

End of Project Report for the Hisiu/Yule Island (dry/saline) Site.

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1. Project Site Description.

The Hisiu and Yule Island are two communities belonging to the Kairuku ethnic group of the Kairuku/Hiri district of the Central Province. The Hisiu people live on the mainland from the coastal sea front on the old Hisiu Coconut plantation on the sandy and alluvial flat to the seasonally inundated swampy areas inland covered with savanna grassland and semi-deciduous thicket, while the Yule Island community live on the Island (originally called Kairuku) on the beach ridges on the rolling foot hills, covered with savanna grassland and semi-deciduous thicket. On Yule Island and along the coast to the southeast (Hisiu), it occupies low spurs, interfluves and foot slopes, covered with a savanna comprised of mid-height Themeda and Imperata grass and scattered Euctalyptus trees. The altitude in Hisiu and Yule Island varies from sea level to 400 m on the upper slopes of the rolling hills of Yule Island. Average annual rainfall at Kairuku (Yule Island) is around 1230 mm and 84% of this rain is received between December and April and only 16% between May and November. On the Mainland (Hisiu) there is a high rainfall gradient from the coast inland, and the coastal dry season is more severe than it is inland. Banana and cassava are the most important staple crops; coconut and yam (*D. esculenta*) are important crops; other crops are sweet potato, Alocasia taro, yam (*D. alata*) and Amorphophallus taro. Separate gardens are made for banana and yam. Two plantings of yam are made before a long fallow. Yam is staked and banana is propped and wrapped. Yam and sweet potato are planted on small mounds. Banana may produce up to 5 years if cared for. Agriculture is highly seasonal and dry season food shortages are common. Seafood is important for supplementing diets and sale for cash income. Villages are surrounded by extensive coconut stands from the old plantation, fruit and nut trees. Root crops and banana, which are obtained from the inland and Bereina people in exchange for fish and shellfish, are important source of food. Processed food purchased using remittances from people working in Port Moresby is also very common and important

Livestock such as pigs and poultry, are also raised for both customary obligations and income or for own consumption. Farmers from these two communities are part of the 20 % of PNG's population that inhabit the dry savanna environments. With the threats imposed by climate change, farming communities in the dry savanna areas are becoming more susceptible to drought conditions. People are vulnerable to drought during prolonged dry periods (Hansen *et al.*, 2001). This compels a major threat to food security especially with challenges to cultivation of the staple banana, yams and sweet potato.

2. Site Selection & Prioritization.

The Hisiu/Yule Island site was initially selected for salinity stress environment because the villages were situated along the coastline and the Island environment but later through discussion with the community it was found that most of the villagers don't cultivate their crops near the sea but farm or cultivate the inland areas and only live or have their villages near the sea. The same ethnic group (Kairuku people) live both on the mainland (Hisiu) and on the Island (Yule Island) and the site is similar to and part of the Port Moresby climatic condition where it has distinct dry and wet seasons. The two communities were selected due to their vulnerability to drought and suspicion of salinity conditions imposed by the changing climate. Through this project, proven agricultural technologies and improved farming practices were introduced as interventions into the farming systems to improve resilience to threats imposed by the changing climate. These interventions were identified and prioritized based on farmer preferences captured via a needs assessment survey conducted in Hisiu and Yule Island. The interventions that followed involved farmer trainings, farmer-field-days and on-farm demonstrations of prioritized agricultural technologies and farming practices for crop and livestock production. These farming technologies were developed by NARI, in collaboration with relevant partner organizations, through continuous research and development efforts.

The initial fact finding site assessment visit revealed the following site specific characteristics which were slotted into SWOT analysis.

Table 1. Project site SWOT analysis.

