Turning **climate science** into **services**

Workshop report

Demonstrating sectoral application of climate change science (data and information) to inform climate vulnerability and risk assessment

Honiara, Solomon Islands
10 August 2017

Australian Government

CSIRO

SPREP
Secretariat of the Pacific Regional Environment Programme

Contents

Background

The Australian Government Department of Foreign Affairs and Trade (DFAT) is funding Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Secretariat of the Pacific Regional Environment Programme (SPREP) to help Pacific Island Countries better use climate change science.

A key product from this project is a guideline for developing and applying climate change information in the Pacific. Aimed at sectoral stakeholders, this guideline steps readers through the process of accessing and using climate change data (observed and projections) to raise awareness and particularly to conduct climate risk, vulnerability and impact assessments. In-country capacity to develop and apply climate change information is critical for informing decision-making for determining adaptation responses and building community resilience in Pacific Island Countries.

A preliminary version of the guideline is being demonstrated through a case study in the Solomon Islands, where climate change information is being applied to a risk assessment on cocoa production on the Guadalcanal Plain. The case study is being developed by the Solomon Islands Meteorological Service (SIMS) and Ministry of Agriculture and Livestock (MAL), with support from climate scientists, climate risk assessment specialists, and program management and communication specialists from CSIRO and SPREP.

As part of this case study a workshop, convened at the Heritage Park Hotel in Honiara on 10 August 2017, was conducted to trial and raise the awareness of the new guideline across the Pacific region. The workshop agenda (Appendix 1) was designed to provide background information for the case study as well as to familiarise participants with the climate change information development process and to provide feedback to the project team.

Participants (Appendix 2) included representatives from National Met Services across the region and sectoral stakeholders from the Solomon Islands, as well as representatives from the World Meteorological Organization, the Bureau of Meteorology (Australia), the National Institute of Water and Atmospheric Research (NIWA, New Zealand), the National Oceanic and Atmospheric Administration (NOAA, USA) and the Australian High Commission in Honiara.

The workshop was complemented by a half-day field trip to a cocoa plantation on the Guadalcanal Plain on 11 August.

Workshop introduction

Opening remarks

The workshop was opened with a prayer led by Noel Sainao (SIMS).

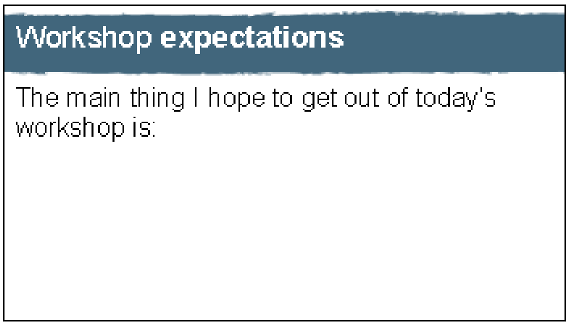
Opening remarks by Chanel Iroi, Acting Permanent Secretary of the Solomon Islands Ministry of Environment, Conservation and Meteorology, focused on the importance of data to decision making. After acknowledging the representatives of important organisations from around the region that were participating in the workshop, Chanel reflected on the role of climate information in addressing important issues that affect the wellbeing of communities and society, including disaster management and development in sectors including water and agriculture. He noted that this information not only needs to be readily available, but also readily understood by users, and he stressed the importance of the role that National Met Services play in collecting and managing climate data. In closing, Chanel acknowledged support from the Australian Government in making climate data available and useful for the Pacific.

Geoff Gooley (CSIRO) then expressed gratitude to the Solomon Islands Government for their hospitality and support in hosting this workshop and carrying out the case study. He commented that it was wonderful to see so many people with an interest in the science and how to use it gathered together. Geoff spoke of the Australian Government's investment in underpinning climate change science for the region and acknowledged the support of the SPREP partnership and Pacific Met Desk and Pacific Met Council in both developing the science and ways to apply it. He noted that recurring feedback from climate science programs in the Pacific was the need for assistance in using climate change data in a practical way to engage with sectors. As part of this project, climate scientists from CSIRO are committed to working with SPREP and National Met Services to provide this support, so the Met Services can offer climate change services to their sectoral stakeholders. In concluding his introduction, Geoff reminded participants of the objectives for today's workshop:

- To promote the sharing of knowledge and understanding of regional climate projections
- To build capacity for sectoral application of climate change science (data and information) to inform climate vulnerability and risk assessment
- To trial and demonstrate such application in the agriculture sector through the cocoa plantation case study.

Participant expectations

After the workshop introduction, participants were given a slip of paper and asked to write down the main thing they hoped to get out of the workshop. These slips were collected at morning tea, and the responses used as the basis of the evaluation activity at the end of the workshop (see Workshop evaluation).


Workshop expectations

The main thing I hope to get out of today's workshop is:

While many of the responses were similar, the nuances offer an insight into participants' information needs and interests. This information is valuable for helping to frame future communication products, guide future capacity-building activities and identify areas that may require additional resources.

