PAFPNet | Supported by the Pacific Agriculture Policy Project (PAPP)

Consolidated Responses for the PAFPNet Discussion for the month of March 2015

Date: 10/03/2015 – 27/03/2015

"Vulnerability of Pacific Agriculture and Forestry to Climate Change"

The PAFPNet topic for the month of March, ***"Vulnerability of Pacific Agriculture and Forestry to Climate Change"*** modelled five questions for the discussion forum. Each question encompassed similar responses in relation to the stability of agriculture and forestry to the change in the climatic state. Members of the network discussed both the positive and negative impacts of climate change on land produce and various ways to incorporate traditional knowledge and practices. Additionally, PAFPNet associates mentioned the importance of climate information being simplified and translated for both subsistence and commercial farmers.

Climate change plays a major role in the production and variation of agriculture and forestry produce. Climate change is known to affect the characteristics of natural resources that are necessary for farming practices. As a result of changes in the climate, plants and animals alike are forced to adapt to the new settings. Therefore, farming systems that incorporate climate change resilient practices should be adopted.

Numerous threats on agriculture were discussed as a result of climate change. Extreme weather conditions was labelled as one of the greatest risks to agriculture. Increased frequency and intensity of drought was highlighted as one of the key factors to crop degradation. Flooding was also mentioned as a significant issue because of the build-up and spread of soil diseases such as the rotting of roots and nematodes. Additionally, the salinity accumulation in soil stemming from floods was pinpointed as one of the many negatives effects on PICTs food sources especially for small islands and atolls. Moreover, changes in climatic conditions like that of the environmental temperature were also discussed to favour large outbreaks of known pests and diseases as a result of the subtle shifts in the bio-dynamics of the ecosystem.

Members also shared their different views on traditional knowledge regarding agriculture and weather/climate information which involves the knowledge passed on from generations before. Communities to date still use some form of traditional indicators of weather and time. To list a few traditional climate information shared from the discussion, had mentioned that during a cyclone in Vanuatu, if a black sea bird was seen flying, it indicated the cyclone nearing an end soon. Also, in Samoa, Savaii, a change in wind direction coming over the mountains was seen as a strong indication that a cyclone was developing. Given what the members had noted down during the exchange, traditional knowledge is still held in high esteem for climatic changes and disaster preparedness.

Traditional approaches are developed over a long time frame with adaptive features to the local environment. It is vital that traditional methods are not discarded, rather adjusted to when dealing with climate change. Agroforestry practice was identified as a means to stabilize the impacts of

climate change. Likewise, traditional agroforestry was mentioned to pave the way to building more resilient communities to combat the negative effects of the changes in climate. However, traditional agroforestry practices have now been perceived to be almost non-existent to date. A solution to promote this approach via workshops and trainings was suggested. This would ensure that this knowledge is collected, stored and packaged to be disseminated to the interested parties and safeguarded for the younger generations benefit.

Furthermore, information related to climate and weather conditions and its readings should be converted to help provide support to the work of farmers in both the agriculture and forestry sector with the aim of receiving the maximum value of work supplied by farmers. Dialogues on this topic stated that there needs to be a steady existence of communication channels in order to help integrate and maintain information from the Meteorological office and community level development plans.

Finally, most members in their various areas of expertise had discussed and described their working relationship with their various Meteorological services as solid. This relationship has opened up great opportunities for both interest groups and has provided a wider platform of understanding between agriculture/forestry and its relevancy to climate change.

The assessments of the consolidated responses were gauged from the questions below:

1. What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?

2. What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?

3. How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?

4. How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?

5. Do you currently have a working relationship with your national meteorological service, and if not, why not?

Please visit the following link PAFPNet discussion: http://www.spc.int/lrd/pafnet-publications/cat_view/137-all/136-pafpnet/491-discussion-queries

Responses from:

1. Mr. Gavin Wall

2. Mr. Andrew Tait

3. Mr. Peter Iesul

4. Mr. Sala Tuiafiso Sagato

5. Mr. Tommy Moore

6. Mr. Richard Chrichton

7. Mr. Sunny Seuseu

8. Mr. Tolo Iosefa

9. Mr. Fereti Atumuriravi

10. Mr. Hanington Tate

11. Mr. Viliamu Iese

12. Mr. Sergie Bang

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1. Mr Gavin Wall

Farmers harness natural resources and apply traditional and modern technologies to produce food and agricultural products. Climate change and variability primarily affects the availability and characteristics of the natural resources that are essential to farming. Therefore, the most obvious threats are that the sun, rain and wind which farmers require and which may have both greater variability and larger extremes. Such variability adds complexity to the daily decisions that farmers make and the extremes of weather also represent a threat to other natural resources such as the soil and the bio-diversity of ecosystems. It is the potential for change in ecosystems that is the often unspoken threat. Changes in climate might favour larger outbreaks of known pests and diseases and it might also create subtle shifts in the bio-dynamics of an ecosystem such that previously dormant or low-level populations of pests and diseases become a problem for crops.