<p>Strengths:</p> <ul style="list-style-type: none"> • Barter system in place (fish for food) with Mekeo people (banana/betelnut) – esp Yule Islanders • Barter system for mainland to increase diversity in banana varieties (long orange fleshed; does not grow in Hsiu) • Grow yam that can be stored • Number of protein sources esp wild (fish, bandicoot) • Grow several different staple crops that are well adapted to environment, FG – Banana most important as it is unseasonal) • Tourism potential and spin-off opportunities in food production • Soil moisture conservation technologies • Good community management on Yule islands (Chieftain system) 	<p>Weaknesses:</p> <ul style="list-style-type: none"> • Yule Islanders rely on barter system to access staple crops • Hsiu – swamp used for fishing infested with aquatic weed • Reliance on remittances from working relatives in POM – no incentives for food production • Only small type income generation (run-down coconut blocks, betelnut) • Not so much motivation to look after livestock with wild sources available • Barter system as disincentive to develop business approach in selling livestock • Access to water, water quality, period shortage • On mainland (other villages besides Hsiu) issues with salinity esp during high tide and strong winds, salt water intrusion in water wells • Only use of own planting material and from within the community • Use of traditional practices (slash and burn, shifting) • P&D (taro beetle, other beetles, rots, rats) • Excess/deficit moisture
<p>Opportunities:</p> <ul style="list-style-type: none"> • Introduction of new varieties (corn, cassava) • Introduction of new crops • Interested small livestock production • Increased food production to sell in POM • Increased livestock production on Yule Island (declining fish stocks) • Introduction of improved feeding (Willing to buy feed from the market) • Sale of puppy tree bark to Chinese (K5/kg – extracting and used as incense) 	<p>Threats:</p> <ul style="list-style-type: none"> • More irregular weather patterns • Yule Island – rising sea level • Declining fish stocks esp Yule Island • Further population increase (ensuing land shortages)

In a first of its kind project for the National Agricultural Research Institute (NARI), community members were engaged in a reporting back workshop to list their major constraints and opportunities during drought conditions. Each community member was invited to participate in the prioritization of the major constraint and opportunities available in their area and wish to do something about it (Table 2). Only the top three were considered for addressing by the project. These constraints and opportunities were later converted to project outcomes and prioritized based on their needs and understanding of the concept. Both gender had a fair representation in the workshop and women and girls were given opportunity to vote separately and independently of the men and boys.

Table 2. Results of a voting exercise options addressing agricultural production constraints and opportunities at the workshop in Hisiu and Yule Island.

Options voted on at Hisiu	Voters		
	Women	Men	Both
1. Improving water logging on my crop fields	3	5	8
2. Improving production of banana, yam and cassava	17	12	29
3. Improving management of pigs and chicken using staple crops	11	7	18
4. Improving soil fertility and stop decline in soil fertility	3	10	13
5. Introducing new crops or crop varieties in my farming	11	9	20
6. Integrating management of pigs, chicken, ducks and fish	0	4	4
7. Managing soil and water salinity	9	4	13
8. Adding value to my staples through processing into feed and food	1	5	6
9. Diversifying my livestock holdings for food and income	8	8	16
10. Protecting our water sources	5	2	7
Total votes	68	66	134
Total voters	22.67	22	42

Options voted on at Yule Island	Voters		
	Women	Men	Both
1. Improving water logging on my crop fields	0	0	0
2. Improving production of banana, yam and cassava	23	25	48
3. Improving management of pigs and chicken using staple crops	0	2	2
4. Improving soil fertility and stop decline in soil fertility	9	13	22
5. Introducing new crops or crop varieties in my farming	25	25	50
6. Integrating management of pigs, chicken, ducks and fish	0	7	7
7. Managing soil and water salinity	0	1	1
8. Adding value to my staple crops through processing into feed and food	9	13	22
9. Diversifying my livestock holdings for food and income	12	12	24
10. Protecting our water sources	0	1	1
Total votes	78	99	177
No. Farmers	26.0	33.0	59

The priorities can be summarized as improving production and diversifying their staples (banana, yam and cassava) and improving management of pigs and chicken using staple crops and diversification of their livestock holdings. Followed by adding value to their staple crops through processing into feed and food and the fourth priority was improving soil fertility and stop decline in soil fertility. The priorities identified were addressed with different appropriate interventions by four technical components of livestock, crop improvement, crop diversification, soils and water teams from NARI and partners to address the outcomes of these priorities during the lifespan of this project.