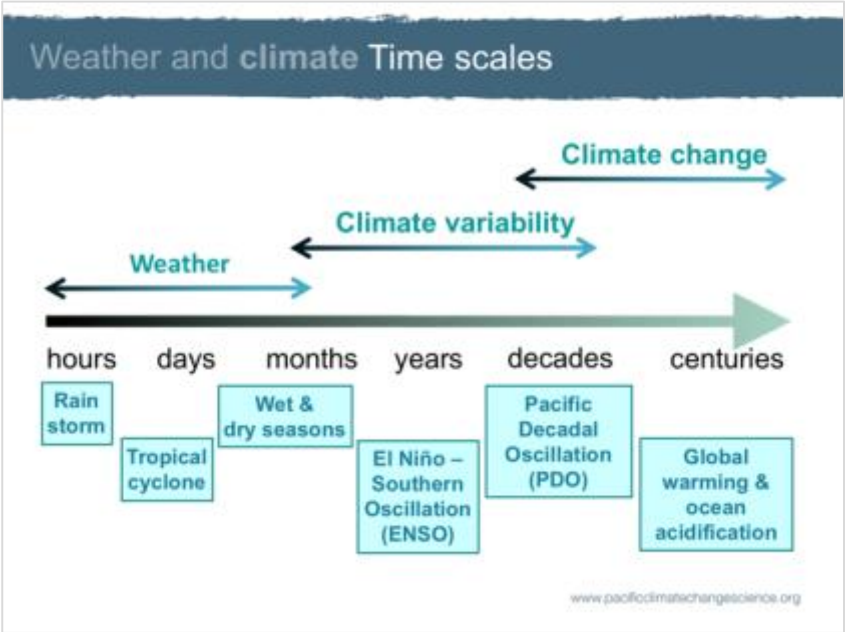
The full list of responses is included in Appendix 3 of this report.

Climate variability, extremes and change in the Pacific/Solomon Islands

Understanding climate variability and change

Alick Haruhiru (SIMS) explained the difference between climate variability and climate change.

The key difference is about timescale – climate variability occurs over months to decades, while climate change occurs over the much longer timescale of decades to centuries.



Alick noted that the climate is a very complex system that is dependent on a range of drivers and factors. These include:

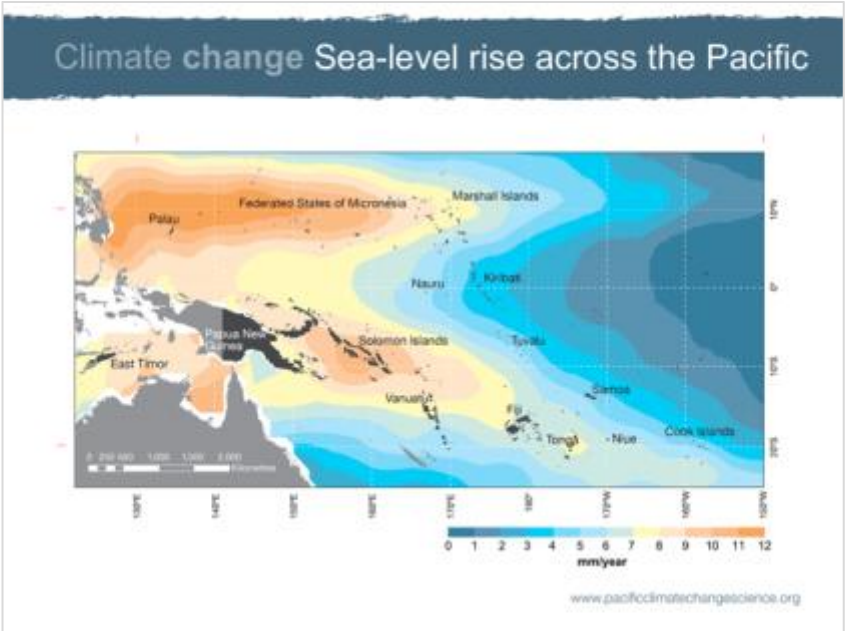
- Large-scale climate features like the El Niño–Southern Oscillation (ENSO) and large rainfall bands called the Intertropical Convergence Zone and South Pacific Convergence Zone
- Smaller-scale climate features, including sub-tropical highs, trade winds and tropical cyclones
- Island geography and topography.

ENSO is the most important driver of year-to-year climate variability in the Pacific. It affects the year-to-year risk of droughts, floods, tropical cyclones, extreme sea levels and coral bleaching.

Seasonal outlooks forecast likely conditions in a region for a period of one or more months, based on conditions in the ocean and atmosphere. They are useful for understanding climate variability and are prepared by National Met Services.

Climate change is natural and influenced by human activity. The changing climate we are experiencing now is a result of rapidly increasing greenhouse gas levels in the Earth's atmosphere.

As a result of climate change, sea level across the Pacific is rising. (This map shows the trend from January 1993 to December 2012.)



Alick concluded his presentation with a summary of important points to remember about climate change and climate variability:

- Climate is the long-term average of weather.
- Climate has natural variability on a range of time scales. ENSO is the most important driver of year-to-year variability in the region.
- Increases in greenhouse gases cause climate change: this is a long-term shift or trend in the average climate.
- It is often more difficult to identify climate change trends in rainfall, because rainfall has larger natural variability.
- Climate variability and climate change occur together – temperature and rainfall are influenced by both.

A workshop participant noted that while we were talking about climate change here, a challenge for the Pacific is predicting the onset of El Niño. Geoff Gooley flagged a recent CSIRO paper published in *Nature Climate Change*[1] that showed that the frequency of extreme El Niño events is projected to double in the future, even if Paris Agreement targets are met. Scott Power from the Australian Bureau of Meteorology said research work was

[1] Wang G, Cai W, Gan B, Wu L, Santoso A, Lin X, Chen Z, McPhaden MJ. 2017. Continued increase of extreme El Niño frequency long after 1.5°C warming stabilisation. *Nature Climate Change*, doi:10.1038/nclimate3351