It is naïve to think that farmers have not faced floods, droughts and pest and disease outbreaks before and so farming practices evolved to cope with these events. The older practices are often referred to as traditional knowledge. Perhaps the most important of these in the context of climate change are diversification, crop rotation, and knowing what to plant when. In some of the older farming systems crop rotation may have meant shifting agriculture; however, the important issue is the appreciation of the need to nurture the soil and to avoid a build-up of pests and diseases. Some modern farming systems place greater reliance on fertilisers and agrichemicals to maintain soil fertility and manage pests and diseases. Modern tillage practices (no-till and minimum till) also play a part in looking after the soil. In parallel with the development of these approaches, agricultural science has also driven the evolution of more sophisticated ‘organic’ systems where composts, mulches and companion plantings are some of a large menu of practices available to farmers.

In many respects, dealing with climate change is about the ability to make well informed decisions. Making decisions requires information and an understanding of the system one is trying to manage. It is fortunate that crop science has not stood still. In fact, we are in an age where scientific advances are evolving at a faster pace than in any other period in history. The convergence of life sciences, physical sciences and engineering is creating a new host of opportunities in all areas, including natural resource management and food production. Farmers face a complex challenge to harness this knowledge to inform their decision-making. To support farmers government and private sector enterprises that sell goods and services to farmers need to ensure that human resources, policies, institutions and investments are aligned to support the level and complexity of the innovations which are required to sustainably intensify agricultural production and to manage the anticipated variability in weather and other factors.

Helping farmers with new knowledge and information on the weather and other factors means that the information must be in a form that is suitable for them. In effect, information and scientific knowledge is the fulcrum which will allow farmers to leverage their capacities to produce food and to manage the impacts of climate change. Scientific knowledge and information on farming systems needs to be translated into the context of each user as it progresses from scientists to policy makers to extension workers to farmers and so on. Unless this translation takes place the information has no or limited value. Such translation is not a trivial exercise as it requires an understanding of the science as it arrives and an in-depth appreciation of the knowledge of the intended user and the decisions which they have to make. In many instances, the ability of a farmer to manage the threats coming from climate change pivots on the delivery of useful information and knowledge to them.

While I have only referred to crops to date, the same principles apply equally to the management of forest and fish resources.

In summary, farmers make daily decisions about what to plant, when to plant, and how to nurture their crops to maximise production and to optimise financial returns. Changes in climate, the evolving expectations of markets, coupled with the growth in agricultural knowledge is making the task of farmers more complex. To make better informed decisions, farmers need more information about more factors and this information must be in a form that enables them to apply it in their decision making processes. This means major investments in agricultural information extension systems to support decision making by farmers.

Gavin Wall (Mr.)

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2. Mr. Andrew Tait

1. ***What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?***

Increased frequency and intensity of drought.

2. ***What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?***

See https://www.niwa.co.nz/climate/information-and-resources/climate-and-m%C4%81ori-society.

3. ***How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?***

Traditional approaches have been developed over very long time periods and are well suited to local environmental conditions. However, climate change may be changing those environmental conditions. Therefore, it's important that traditional approaches are adapted (rather than discarded) to cope with the changing climate.

4. ***How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?***

In New Zealand, weather and climate information are directly accessed by farmers throughout the country (usually via smartphones or computers). NIWA are also a member of the National Adverse Events Committee, which regularly meet especially in times of drought. The committee is made up of representatives from agricultural industries, rural support groups, and government agencies. It is an excellent communication channel.

5. ***Do you currently have a working relationship with your national meteorological service, and if not, why not?***

NIWA does perform many of the functions of a NMS, but we also have a good working relationship with the NZ MetService.

Andrew Tait

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3. Mr. Peter Iesul

1. ***What do you think are the greatest threats from Climate Change and variability to agriculture from your perspective?***

The greatest threats from Climate Change and Variability to agriculture from my own perspective are soil moisture deficit (*Drought*) and Excessive soil moisture conditions (*Flooding*). Soil moisture deficit associated with increased temperature limits availability of water in the soil and encourages the

build up and infestation of pests and disease. On the other hand, excessive soil moisture encourages the build up and spread of soil disease such as root rot and nematodes. Sea level rise with respect to salinity problems in our context is not an agricultural problem because in small atoll islands people reside in the coastal areas but do their gardening on the hills. Climate change and variability also bring in opportunities which include the flowering of fruit trees 2 or more times outside the normal flowering season and the shifting of crops. According to numerous assessments conducted as baseline studies for each island, the latter is experienced by majority of farmers in the southern part of the archipelago.