3. Interventions implemented at the site and summary of achievements

Table 3 shows an overview of outputs achieved and participation of different community members in relevant learning workshops and demonstrations that were conducted in Hisiu and Yule Island

communities. There were usually a number of learning events conducted per output and some community members chose to participate in only one of the events while others participated in all events for that output.

Table 3. The various outputs and participation of community members in relevant technology demonstration and learning events at the Hisiu/Yule Island Pilot site.

	Outputs achieved in Hisiu/Yule Island	Farmers Trained	Male farmers	Female Farmers	Model Farmers
O1	Capacity for growing yam using improved locally acceptable production practices and farmer-selected varieties increased in the Hisiu/Yule Island Community	43	24	19	4
O2	Capacity for growing rice using locally appropriate production practices and varieties developed in Hisiu/Yule Island Community	35	23	12	3
O3	Capacity for growing cassava using improved locally acceptable production practices and farmer-selected varieties increased in the Hisiu/Yule Island Community	25	17	8	4
O4	Farmer-preferred drought tolerant sweet potato varieties identified and available to the Hisu and Yule Island communities				6
O5	Capacity for growing vegetables (tomato, capsicum and beans) using improved locally acceptable production practices and locally performing varieties increased in the Hisiu/Yule Island community.	20	11	9	5
O6	Increased capacity of interested farmers for using improved pig feeding and management practices	42	36	6	3
O7	Increased capacity for using improved chicken feeding and management practices based on SP (or cassava) as feed	41	24	17	5
O8	Livestock holdings of interested farmers in Hisiu/Yule Is. diversified and capacity for livestock management improved : (a) Fish-Duck Integration	56	46	10	3
O9	Livestock holdings of interested farmers in Hisiu/Yule Is. diversified and capacity for livestock management improved : (b) Goat management	29	29	0	3
O10	Farmers have knowledge and skills on most pertinent soil fertility constraints and their causes to address limitations on crop production.	16	13	3	3

Model farmers were identified and nominated amongst the farmers themselves, based on their interests and past experiences. The model farmers volunteered to take on new innovations using their land for crop variety trials, and livestock pen/ shed for livestock husbandry demonstration trials. These were mostly interested and resourceful or knowledgeable in their selected areas and willing to try new ideas and technologies in other areas that they don't know as well. The success of the respective projects or demonstrations depended on the pro-activeness of the model farmers. Model farmers responsible for one demonstration were also able to participate in other areas based on his/her interests. For example, the model farmer for broiler chicken was also the model farmer in food processing or other components such as evaluating cassava varieties or yam production technology demonstration trials, if he/she chose to. The attendance of farmers for different learning events, technology demonstrations and meetings depended on the local social factors such as funerals, graduations, tribal conflicts, market days and of course the weather sometimes affected the farmer participation levels, but most farmers do made up for it in the next learning event or demonstrations. Not all farmer trainee names were listed by the visiting NARI staff, as it was difficult especially during field days.

The planned activities under each of the technical components were delivered through field demonstration trials, training demonstrations and field days. Table 4 shows an overview of the technologies and practices that were introduced for each output and some farmer responses gathered during implementation.

Table 4. Technologies/ innovations disseminated as part of project interventions at Hisiu/Yule Island pilot site and farmer impressions.