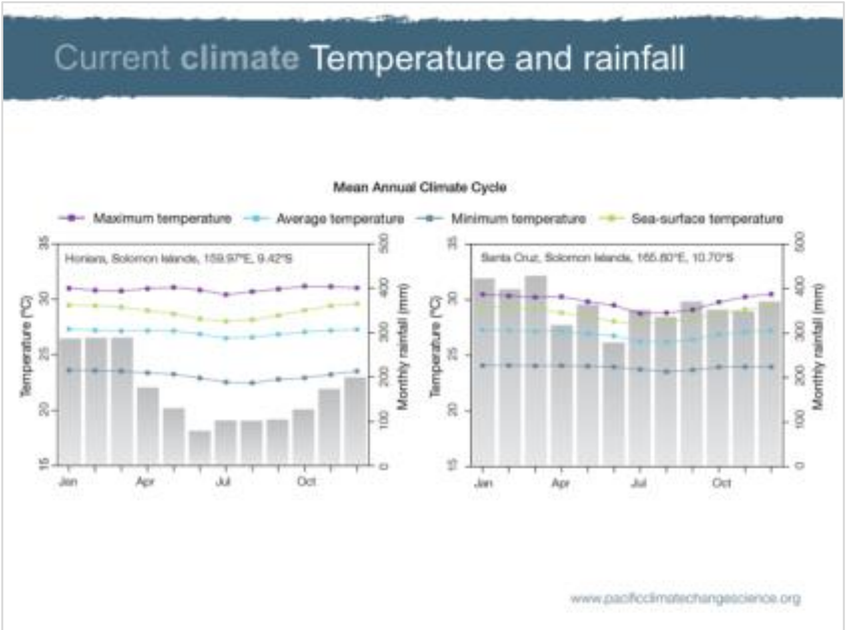
progressing on this (earlier this year Scott and his colleagues published a related paper in *Nature Communications*[2]).

In wrapping up this session, the point was made that climate change and climate variability happen hand-in-hand, and that climate change impacts both long-term averages and climate variability.

Current, changing and future climate of the Solomon Islands

Alick Haruhiru then examined the current and future climate of the Solomon Islands.

The Solomon Islands has a wet season from November to April, and a dry season from May to October. Mean temperatures remain relatively constant throughout the year.



The climate varies from year to year due to ENSO. El Niño brings warmer, drier wet seasons while La Niña brings cooler, wetter wet seasons. Tropical cyclone numbers also vary from year to year.

Observation data shows that since 1950, mean temperature in Honiara has increased slightly while there has been little change in rainfall.

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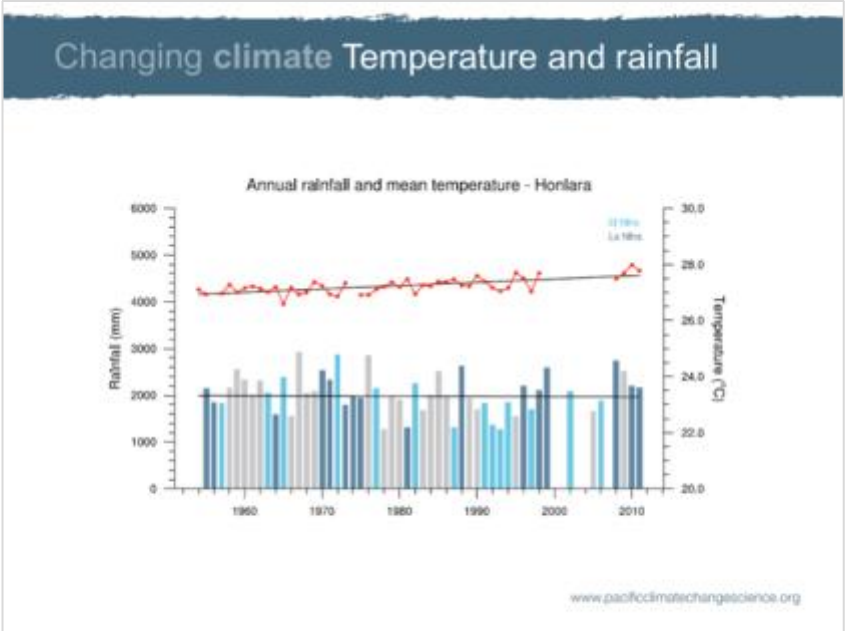
[2] Power SB, Delage FPD, Chung CTY, Ye H and Murphy BF. 2017. Humans have already increased the risk of major disruptions to Pacific rainfall. *Nature Communications*, 8, 14368, doi:10.1038/ncomms14368



Climate projections for the Solomon Islands indicate:

- Annual mean temperatures and extremely high daily temperatures will continue to rise (very high confidence)
- Annual rainfall is projected to increase slightly (low confidence) with more extreme rain events (high confidence)
  Incidence of drought is projected to decrease slightly (low confidence)
- Annual rainfall is projected to increase slightly (low confidence) with more extreme rain events (high confidence)
- Incidence of drought is projected to decrease slightly (low confidence)
- Tropical cyclones are projected to be less frequent but more intense (high confidence)

Alick pointed out the significant impact of tropical cyclones in the Solomon Islands. When they occur, there is wind damage but the accompanying rainfall also causes many problems. Mudslides and flooding are issues, especially for subsistence farmers.

In the brief discussion about projections that followed, a participant noted that in the Pacific, ocean projections for risks related to fisheries and coral bleaching are just as important as land projections for sectors such as agriculture.

Developing climate change information: Introduction of the case study on cocoa in the Solomon Islands

Using science-based climate change services for an assessment

Michael Grose (CSIRO) began by talking about understanding the climate. He noted that although we experience weather and climate, and see its effect, to assess the climate we need good quality measurements to make datasets. While averages are useful, other metrics might be more relevant, so good quality datasets are essential for understanding change in climate over time. Michael added that it is also important to understand both climate variability and climate change.