2. ***What are some traditional knowledge and methods incorporating agriculture and weather/climate information that is still used today that you are familiar with?***

There are many traditional knowledge and methods incorporating agriculture and weather/climate information and it varies from one island to another. In the central group on an island called Malekula (*second largest island in Vanuatu*) black sea bird flying during the cyclone event could signal the end of a cyclone. Similarly, snakes sleeping close to the river banks could signal that a Dry season or El Nino is approaching. In the southern part of the archipelago, when fruits trees are at their peak of production it could mean that the likelihood of a cyclone occurring is very high. Furthermore, red clouds appearing in the evening could mean that the next day will be sunny. I have a comprehensive list of traditional indicators for other islands that was documented at an agro met summit in Santo in 2012.

3. ***How can traditional agro forestry practice help build resilience in today's agriculture community to climate resilience and natural disaster***

The sustainable farming system practice of planting crops in alley using leguminous plants can help build resilience. Whilst the main objective is to improve soil fertility through nitrogen fixation process, its secondary benefit is to provide shade to the plants during periods of drought. In Vanuatu, key farmers of alley cropping use to prune the glyricidia trees during wet season (*Nov to April*) and the leaves and small branches are applied as green manure to the crops. During the dry season (*Dec to March*) branches that have regenerate are left to provide shade to the crops. In other parts of the country, crops are grown under big trees and forests encompassing the cultivation area are left undisturbed and act as wind break during strong winds. Furthermore, some of these big trees are left because they absorb a lot of water and are advantageous during periods of flooding.

4. ***How can/has climate information (rainfall amount, sunshine hours, maximum temperature, projections etc) add value to your work and that of the agriculture information end user as a result***

Climate information has added value to the extension work in a sense that farmers are getting a lot of climate information so that they can better plan/ program their daily work. For instance, the seasonal forecast (*three months outlook*) enables a farmer to understand the weather for the next 3 months so that he/she can plan accordingly and prepare for the worst case scenario.

5. ***Do you currently have a working relationship with your national meteorological service, and if not, why not?***

Yes, we have a good working relationship with our National Meteorological service through a Memorandum of understanding (MOA) entered into by the Department of Agriculture and Rural Development (DARD), Vanuatu Meteorological and Geo-harzard Department (VMGD) and SPC-GIZ. Basically, climate products from VMGD are simplified and disseminated to the farming community through the DARD extension network and other existing networks such as the churches and chiefs and etc. What happens is that a team of specialist comprising of DARD and VMGD Staffs translates scientific information to understandable forms that can be used by the farmers. This is transferred through the agro met bulletins produced by the experts on a quarterly basis. It is a two way system in a sense that any feedback received from the farmers is reported back to VMGD and the technical team for improvement. We have also organized agro met summits through this information sharing and networking which have resulted to numerous achievements among others are the

i) Development and production of an El Nino/La Nina Handbook which state what adaptation strategy farmers should take **before**, **during** and **after** an El Nino/La Nino for all land- based sectors.
ii) Documentation of traditional indicators for all the islands
iii) Revision of agriculture extension materials to reflect climate change
iv) Conducting farmer field schools including outreach programs to farmers
v) Development of Livestock fact sheets to reflect our local context
vi) Development of a Food security and Agriculture cluster under the Vanuatu Humanitarian Team (VHT) lead by the Department of Agriculture and supported by FAO.
vii) Attending agro meteorology training in Fiji, China and Malaysia. I attended the one in Fiji in 2012 that was funded by UNDP.

Peter Iesul

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4. Mr. Sala Tuiafiso Sagato

1. ***What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?***

Climate Change will have positive and negative impacts on agriculture and this is depends on the natural ability of plants and animals adapting to rising temp, drought and changing rainfall intensity.

Example cold region could able to grow semitropical plants and warm region could not able to grow same plant or plant could change its growth rate and production ability.

2. ***What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?***

As a Professional Meteorologist and a Farmer I still practice mixesd planting of tradition nitrogen fixing

trees and shift farming (farming at well drain area -rocky - for vegetables) during raining season.

I still practicing Seasonal planting and planting the right crop at a suitable climate region.

3. ***How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?***

Agrofiresty would help in sustainability of soil fertility but it would also depends on the type of crop and intensity the crop on the soil. Agroforestry has to be well plan and plants has to be selected as some plants are not suitable for other crops.

In term of disaster it is depend on type of disaster, example tropocal cyclone cat -5 would leave non on the land it it stays more than a day. In term of drought it also depends the type of plant and crop growing at same area. Si it is not a real solution but it does able to reduce the risk to a certain degree.

