cover cropping; limiting the use of fire in the garden; live staking of yams; minimum to no tillage and use of live fences

Legume seed garden area

- Encourage an area or areas near the gardens where different types of legumes are actively encouraged to grow. This includes legume trees, large perennial shrubs, annual shrubs and vines. The idea behind these areas is to allow easy access to and utilisation of valuable legume products. Uses include: live fencing stakes; seed for green manuring or cover cropping; seed for establishing contour hedgerows; mulch for using a slash and carry mulching technique; wood (from certain fast growing legume species). These areas can later be cleared and reused as new garden plots in a shorter period than the traditional bush fallow.

Moving to new gardening system

Sloping Agricultural Land Technology (SALT)

- SALT is a system of farming developed in the Philippines for steep sloping ground, very similar to Samarai-Murua District conditions. SALT is based upon nitrogen fixing plants; predominately in the form of alley cropping between closely spaced permanent double hedgerows of legume trees, established on the contours. However, nitrogen-fixing plants are also incorporated into the system in other ways, including as cover crops, as green manure crops, inter-crops and as animal fodder. SALT is a possible viable option for sustainable farming in the Samarai-Murua District and is being actively trailed at the SMART Centre on Misima.

Permanent kitchen / Nutrition Garden

- A feature of agriculture is its dependence on bush gardens located many kilometres from the village. This means that people, especially women, must walk long distances, often carrying heavy loads. Also these bush gardens generally consist of a relative monoculture of high carbohydrate staple crops, neglecting crops from the other food groups. Even when these other food group crops are evident in the bush garden, the distance discourages their regular harvesting and consumption.
- Kitchen or nutrition gardens can be viewed as permanent gardens, located near or ideally around the house. These help supply some staple crops, but are most important for supplying vegetables and greens that make up what is lacking in nutrition in crops coming from the bush garden. They also help take pressure off the bush garden as the only source of food. The advantage of a kitchen garden is in its close proximity to the house, allowing easier and more regular access where nutritional crops, such as beans and various green leafy vegetables, which generally require more care and attention, can be carefully tended. Regular access is also advantageous for controlling or limiting the build up of pests (especially *Achatina fulica*). It may also allow limited 'irrigation' and the application of more fiddly sustainable gardening techniques.

Other areas needing further exploration

The following are areas where little work has been done so far, however they are areas which should be looked at in order to continue a holistic approach to encouraging sustainable subsistence land use.

Drought resistant crop and legume species and varieties

- As one of the most limiting factors on the islands within the Samarai-Murua District is water and rainfall, research and trials will need to be conducted into crops and legume species and varieties, which are more tolerant of, dry conditions. This would involve a thorough analysis and exploration, again with the relevant communities, to identify existing species, which can be utilised to a greater extent. For example, many of the traditional crops such as certain yam varieties are already existent and well suited to small island conditions. Other crops such as pigeon pea (which is already used on Brooker), and jack bean, can be introduced or encouraged. Legumes such as *Luecaena* spp, Rosewood, *Erythrina* spp, *Casaurina* spp and *Crotalaria* spp are already wide spread throughout the islands and resistant to dry conditions.

Livestock care and integration into the garden

- People currently 'husband' pigs and chickens. Generally these are not fenced or penned, with feeding by the farmer really only supplementing the animals main nutritional intake which comes from foraging around the village and in surrounding bush areas. Therefore, a feature of agriculture is a complete lack of integration of livestock into the gardening system in any way such as in the use of their manure. In fact, livestock, particularly pigs have a hugely negative impact upon subsistence agriculture, causing crop loss, garden damage, and necessitating the arduous task of fencing off gardens. Chickens also cause damage to kitchen gardens in the village through their scratching and foraging. Animals also generally pose a health hazard by polluting water and fouling village paths. Research needs to be conducted into socio-culturally-appropriate husbandry methods. These include: fencing and penning methods and land requirements; feeding and fodder; animal disease and general care; and how existing livestock can be integrated into the subsistence garden.

Rabbits and Ducks

- A lot of work and interest in the past 5 years or so has been put into caged rabbits. Small-scale village projects are being set up throughout PNG involving rabbits and ducks. The advantage of rabbits is that they do not compete with humans for food but can be fed a range of legume and leaf material. They are useful for integration into the garden through the use of their composted manure as a fertiliser source. They also provide the 'excuse' or impetus for farmers to actively plant legumes (as this is the main source of feed for the rabbit). This facilitates the integration of legumes into the garden, something that farmers are otherwise fairly resistant to.
- Muscovy ducks have long been recognised as an excellent small animal for the tropical subsistence farmer. They are generally hardier than chicken. While muscovy ducks have been, and are, raised separately in PNG, more recently there has been renewed interest in their suitability to be raised along with rabbits where they act as excellent fly controllers. Rabbits and ducks have potential to be beneficial to the subsistence farmer's system if approached in the right way. That is, they must be fully integrated into the garden and be seen first and foremost as a way of sustaining the soil and encouraging sustainable gardening techniques such as legume use and composting, and then secondly as a protein source.

Natural pest and disease management

- The biggest current problem for people in the Samarai-Murua District is the recently introduced African Giant Snail (*Achatina fulica*) which generally does significant damage to a range of crops, including the main staple yam, especially when it periodically hits epidemic numbers. At present *Achatina fulica* is found throughout Misima and in the Deboyne Islands where it is considered a serious threat to food

security. *Achatina fulica* also poses a health risk to humans, as it is a vector of the rat lungworm (*Angiostrongylus cantonensis*), which causes eosinophilic meningitis and human angiostrongyliasis in humans.

- Taro blight and beetle are also an ongoing problem, which discourages the cultivation of this staple in some areas of Samarai-Murua. Another problem, one impeding the greater cultivation of 'nutritious' crops such as leafy vegetables, is the host of beetles, weevils, caterpillars and other pests that attack these crops. The NGO, APACE, has done significant work in this area in the Solomon Islands, by encouraging farmer experimentation using cultural methods of control.

Alternative or improved crops

- The National Agricultural Research Institute is currently conducting research into improved taro strains (leaf blight and taro beetle resistance), African yams, and improved cassava strains, drought tolerant sweet potato amongst other crops.

Fruit trees and orchards

- The amazing arrays of fruit and nut trees that are able to be cultivated unfortunately are not taken advantage of to any real extent within the Samarai-Murua District. Further work should be conducted into encouraging both the increased cultivation and selection of local or PNG fruits, nuts and food trees, and the introduction of imported varieties or species. Again, a lot of research has been already been conducted in PNG around this area. Research stations such as Laloki in Port Moresby and the Lowland Agriculture Experimental Station in Kerevat can supply or at least provide access to many different food tree varieties.

Agroforestry

- One problematic area of increasing concern to people in the Samarai-Murua District is a gradual decline in bush resources, particularly timber and house building materials, but also the numerous other products a subsistence dweller utilises the forests for, such as medicine, boat building, rope, fencing, etc. Therefore, an area where further work needs to be done is in agroforestry or broadly, the conservation of existing forest areas and re-establishment of new areas. The use of agroforestry here is not in the conventional commercial sense of establishing timber plantations, but rather in simple practical methods aimed at sustaining a resource vital to subsistence existence.

Seed storage or dispersal technologies

- Another problematic area to do with nutrition, as effected by the diversity of crops grown in the Samarai-Murua District is the loss of potentially beneficial crop varieties through poor seed storage. Again the NGO, APACE, has done excellent work in the Solomon's in this area, including setting up a seed network between farmers and villages.