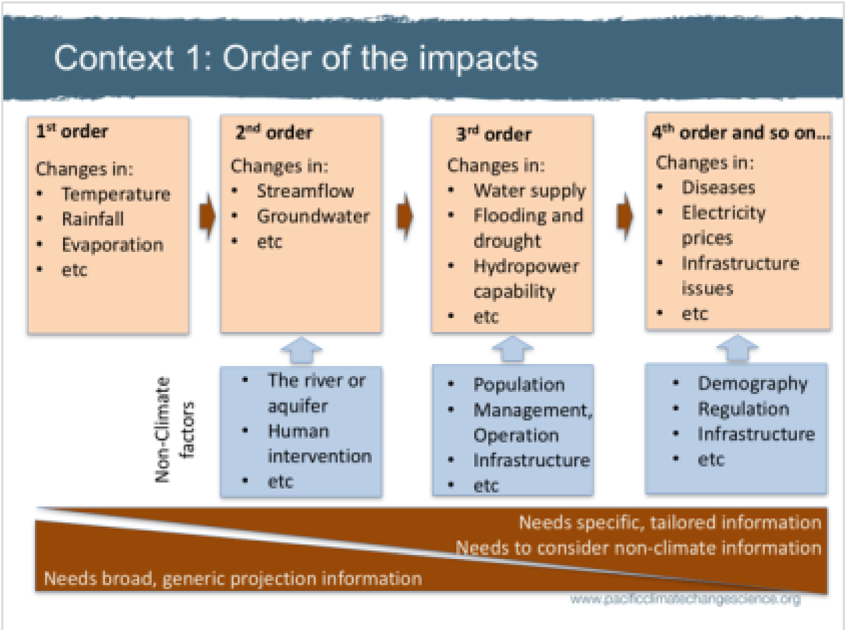
He then spoke about understanding the future climate, and how this is important for planning ahead. If we had exact predictions of the climate for every season and every year we could do our planning with much certainty. Unfortunately, exact predictions of the future are impossible, so how do we know what to plan for?

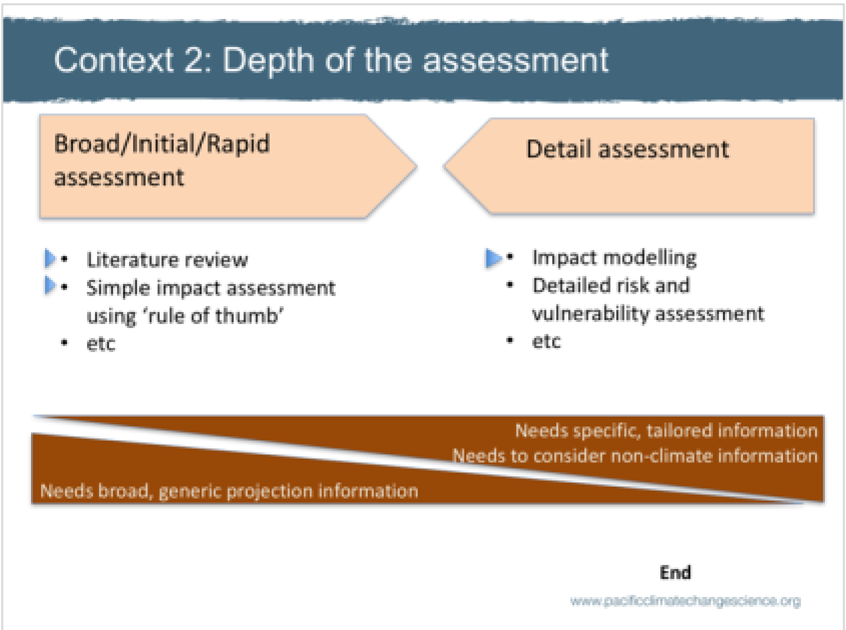
Michael explained that we can use climate projections. Projections use the latest climate science and modelling and give us a range of likely climate conditions for the future. We have projections for many aspects of climate, including air temperature (averages, warm nights, cold nights, heatwaves), sea temperature, sea level, rainfall (averages, heavy rainfall, droughts), wind, storms, waves, cyclones and ocean acidification, with some projections being more certain than others.

Chanel Iroi commented that it is important to tell people when to expect more rainfall; not so much how. In the Solomon Islands the Met Service uses the SIMS website (www.met.gov.sb), newspapers, networks and a Facebook group (Solomon Islands Weather & Climate Information) to share weather and climate updates.

Dewi Kirono (CSIRO) followed on from Michael and discussed the role of risk and vulnerability assessments for sectors. She explained that assessments help you decide what you need to do (i.e. what climate change action you need to take). For example, can you carry on with ‘business as usual’ or should you look at undertaking adaptation activities or other forms of preparedness.

To assess climate change risk, you need climate projections information. There are many types of information available, ranging from broad, generic projections (which are generally publicly available) through to specific projections tailored to user needs (which may not be publicly available). The climate projections information you need will depend on the type of assessment you carry out. To determine this, you need to consider the order of impacts and depth of the assessment you wish to undertake (which, in turn, depends on your objective).





To demonstrate the place of rapid and detailed assessments, Dewi used the analogy of a check-up at the doctor’s office. She said rapid assessments are like a visit to the General Practitioner (GP) and detailed assessment being like a visit to a specialist. Most times we only need to visit the GP to get the advice we need (and the GP is much cheaper and quicker than a specialist!).

A workshop participant asked about the role of stories and traditional knowledge, and where they fit into modelling in assessments. Dewi advised that mathematical models use numbers but that social scientists can use qualitative modelling to capture information from stories.