4. ***How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?***

I introduced this to Samoa and most garners are still use seasonal planting and commeccial Farners now starts considering climate / weather info. Some Farners are now use new technology to overcome weather and climate adverse

5. ***Do you currently have a working relationship with your national meteorological service, and if not, why not?***

Am still helping the Samoa met with improving their products and providing technical advise to those who had asked for it.

Sala Tuiafiso Sagato

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5. Mr. Tommy Moore

1. ***What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?***
    a. Enhanced vulnerability to flooding and drought due to poor land use management – i.e. removal of trees leading to greater erosion during heavy rains, and contaminated/poorly managed groundwater.
2. ***What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?***
    a. Not sure (I'm not from the region). Awareness of when to plant (in the Cook Islands they plant some crops on the low neap tide).
3. ***How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?***
    a. Well managed forests (and other beneficial ecosystems such as wetlands and mangroves) can stabilize soils, help prevent runoff, etc.
4. ***How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?***
    a. At SRPEP we are currently working with countries to develop seasonal climate ***outlooks, and helping countries prepare for future climate change.***
5. ***Do you currently have a working relationship with your national meteorological service, and if not, why not?***
    a. SPREP is the Secretariat of the Pacific Meteorological Council, and we work with all of the countries and NMSs in the region.

The best person to talk to about this at SPREP is Salesa Nihmei and our new Climate Prediction Services Coordinator when he starts later this month.

Best,

Tom

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6. Mr. Richard Chrichton

Ni sa bula Ms Hazelman,

I am deeply humbled by your invitation to join the Pacific Agricultural and Forestry policy network. My background is in Climate Change: particularly conducting Environment Impact Assessment (EIA) & Strategic Environmental Assessment (SEA), Disaster Risk Reducton/Management (DRR/M), Climate Change Impacts and Adaptation and I am heading more into fisheries sector and coastal protection and conservation. I have very little experience working in the Forestry area and so it does not give me great confidence to speak about forestry/forestry policy. In recognizing this I am copying in Mr. Aru Mathias our Forestry Officer also on this email that perhaps may provide more informative comments on the issue in discussion.

1. ***What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?***

From my perspective: Water and Food Security is a major concern for Pacific small islands states. The vulnerability particularly higher among small island atolls given the soil quality, quantity of workable lands for agricultural, forestry and aquaculture purposes, inundation, salt water intrusion sea level rise, king-tides, ocean warning and acidification. These will affect agricultural production, fisheries, as they provide a important food source for subsistence on islands atolls but also small volcanic islands. This will have large implications on the economies of island states with large EEZ especially Micronesia, although projections for eastern Pacific stands to benefit from migratory species of oceanic fisheries such as tuna due to ocean warming.

Frequency and intensity of natural disasters (cyclones, flooding, droughts) also pose a threat to the security of Pacific Islands, this will have a large consequence on the GDP and economic growth of island nations given limitations on available resources. Will affect livelihood of local population in agricultural and fisheries. Threaten endemic, even endangered species.

Climate Change projection for pest and diseases will affect also the agriculture (including forestry) sector and food security.

2. ***What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?***

In my experience working with community based adaptation and living in the Pacific, traditional knowledge is prevalent for indicators to identify incoming cyclone, droughts. An example of this while working in the northern part of the island of Savaii communities shared how change in wind direction coming over the mountains is a strong indication that a cyclone is developing, also the presence of birds (frigate birds) is a strong indication, certain fruits and their behaviour is a strong indication of droughts approaching.

3. ***How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?***

Agroforestry practice is a mean to adapt to the impacts of climate change. Trees improve agriculture by combating the effects of climate change by helping to stabilize erosion, improving

water and soil quality as well as provide food security when they yield fruits. Traditional agroforestry practice will build resilience of communities the negative impacts of climate change and increase food security for reasons stated above.

4. ***How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?***

Climate information could help farmers make sound decisions on where and when to plant their crops and fields. Access to climate information is therefore important to make best decision based on scientific evidence/climate data. The incorporation of traditional knowledge is also important to take into account. Climate information however needs to be simplified/translated to a language that subsistent/commercial farmers are able to understand.

Climate information will also be useful at the regional/national and policy level to make informed decisions on agriculture. Increase the success of agriculture programs and projects.

5. ***Do you currently have a working relationship with your national meteorological service, and if not, why not?***

Work with National meteorological services is very limited in my currently in my position, besides updates on natural hazards within the Pacific Region, such as developing natural hazards, such as cyclones, etc.

Best regards,

Richard Chrichton

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7. Mr. Sunny Seuseu

Dear Brittany,

Here are my responses

1. ***What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?***

   The greatest threats are the increasing frequency and intensity of weather and climate extreme events, for instance tropical cyclones, prolonged droughts, heavy rainfall/flooding, sea level rise etc. These are caused by the natural variability of the climate and heavily influenced by the El Nino Southern Oscillation, but further compounded by Climate Change.