Output	Description of intervention	Innovation	Farmer impressions
O1	Capacity for growing yam using improved locally acceptable production practices and farmer-selected varieties increased in the Hisiu/Yule Island Community	Yam cultivation practices (mini-setting demos).	<ul style="list-style-type: none"> • Staking of African yam received higher yields than local varieties • Many farmers wanted to expand their African yam.
O2	Capacity for growing rice using locally appropriate production practices and varieties developed in Hisiu/Yule Island Community	Rice production technology	<ul style="list-style-type: none"> • The introduction of new rice mill created positive impact and many members of the community interested to grow rice. • The rice farmers expressed that they will grow more rice and store them for consumption during drought and food shortage periods.
O3	Capacity for growing cassava using improved locally acceptable production practices and farmer-selected varieties increased in the Hisiu/Yule Island Community	Drought tolerant cassava varieties	<ul style="list-style-type: none"> • Communities preferred their own local varieties
O4	Farmer-preferred drought tolerant sweet potato varieties identified and available to the Hisiu and Yule Island communities	Drought tolerant SP varieties	<ul style="list-style-type: none"> • Farmers wanted to keep all the introduced cassava varieties
O5	Capacity for growing vegetables (tomato, capsicum and beans) using improved locally acceptable production practices and locally performing varieties increased in the Hisiu/Yule Island community.	Improved & vegetable production techniques	<ul style="list-style-type: none"> • One farmer bought a second hand vehicle from vegetable sales. • Farmers have expressed that with the introduction of vegetables into their cropping system, they are now able to have diversity in the daily diet and earn a little income from the surplus that they produce.
O6/7	Increased capacity of interested farmers in Hisiu/Yule Island community for using improved chicken and pig feeding and management practices	SP silage and broiler concentrate technologies.	<ul style="list-style-type: none"> • Pigs fed on sweetpotato silage gives tastier meat. • The NARI feed concentrate (LE) is not available in commercial shops for the projects sustainability.
O8	Livestock holdings of interested farmers in Hisiu/Yule Is. diversified and capacity for livestock management improved : (a) Fish-Duck Integration	Introduction of ducks and integration with fish ponds	<ul style="list-style-type: none"> • Not only protein but as a means of recreation, they do enjoy watching the ducks. They stated that some of their ducklings are killed by eagles • Elisabeth said she had already identified her buyers for her ducks in Port Moresby

O9	Livestock holdings of interested farmers in Hisiu/Yule Is. diversified and capacity for livestock management improved : (b) Goat management	Introduction of goats as a new livestock species	•The goat population has increased and the couple has passed 5 goats to the other interested farmers, Elisabeth and John Warupi
O10	Farmers have knowledge and skills on most pertinent soil fertility constraints and their causes to address limitations on crop production.	mulching, composting, planting of leguminous hedge rows using <i>Glyricidia sepium</i> , <i>Mucuna</i> spp. and planting other legumes crops and plants	No comments available

4. Challenges in Project Implementation.

Despite the very good site specific plans that were developed to implement project activities, project staff encountered issues that affected the project activity schedules Table 5 provides an overview of some of those issues. Generally the farmers and community participation at Yule Island was much better and well coordinated compared to the Hisiu component. The Yule Island community activities, demonstrations, trials and other activities were coordinated very well by Mr. Joe Baupua, a local community leader, while Hisiu community leaders had differences among themselves which affected some of the planned activities. A prolonged drought in 2013 and the El Nino in 2015 affected some crop demonstrations especially the upland rice cultivation demonstrations at Hisiu.

Table 5. Issues of significance that impacted the project implementation schedules.

Issues arising during implementation and lessons learnt		Type of action required/suggested taken to resolve problems and delays etc.
1	People have other activities/happenings more pressing to attend to than NARI work. e.g. graduations, funerals, etc.	Communication with lead model farmers was critical at the initial stages and plan activities.
2	Some of the nominated model farmers especially from Yule Island had migrated to the city (Port Moresby) and abandoned the demonstration trials	The abandoned activity or trials were brought to the village project coordinator and assigned to new farmers or taken care of some relatives.
3	Differences among the different clan leaders had lead to many model farmers abandoned their activities	Divide activities and demonstration equally among the different clans and their leaders.
4	Some model farmers don't want to share the results and materials with other farmers.	Quick meeting between NARI, Village Coordinator and the farmers concern resolved the problem and materials and information shared.
5	The prolonged drought in 2013 had impacts on Hisiu and Yule Island rice demonstration plots.	Rice production demonstration plots at Hisiu were discontinued due to the impact of prolonged drought.