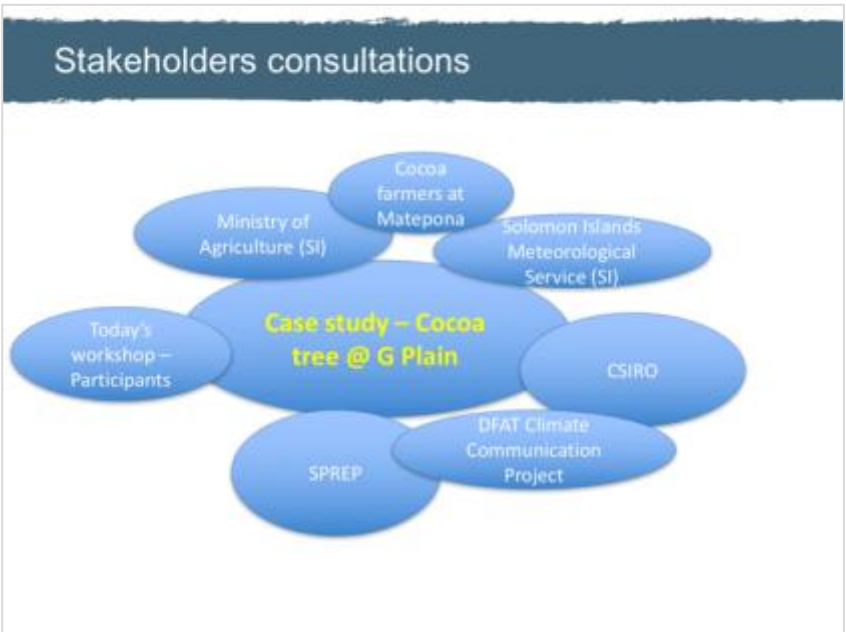
Another participant asked if there was any software that provided shortcuts or guidance to this process – perhaps a mobile app? No one was aware of such a tool. Geoff Gooley commented that future issues for managing climate-related impacts are now more complex than they have been, so we can't use past ways to address them. Instead we all (i.e. NOAA, NIWA, CSIRO and the Bureau of Meteorology) need to work together with Pacific Island Countries to find new ways – such as the suggested use of technology – to address them.

Cocoa case study introduction

Alick Haruhiru introduced participants to the cocoa case study by stating the aim of the activity is to carry out climate vulnerability and risk assessment of cocoa trees and in Guadalcanal plain, Solomon Islands, with the goal to build capacity of regional and national meteorological officers, climate change adaptation practitioners, sectoral officers and individuals.

Cocoa was chosen as the subject of this case study as it is recognised by the MAL as an important economic product for smallholder farmers with potential for further development. There is currently limited information available for the impacts of a changing climate on cocoa farming in the Solomon Islands.

Alick noted the importance of stakeholder consultation in the assessment process. He pointed out the importance of including the cocoa farmers in consultations, as existing knowledge often gets overlooked.



Alick identified four expected outcomes of the case study:

- Capacity building at national and regional levels
- Information on cocoa in the Solomon Islands under future climate that can be used for planning and adaptation
- Free manuals and publications (including summary reports of the process) for use in stakeholder communication and outreach
- Demonstration of how climate science can be used in sectoral areas.

Cocoa in the Solomon Islands – a snapshot

Ahead of the workshop, Solomon Islands cocoa expert John Konam was engaged by the project team to prepare a synthesis report on cocoa farming in the Solomon Islands to support the development of the case study. Although John was unable to attend the workshop, Jules Damutalau (MAL) provided workshop participants with an overview of cocoa in the Solomon Islands based on this synthesis report.

Jules explained that the Solomon Islands cocoa industry is entirely smallholder based. It is estimated that more than 20% of the population grows cocoa, making the crop the second most important cash crop after copra (in terms of geographical coverage – which is an estimated 10,000–15,000 ha). Cocoa is grown in all provinces except Rennell/Bellona. Highest production is in Guadalcanal, followed by Malaita and then Makira. Cocoa is the third most important export commodity (behind logging and fishing), and was least affected by the social unrest in Solomon Islands between 1999 and 2003. Cocoa has the potential to surpass oil palm.

The Solomon Islands cocoa industry is robust because:

- Cocoa is grown as part of a mixed cropping system.
- Cocoa is a family-friendly crop.
- There are reasonable economic returns to labour, even when prices are relatively low.
- There is a competitive domestic marketing system.
- Increases in transportation costs can be absorbed due to its relatively higher unit value.

The major cropping season in Guadalcanal is April to July, with a minor harvest from October to December. Cocoa is a ‘prescribed’ commodity. Its production is subject to regulations and standards enforcement for cocoa beans (fermented and dried) and products (manufactured and value added).

Climate factors affecting the growth of cocoa include:

- Rainfall: total annual rainfall, rainfall distribution, and the relative dryness and duration of the dry season are important as cocoa is very sensitive to water stress.
- Winds: regular strong winds are unsuitable for cocoa.

- Sunlight: cocoa needs around 75% sunlight as exposure to strong sunlight will reduce tree carbon dioxide assimilation.
- Temperature: Cocoa growth and flowering is directly related to temperature, with the best range for cultivation 25–30°C.

Black pod (*Phytophthora palmiv*ora) is a serious plant pathogen in Guadalcanal that spreads through rain splash and humid (>70% RH) conditions, as well as via insect vectors.