2. ***What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?***

There are several traditional knowledge that exist in Samoa, the appearance of large number of cockroaches inside the house at night, means the following day will be sunny-fine weather. The strengthening of the westerly winds or the appearance of blood-red sunset means bad weather/cyclone is approaching – banana leaves should be cut halfway to the main stem so it will not be downed by the wind gusts (become resilient to strong winds). See http://bit.ly/1L4VSJ1

3. ***How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?***

   The use of traditional agroforestry practice should be promoted and brought back. Some of these practises are slowly lost. There must be national programs to do engagement workshops and trainings to ensure these knowledge and practises are collected and stored – then packaged and communicated back through various means (crop calendars etc) of capacity building and awareness raising to ensure the younger generation benefit but to also give back to communities.

4. ***How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?***

   The climate advisory services we have provided to the farmers through our Climate Early Warning System project has assisted the farming community adapt to (climate variability) the changes of the climate, but also to support their decision making in ensuring resilience of their farms and livehoods from adverse impacts of extreme events and long term climate change. The support we have provided includes advance warnings in occurrences of El Nino or La Nina (ENSO Alert System), in Droughts (Drought Alert System), for Forest Fire Warning System (FWI), in Seasonal Climate Prediction System for the next 3 and 6 month ahead in time, but also other specialised climate products to achieve the above objectives.

   We also provide raw climate data to all stakeholders who request them, and provide support to crop models and extension services in micro climate advice.

5. ***Do you currently have a working relationship with your national meteorological service, and if not, why not?***

   We have a good working relationship with the agriculture community, but there are areas where it can be made closer. UNDP funded a ICCRAHS Climate-Agriculture project from 2009-2012 where most of the climate services mentioned in 4 (above) was developed. Where a manual was developed called "Climate Early Warning Services to Agriculture". At this time all the people within the Ministry of Agriculture have left the ministry, new focal points and contacts are required to re-connect the meteorological office and MOA.

   Many thanks

Sunny

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8. Mr. Tolo Iosefa

1: what do you think are the greatest threats from climate change and variability to agriculture, from your perspective?

Climate Change will continue to have an adverse effect on food production and the livelihood of people in the Pacific region.
Root crops are very important source of starch in Samoa and other countries, where Talo (*Colocasia esculenta)* is the main food staple of the country and the most consumable starch in everyday meal, Other food crops like banana and breadfruit*,* taamu *(Alocasia macrorrhizo*), talo palagi *(Xanthosoma sagittifolium)*, yams (mainly *Dioscorea nummularia)* and sweet potato *(Ipomea batatas)* were also consumed but are of lesser important if compared to taro*.*
Cassava (*Manihot esculenta)* is not a popular root crop in Samoa but several people and villages planted cassava as a reserved crop in time of famine especially in drought stricken areas.
More frequent and prolonged dry seasons with increase temperature, increase variability and intensity of rainfall, flooding and soil erosion and unpredictable cyclone seasons will continue to put pressure on crop production in the subsistence agriculture, not only in Samoa but through out the Pacific region.
Salt water intrusion is and will be a persistence problem in atolls and low lying coastal areas in some countries where most of the people lives with backyard farming to sustain their daily food supply.
Dry seasons during El Niño years were and will be seen as real threat to traditional cropping systems activities in Samoa, especially aroids production (mainly taro) in rainfed areas. Taro is drought susceptible and will suffer from frequent low rainfall during rainy season due to poor water retention ability of shallow and rocky soil in most areas of the country..

2: What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?

Traditional knowledge is based on farming system still practising by some farmers these days, this experience is based on what they learned from their forefathers in the past. Not much I know about this but by informal discussion and talking to some old friends, it looks like most of these practices were directly related to some phenomenon in the sky, for example; some yam species and kava planting and harvesting time (for better yield) were directly determined by certain moon phases.
Taro cultivation in most villages in drier areas of Savaii Island usually started towards the end of the dry season, they called it *"tu'i efu"* or planting while the soil is very dry and dusty, this early planting is normally carried out in the month of September and is usually two or 3 weeks before the first rain of the rainy season, then farmers continue planting taro towards the beginning of the rainy season..

We are now experiencing a lot of variation, intensity and duration and locality of rainfall, so with this practice of *"tu'i efu"* better for farmers to seek advice and guidance from Met services on weather forecast.

3: How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disaster?

Traditional farming systems in the Pacific are known as Agroforestry systems (Agro-ecosystems) where farmers intentionally planted traditional or useful trees that are seen as economically, socially or ecologically integral to the system as described by Clark & Thaman (1993).