6. Final Assessments and Comments

There was a lot of excitement, hype and expectations from the European Union funded project in Hisiu and Yule Island communities as the communities' expectation of the term project as free handouts of materials and cash. The general perception and the expectations in the community when the project idea was taken to the village was that NARI or the project was going to start something big and visible, with reference to a structure or building like they have seen in other projects. That perception was cleared through community meeting and discussions. The new approach of farmers taking a lead role in what they expect from the project in terms of their local priorities was a new approach that also was breaking traditional extension approaches and may have astounded many farmers, who expected NARI officers to

tell them what they should have and what not to have in their communities. After working with the model farmers and them applying the introduced technologies during the 2015 drought period, farmers highly appreciated the project going to their village especially the Yule Island community, which is isolated on the Island away from the Hiri-Tano Highland and the Mainland. The engagement of the womenfolk in all the community consultations in giving equal importance to their views was also new approach to a male dominant Melanesian society. The women members of the community were lead model farmers and carry of the technology and innovations demonstrations and verification trials. Some farmers lost interests along the way but many continued to the end of each planned activities saw the benefit for both food and income generation.

There were no law and order related problems faced by the NARI project team while working in the areas for the five years project duration. Farmers mentioned in the final site assessment meeting that water harvesting and irrigation technologies would have been the priority one in the project had the farmers knew of the implications of their voting and prioritizing constraints in the first workshop after they had endured the *2015 El Nino* induced droughts. The following Tables 6 - 9 summarize the information gathered during the final assessments at Hisiu and Yule Island, respectively.

9. References.

Allen, B.J., T. Nen, Bourke, R.M, Hide, R.L. Fritsch, D. Grau, R., P. Hobsbawn and S. Lyon (1996). Agricultural Systems of Papua New Guinea. Working Paper No. 15. Central Province. Text Summaries, Maps CODE Lists and Village Identification. The Australian National University, ACT 0200, Australia.

Table 6: Technology performance in Hisiu Community as assessed by representative community members

Technology	Performance -Better -Same -Poor	Area Cultivated (for crops)			Do they plan to continue in the future (livestock)? -Yes -No	General Interest from the community- High (H) Medium (M) Low (L) Give Reason	Engage in Market. If Yes, What is the price?
		Old practice	New Practice	Plan to Expand, If yes by how many			
Improved production practices for yam and farmer-selected varieties	Better	≈2000-2500 m ² .	≈200 m ²	≈1000 -2000 m ² as more seeds are available.		High, yams were bigger and longer	K16-K20 per yam
Production practices for rice	Better		24 m ² , 30 m ² ,	>100 m ²		High, cater for food shortage, resource available.	Own consumption
Improved production practices for cassava and farmer-selected varieties	Better	≈2000 m ²	Researched plots- 100 m ²	≈ more than 100 + m ²		High, tubers were bigger and long	-Own consumption
Drought tolerant sweet potato varieties	Better,	≈160	<ul style="list-style-type: none"> • ≈50 m² for research • 600 m² 	≈600m ² +		-High, > tubers, better sizes -Shorter duration to reach maturity	
<ul style="list-style-type: none"> • Improved production practices for vegetables 	Better,					<p>High, all the vegetables planted were able to thrive well with good/ quality harvest results.</p> <p>Farmers wanted to continue.</p>	<ul style="list-style-type: none"> • K1/ heap- • K40 per noodles carton- (Gordons- Open Market) • K6-K8 per kilogram in supermarkets (Dynesty) • Egg plant-50t and 30t per egg plant • Chilly- K80-K100 per 20 Kg • K6/kg x 6kg = k36