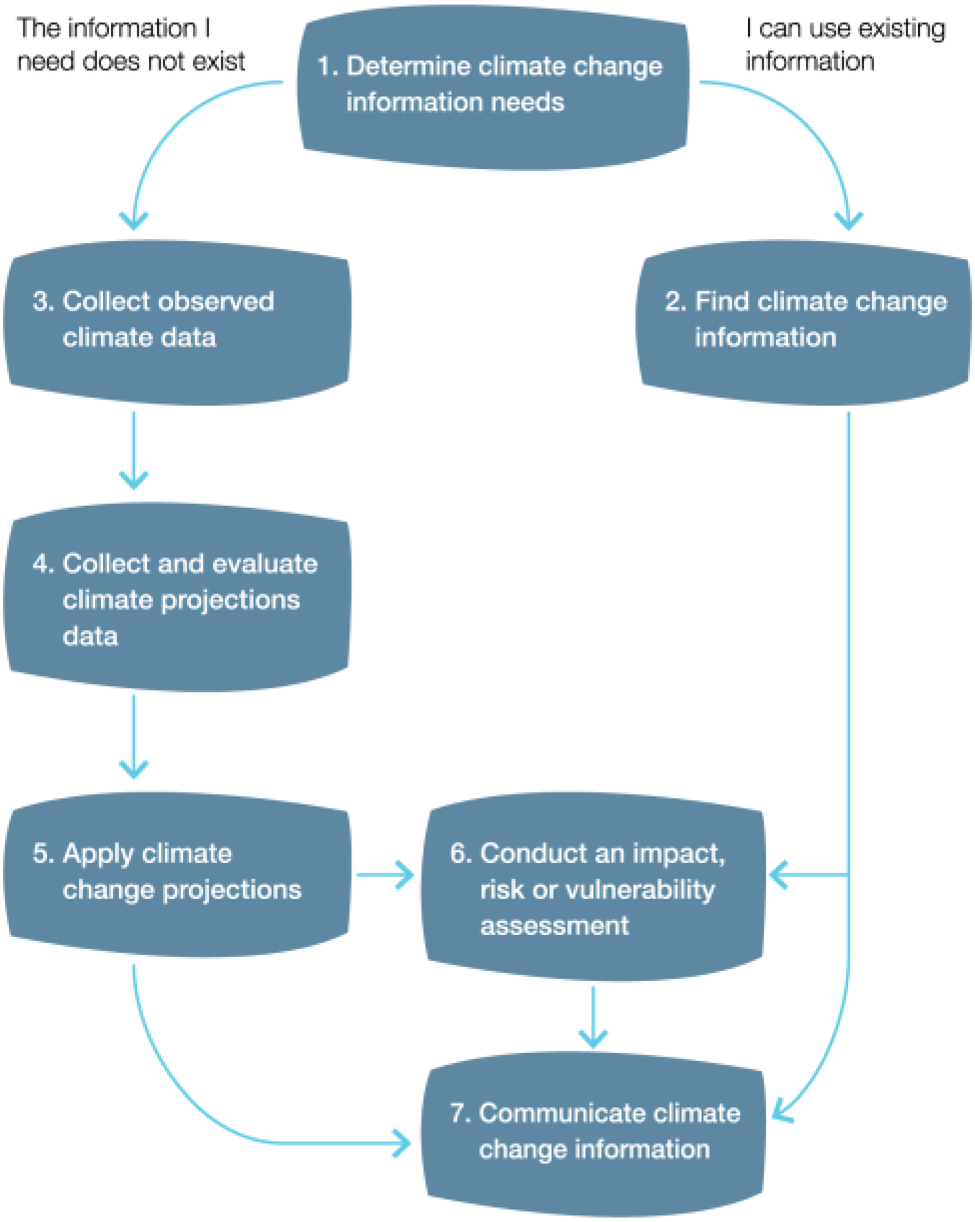
The cocoa case study will help to identify high-yielding areas and provide useful information for managing plant disease.

More detail about the Solomon Islands cocoa industry is available in John Konam's synthesis report[3].

[3] Available at www.pacificclimatechangescience.org

Developing climate change information: Seven steps demonstration

The following sessions stepped workshop participants through the seven-step' climate change information development process outlined in the guideline material. Detailed information for each step, summarised in the figure below, is available in the guideline document[4].



[4] The guideline document will be available at www.pacificclimatechangescience.org when completed.

Steps 1–4: Determining needs, finding information and collecting data

Michael Grose showed how the first four steps of the process could be applied to the cocoa case study.

Step 1 is to determine climate change information needs. This involves:

- Asking a specific (answerable) question. In the case study, the question could be 'Could the average temperature of places in Guadalcanal change from OK for cocoa to not OK for cocoa?'
- Working out how you can answer the question. In the case study, the question can be answered by comparing projected temperatures to temperature thresholds for cocoa.
- Determining what you need to answer the question. For the case study, we need to know what the temperature thresholds are, as well as detailed maps of the current and projected temperatures.

Michael highlighted the importance of talking to relevant people in this step, and indeed in every step of the climate change information development process.

Step 2 is to find climate change information. Michael advised to always present and summarise existing information, and only do a new analysis if there are gaps. Ensure only reliable and complete information is used. Good sources of this kind of information are agencies such as National Met Services, SPC and SPREP, and scientific articles and reports, as well as websites such as www.pacificclimatechangescience.org and www.pacificclimatechange.net.

No specific information on the impacts of climate change on cocoa farming was found for the Solomon Islands for this case study, but useful information from previous work in Africa and an SPC book on climate change impacts on Pacific agriculture, including cocoa, were referenced.

Step 3 is to collect observed climate data. Again, Michael highlighted the importance of talking to experts and your National Met Service for advice and assistance with this step. For the case study, a high-resolution map of average temperature is advised.

Step 4 is to collect and evaluate climate projections. For the case study, only a change in the average is needed. With no high-resolution modelling available, Michael suggested applying a 'change factor' to the high-resolution observation data, using projections from PACCSAP reports[5] and from the Pacific Climate Futures tool (www.pacificclimatefutures.net).