Due to accelerating population growth, increasing economic needs, environmental degradation, shortage of arable land together with Climate Change extreme variability and uncertainty in the future, there is a need to develop appropriate farming system techniques that are more sustainable, environmentally sound, profitable and locally acceptable. From my understanding, "Agroforestry system" is seen as the most appropriate technology that is crucial in the development of sustainable food cropping systems for the region to counter climate extremes.

These are some of the benefits of Agroforestry I believe should help build resilience in today's agriculture community.

1: Agroforestry makes more efficient use of natural resources ie, soil nutrients; solar radiation & water

2: Agroforestry provides favourable environment for sustainable production, ie, shade; wind protection; soil conservation; nutrient cycling & habitat diversity..

3: Agroforestry is more profitable. ie, diversify products & continuous flow of products

4: Agroforestry can improve the environment, ie, reduce pressure on natural forests; species diversity; resources conservation; carbon sequestration and help decrease pollution..

4: How can/has climate information (rainfall, sunshine hours, tempt. Projections etc) added value to your work and that of agriculture information end user as a result?

Plant growth are determined mainly by the amount of rainfall (how well the soil absorb or conserve water with nutrients availability); solar radiation (also determines temperature) and carbon dioxide (CO_2). Rainfall availability is vital and is the key factor in determining crop growth and productivity. The seasonal pattern of rainfall distribution and variation greatly determines the type of farming systems including crop calendar to be adopted and used by farmers together with selection of varieties of crops to be planted from time to time (wet and dry season).

As a researcher and farmer, easy access to climate information (mainly on rainfall forecast, monthly, annual in different zones) is very vital, this is the most sought information that I required the most from the Met services as this will give guidance to planning and decision making on time of planting

(mainly on taro and other root & tubers production and research purposes). Other information on temperature and solar radiation are required less and mainly on annual or decade basis.

5: Do you currently have working relationship with your national meteorological service, and if not, why not?

In agriculture, farmers, researchers and advisory together with the meteorological services work together as a team and in Samoa this relationship is improving in term of communication with minimum or no costs to the farming communities and researchers. MAF (Crop Advisory & Research) and MNRE Met service are now working together to share and exchange information for the benefits of farmers', this relationship is building and is like a sandwich.

Tolo

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9. Mr. Fereti Atumuriravi

1. ***What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?***

The greatest threat to agriculture, would be the future weather predictions of "fewer but higher intense TCs" expectations. I think those sudden high impact natural disasters such as cyclones and floods could potentially pose the highest threats then followed by more short to medium term impacts such as drought and king tides. Cyclone and floods depending on the magnitude could rampaged the so called resilient agricultural crops and structures etc that mankind has established and put in place for food security and economic development. As for drought and king tides, screening of selective cultivars for specific site adaptations and provision of irrigation could minimise threats.

On another part of the question on CC variability on the likes of average day and night temperatures, increase/decrease in sunshine hours, increase/decrease in rainfall, shifts in summer/winter, agricultural crops and livestock will likely to adapt along with the changes as this happens only gradually, therefore, adaptation process through natural selection will take its course (genetic makeup through shifts, drifts or mutation) thus, in each generation or cycle, the off springs or types would adjust to the environment on whatever form it inclines to be.

2. ***What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?***

I haven't been old enough to witness significant change of events but traditional knowledge definitely is still in-practice at subsistence levels. Shifting cultivation, mixed cropping, planting under trees (shrubs/coconuts/shade etc), trellising/non trellising, crop rotation, plant taro during the wet

season and harvest during dry season, bury excess root crop tubers in the soil, force ripen technique for bananas, many food preservation methods, delay maturity methods of certain crops and many more. However, it's the commercial cultivation that has limited choices as the ultimate aim is to sell all year round so has many challenges.

3. ***How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?***

As indicated above, agroforestry has advantages and disadvantages depending on the situation. If space is a problem than agroforestry could an obstacle to production and vice versa. Planting certain crops like kava incorporate into shrubs could work well for cyclone and drought conditions.

4. ***How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?***

It would contribute tremendously for the planning in the preparations stages for the following;, planting, establishment, maintenance, harvesting, storage and marketing especially in commercial crops in particular.

5. ***Do you currently have a working relationship with your national meteorological service, and if not, why not?***

To a certain extent, yes especially for research purposes in screening varieties for multisite adaptation, diagnostic analysis for pest and diseases incidences etc.

Atu Fereti

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10. Mr. Hanington Tate

Hi all,

I have following all the discussions with great interest. All the contributions on this topic are valuable. Anyway, for Vanuatu, the greatest threat to Agriculture and Forestry is sere cyclones. Severe cyclone Pam (category 5) have just passed through Vanuatu and has flattened almost anything on its way. The current prediction as more oceans are continuing to warm is to get more category five cyclones in the pacific region. Drought and flooding, pest outbreaks may be some of the serious issues threatening forestry and agriculture. But a severe tropical cyclone threatens forestry, agriculture as well as puting the life of the farmer on the line at the same instance.