Improved chicken/pig feeding and management practices	Better,				Yes	High, more birds, eggs for food and income Pigs grow better	
Ducks/pond integrated farming	Better				Yes, but all fish died caused by drought	Medium, more awareness to be done	
Rope and Washer Pumps	<ul style="list-style-type: none"> • Poor, difficulty in pumping water when the table is low, so the pump lay idle and the villagers again had to use the old practice of taking the water out of the well. • Need other means 						

Table 7: Responses from Focus Group at Hisiu during final assessment on food production and priorities

Periods of Food Shortage	<ul style="list-style-type: none"> • Feb-April-, food shortage is usually caused by rainfall-excess soil moisture damaging cassava and other food crops. • Given the geographical location of the community, farmers stressed that staple food like cassava and yam becomes harden and becomes unpalatable during the rainy periods.
Views on whether improved technologies would improved food shortage period	<ul style="list-style-type: none"> • It was mentioned that food shortage can be managed if they plant know they plant food on the higher land with proper drainages and also plant when the swamp dries up according to the current cropping calendar and also weather patterns. • It was also noted that another way forward is for them to grow vegetables and sell them to buy food (rice etc...) to sustain them during food shortage period. • Many who accepted and implemented the interventions are experiencing financial and also other associated benefits while others who were not doing it were still facing food shortage.
5 Years ago, communities voted on certain priorities. Do these still remain important or have now changed?	<ul style="list-style-type: none"> • Most of them mentioned that the choices made five years ago, still remain important today however, if they are to vote again, water would be one of the most important element voted for because it is important and would help in irrigating the gardens and drinking as well. • Water is important for irrigation of crops, animals and human consumption therefore it was mentioned vital for further development.

Table 8: Technology performance in Yule Island Community as assessed by representative community members

Technology	Performance -Better -Same -Poor	Area Cultivated (for crops)			Do they plan to continue in the future (livestock)? -Yes -No	General Interest from the community- High (H) Medium (M) Low (L) Give Reason	Engage in Market. If Yes, What is the price?
		Old practice	New Practice	Plan to Expand, If yes by how many			
Improved production practices for yam and farmer-selected varieties	Better	81 m ²	400 m ²	400+ m ²		Medium, interest growing, last long, drought tolerant,	
Production practices for rice	Better		100 m ²	200 + m ²		High, better yield, reduced food cost, food security in food shortage period. 11 farmers using the tech.	
Improved production practices for cassava and farmer-selected varieties	Better	400 plus m ²	200 m ²	200+ m ²		High, high yielding, diversification	
Drought tolerant sweet potato varieties	Better	50 m ²	162 m ²	50 m +		High, high yielding	
Improved chicken/pig/ducks feeding and management practices	*Better, for ducks and Chickens *Poor (Pig)				Yes, continue only with duck and chickens but pig failed due to drought impact on sweet potato.	Medium, interest is growing slowing given the drought impact...	K1.00/Egg
Livestock (goat, ducks) holdings and improved capacity for management	Better, goats thrives, Better, Ducks survived					Medium, destructive behavior, newly introduced	

Table 9: Responses from Focus Group at Hisiu during final assessment on food production and priorities

Periods of Food Shortage	<ul style="list-style-type: none"> • It was mentioned that food shortage is usually experienced in February to April and is usually caused by transition from old to new gardens. When all the food from the older garden is used up that is where food shortage is being experience in the village generally.
Views on whether improved technologies would improved food shortage period	<ul style="list-style-type: none"> • The farmers mentioned that with those introduced practices like rice, cassava, African yam is cultivated and stored, can be used to solve the problem for food shortage generally faced on the Island. • Livestock can also be sold for income and used to buy food to solve the food shortage problem to also manage food security issue.
5 Years ago, communities voted on certain priorities. Do these still remain important or have now changed?	<ul style="list-style-type: none"> • It was mentioned that since the new crops were introduced and the project is at its initial stage and their priorities are still the same and they want to continue use the interventions introduced.