One participant commented that the Pacific Climate Futures tool was too general to produce data for specific locations, like the high-resolution temperature map. Michael advised that

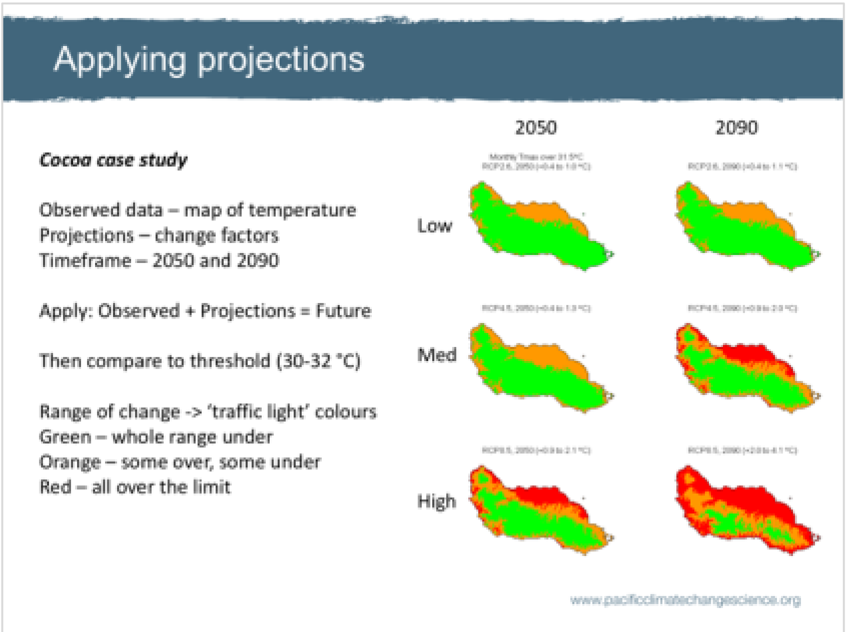
[5] Available at www.pacificclimatechangescience.org

the utility of the tool is in the collection and evaluation of climate projections where it can aid the selection of the best models/climate projections data to be used.

Step 5: Applying climate projections

Michael Grose explained that **step 5** allows you to explore views of possible future climates in relation to your question (from step 1). There are different approaches to using data for climate projections. Advice is available from your National Met Service, SPREP and CSIRO among others.

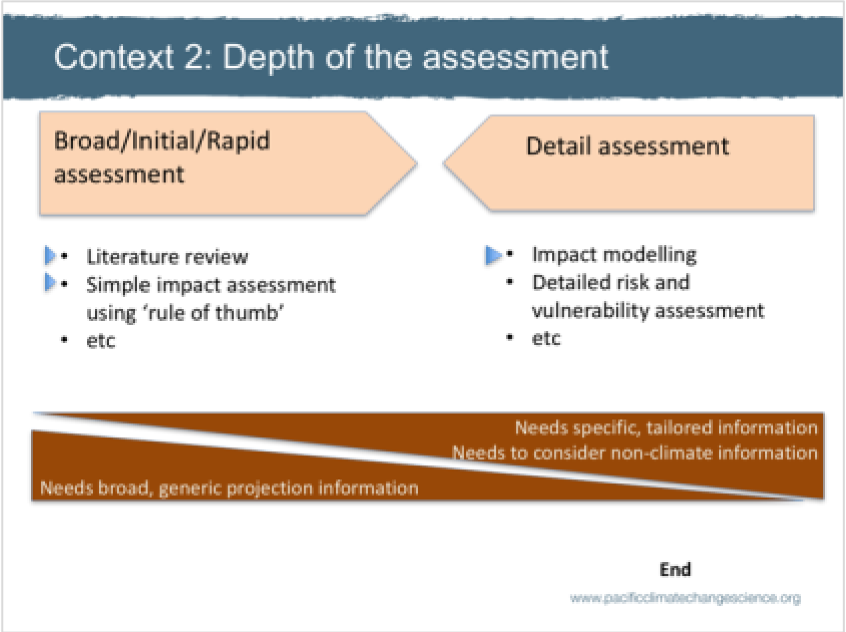
For the cocoa case study, a 'change factor' applied to observed temperatures gives a map showing projected temperatures for the future. These temperatures can be compared to the 30–32°C threshold to determine which areas will have a suitable temperature for growing cocoa in 2050 and 2090.



These maps suggest that Guadalcanal could become too warm to grow cocoa under a worst case at 2050 and beyond; however, the near future is OK. The emissions scenario makes a big difference: under a low scenario, cocoa maybe OK but not under a high scenario. Adaptation actions may include farmers moving cultivation up the slope to cooler areas or changing the variety of cocoa grown (i.e. to more temperature tolerant variety). This analysis is only about temperature. A thorough analysis should also consider rainfall in relation to dry seasons and drought, incidence of fungal disease, impact on supply chains, etc.

Step 6: Conducting an impact, risk or vulnerability assessment

In introducing **step 6**, Dewi Kirono referred to her earlier presentation, and advised that this case study involved a rapid assessment that would use simple 'rules of thumb' (e.g. looking at areas with a maximum temperature less than 32°C).



Assessments are a decision-making tool that require multiple variable scenarios, so other climate factors, such as rainfall, also need to also be analysed along with non-climate factors, such as the economic position of farmers.

To demonstrate, Dewi provided each table with a series of different maps showing changes in temperature, rainfall and incidence of fungal disease and asked workshop participants to determine the impact of the changes in these variables on cocoa production. Participants were also asked to discuss the following questions:

- What climate factors could affect the cocoa industry?
- Do you think different climate indicators would have different levels of importance with respect to their impact on cocoa? (e.g. Do you think daily maximum temperature is more important (or as important) as mean annual rainfall?)
- What non-climate indicators could affect the cocoa industry?
- Do you think these non-climate indicators need to be considered when you do climate impact assessment on cocoa in Solomon Islands? Why?