Thank you and kind regards.

Hanington Tate
Director
Vanuatu Department of Forests

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11. Mr. Viliamu Iese

Bula all, thank you to the coordinators for this great opportunity to share my 20 tala contribution to answer the questions. Prayers and support for our brothers and sisters in Vanuatu, Tuvalu, Kiribati, Fiji who were affected by TC Pam.

1. What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?

In terms of exposure of our agriculture systems to extreme events and climate change related hazards.

I was thinking of dividing my response into long term and short term exposures, especially the slow manifested direct impacts of climate change such as rising of sea level and increase of average temperature but I realized that in our Pacific Island Region it is not a long term issue anymore. It is right here, right now. With the small increase of sea level plus the forces of storms and winds it leads to severe salt water inundations and intrusion and salt sprays for coastal lands and especially atoll islands. Affecting crops, agricultural related infrastructures and livestock.

With the increase of average temperature and hot days it does pose a threat to high temperature sensitive crops, livestock and natural habitat of fish (if we take fisheries as part of agriculture) especially if it is close or beyond their tolerant limit. Increase of hot days/nights also affects the labour activities or inputs as well. Based on the information we received from farmers, they hesitate to visit the farm if it is far away and the sun/day was too hot. They adjust by visiting the farms early morning or late evening.

With our "normal" very variable climate system, climate change exacerbates the variability and will affect the occurrence, intensity, frequency and distribution of climate related hazards (extreme events). This is a main threat of concern as this will make it harder to predict the occurrence of extreme events. Furthermore, this will increase the exposure of our agriculture systems to adverse impacts of these hazards like droughts, floods, cyclones etc. The type of hazard and its severity depends on "time and space" specific. I agree with the others that out of cyclones and floods, drought seems to affect our communities and agriculture the worst. It is a slow onset hazard. It is hard to know when it starts and when it is going to end. It can take months and years. It affects the crops, livestock and makes the ground hard to prepare. At this time both water and heat stresses are causing the damages. It has subcategories like meteorological, hydrological and agricultural droughts.

It is also interesting to note that some farming practices used by farmers increase their vulnerability. We have some crop modelling data (rainfall, soil, crop growth) that shows that farming on slopes (without control of erosion etc) leads to increase run off from low rainfall. Farmers also remove the weeds from around their crops (with the mindset the "cleaner" the farm the hard working the farmers) but this expose the soil to heavy rain drops and heat of the sun. So even within the "normal" climate variability unsustainable farming practices lead to high vulnerability.

In terms of our agriculture systems and communities, I think limited adaptive capacity is an issue in terms of level of awareness, tools to support decision making regarding risks, understanding forecasts and its implications on crops and livestock and labour inputs etc. The good thing is there are many organizations and governments who are working to address the adaptive capacity and sensitivity issues of our agriculture systems. I hope we should share more information on the tools we are using and the best practices and we should also focus on the holistic approach, not only to

look at vulnerability of crops and livestock but also soil, infrastructure and also the labour time and the general health of the farmers.

2. What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?

Communities use traditional indicators of weather, time, month such as the moon, migration of birds, flowering of plants and even day length as clues to plant certain crops. Farmers in Tuvalu use phases of moon for application of "green compost" to "feed" the giant swamp taro and other important crops. The type of plant used and amount applied depends on certain time and tide (moon) and migration of specific birds.

Farmers also use traditional methods of disaster preparedness such as pruning the trees, cutting the tops of the cassava etc when there are warnings of cyclones.

I think some of the important traditional knowledge are not documented and practiced now-a-days. When I was in Tuvalu at the island of Niutao, the elders shared with me the Traditional Disaster Response called Te Liiga (sounds like that, unsure of the spelling). This is when a drought occurs and the land and sea are both not productive. The Chief of the Island will hand over the authority to a specialized family with natural resource management skills. This family will then activate the rules of planting, harvesting and fishing. There is a certain time for people to go to the plantation, certain amount of coconut to collect or harvest and also time to fish. This helps to sustain the resources in the island until the drought is over and the island recovers. The family will hand over the Island Chief Authority back to the Chief when the island recovers.

I asked the people from Niutao and only very few elders who saw this practiced and enforced. This is before the modern Disaster Response Process was established.

3. How can traditional agroforestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?

I think agroforestry is very helpful as it helps to diversify food and material supply for food and livelihood before, during and after disasters therefore help the communities with quick recovery. It is also helpful as a short term and long term supply of food and livelihood, helps with soil recovery and ecosystem services. But there is a need to plan and do it properly to use the right combination of trees, crops and livestock to make it efficient and sustainable.
Some farmers mentioned that some trees introduced for agroforestry systems damage more crops and kill livestock when they fall down during a cyclone.

4. How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?

1. At the community level, Risk maps, hazard historical information, weather – helps to assess the risks and integrate it in community development plans. These information are sometimes from the Met office or websites but mostly from the communities themselves. It is important for communities to understand the type of hazards that are responsible for disasters they faced so that they understand the hazards likelihood, impacts, consequences, vulnerability to assess their level of risks to develop options to reduce the risks and improve resilience.

2. Forecasts (short terms (3 months or more) for farmers to decide what options to take in terms of planting, harvesting, postharvest treatments and marketing. But sometimes the accessibility, technicality of language used and relevance in terms of site specific and general accuracy of forecast leads to confusion and farmers making high risk decisions.
3. We also work with Daily weather data (Tmax, Tmin, Rainfall, Solar radiation (Sunshine hours) to run crop growth and development simulations using crop simulation models. We used these tools to assess the impacts of climate change (historic) and future projections on Pacific Island Crops. These are dynamic models that combined weather data, soil data (Physical and chemical profiles) and crop genetic coefficient (crop phenology) and farmers crop management) for our research. These are decision support tools for farmers. We also run simulations on best adaptation options in different scenarios. We have been running simulations on taro, cassava, corn in Solomon Islands, potato in Fiji and we are working with rice and sugar cane in Fiji. We are hoping to continue this research and especially developing information packages to pass on the information to relevant stakeholders for decision making.

The main issue with the climate data we access to are: hard to access (long time), many missing data, no weather station at the plantation (agriculture lands, farmers lands), missing parameters (no sunshine hours measurements/solar radiation), different formats. These are also the issues with the soil data and crop production data.
We also need to build the technical capacity of agricultural extension officers to be competent in understanding weather forecasts and its implications on crops and livestock and also transmitting the information farmers. We should also work in building the capacity both through informal, non formal and formal means at different levels to link climate information to support decision making and actions at the farm level.

5. Do you currently have a working relationship with your national meteorological service, and if not, why not?

Yes, we have a working relationship with the Fiji Met Office. When we need weather (Climate data) data we send a request for it and wait for their response. We thank them for their kind support. There are other Met offices who are helping and support our students when they need weather data such as Tuvalu, Solomon Islands and Vanuatu. I hope we will have a more active working relationship with other national met offices. I also hope there is a pathway to access raw met and agricultural data timely so that our students can use them in the timeframe of their scholarship. Sometimes, the scholarships get extended because of the delay of receiving weather data or soil data for their analysis.

Vinaka!!!

Viliamu Iese
Research Fellow (Climate change, Food Security, Disaster Risk Management) Pacific Centre for Environment and Sustainable Development The University of the South Pacific Suva, Fiji Islands

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12. Mr. Sergie Bang

1. What do you think are the greatest threats from climate change and variability to agriculture, from your perspective?

In PNG and Western Pacific, the greatest threats from Climate Change (CC) are drought (heat stress), frost, excess moisture, salinity, landslides and soil erosion and cyclones.

2. What are some traditional knowledge and methods incorporating agriculture and weather/climate information that still is used today that you are familiar with?

a) Saline tolerant banana varieties on atolls in PNG

b) Gardens on slopes are less affected by frosts than those on valleys.

c) Using trees in garden periphery as wind or frost breaks

3. How can traditional agro-forestry practice help build resilience in today's agriculture community to climate resilience and natural disasters?

a) Collection, evaluation and distribution of crop and tree varieties and livestock breeds that can tolerate climatic extremes (drought, heat-stress, salinity and excess moisture);
b) Development and promotion of climate change resilient farming systems more suited to changing environmental conditions, such as traditional mixed cropping and agro-forestry systems;
c) Promotion of sustainable land and forestry management (including strong enforcements of reforestation in logging areas) and land-use planning to minimize the projected impacts of climate change on agriculture and forestry, such as more regular inundation and soil erosion.
d) International market development for organic produce of agriculture (dried fruits & nuts) from the Pacific as a way of improving productivity of subsistence farming, greater carbon sequestration (reduced forest clearing for new gardens) and improved income earning opportunities.

4. How can/has climate information (rainfall amounts, sunshine hours, maximum temperatures, projections etc.) added value to your work and that of the agriculture information end user as a result?

a) NARI uses information on rainfall, sunshine hours and temperature for its Research planning and data interpretation.

b) Develop climate scenarios and early warning systems

5. Do you currently have a working relationship with your national meteorological service, and if not, why not?

Yes, NARI has a close working relationship with PNG National Weather Service.

With Best Wishes,

Sergie Bang

Director General

National Agricultural Research Institute