Step 7: Communicating climate change information

This session looked at broad issues and experiences in communicating climate change information (**step 7**).

Karen Pearce and Mandy Hopkins (CSIRO) opened this session by continuing Dewi Kirono's GP/specialist analogy, sharing some ideas about how we deliver good and bad news, confidence and trust in our sources, and how these relate to communicating climate change information.

Alick Haruhiru then shared his thoughts on the type of information that does (and does not) need to be communicated along with climate change information.

His key message was that responsible communication acknowledges that not everyone knows about emissions scenarios, time periods, uncertainty and confidence in projections and model biases and that we need to be smart enough to know how and when to tell people about these things.

The topic was then opened for discussion, with workshop participants sharing their experiences. Suggestions for and comments about better communication of climate change information included (in no particular order):

- Don’t dilute the science but use language that your audience understands.
- Explain with practical examples; use country-specific or local examples that draw on what your audience has seen or experienced to illustrate your information.
- Be aware of local language issues. For example, ‘high’, ‘medium’ and ‘low’ confidence ratings don’t translate to local language in Tonga – it is just yes (confident) or no (not confident).
- If using ‘high’, ‘medium’ and ‘low’ confidence, give examples of what this means.
- Better to talk about sectoral impacts instead of weather elements (i.e. describe the impact of the change in climate on the sector of interest, rather than just describing the change in the climate only).
- It is important to convey relevant information and to frame your message according to the audience. Be realistic about what will be understood. (e.g. This year could be a good year for vanilla production, so prepare for this.)
- The audience does not always need to fully understand climate projections and weaknesses – but they do need to understand the impacts and adaption options available.
- Statements of confidence are important – but think how it is conveyed (e.g. many scientists are studying this; most think… [high confidence]; some think…. [medium confidence]; A few think… [low confidence])
- Relationship building is important for getting people to listen. Sharing useful information enhances this relationship (e.g. what they told me last time worked, so I’ll listen again this time). Experiences matter.
- It is very hard to translate information around models, etc. but farmers know how things work through their experience and traditional knowledge. The challenge is blending in the scientific information.
- Communicating about slow onset climate events is difficult, so you should bring it closer to home.
- Climate affects non-climate factors. Remembering this may open new examples to use or ways of communicating.
- People’s beliefs are important to them (e.g. Christianity), and these beliefs can be a useful way to frame information so it is acted on; particularly at a local community level.
- Information must be relevant and useful to your target audience.

Where to from here?

Geoff Gooley opened the final session of the workshop by recapping some key points from the communication session:

- Everyone needs to come to the table to communicate climate change information effectively; it's a team effort.
- Different languages and methods of communication for different audiences; tailor content to your target audience.
- Everyone has a contribution – from climate scientists to farmers.

He also suggested that intergenerational conversations about climate change need to happen (e.g. in schools) so youngsters understand what's ahead for them in years to come.

Geoff reminded participants that technical information from today's workshop was in the new guideline being developed by the project, and additional resources on the USB drive that each person had received.

Going forward, it is important to have a better understanding of the climate change science and information needs in the region, so we can all work together to address them. Communities of practice and feedback loops developed through existing and new climate change services projects such as funded by the Asian Development Bank and Green Climate Fund in Asia-Pacific would help with this.

Geoff advised that the project responsible for today's workshop would conclude in December 2017. The Australian Government's ongoing commitment to a Pacific program for 2018 and beyond is currently being determined. Case studies that demonstrate how to develop and use climate change information go a long way to showing the value of capacity building activities (such as this workshop), and Geoff encouraged participants wishing to develop their own capacity to get in touch with him to discuss.

In wrapping up the workshop, Geoff acknowledged the valuable participation of all present, and gave particular thanks to the workshop organisers Jodie Kane (CSIRO), Alick Haruhiru (SIMS) and Azarel Mariner (SPREP).

Workshop evaluation

Evaluation activity

Participant expectations (Appendix 3) collected at the beginning of the day were used to formulate five evaluation questions. These questions were written on large sheets of paper and stuck on the wall around the room. Participants were asked to rate their response using a visual three-point scale. Twenty-four workshop participants took part in this activity.

	☹	😐	☺
I now have ideas about how to use climate change information in my work/sector/country		4%	96%
I learned how to develop climate change information for use in my sector/work		42%	58%
I have a better understanding of climate change and climate variability		4%	96%
I have more information about how to communicate climate change information to different sectors/groups		12%	88%
I had the opportunity to meet and talk to people doing similar work in other sectors/countries			100%

A sixth sheet of paper asked participants what the best part of the day was. Responses were:

- Sector application of climate science
- Dewi [Kirono]
- Communication of climate science/climate change to end users
- Hearing my colleagues in the Pacific sharing similar challenges in communicating climate information
- Sharing of experience of communicating uncertainty.

(Participants only added a response if it had not already been written on the sheet.)

Evaluation form responses

Twenty-two evaluation forms were completed at the workshop.

Usefulness and level of information

Responses suggested the workshop content was useful and pitched at the right level.

Q1. Today's workshop was:	Very interesting and useful	Slightly interesting and useful	Not very useful	Difficult to understand
	86%	14%		

Q4. The information presented at the workshop was:	Too easy – I knew most of it already	The right level – I learnt new information	Too hard/complex – I found it difficult to understand the information
	8%	86%	4%

Most and least useful parts of the day

The most frequent response to **Q2. What was the most useful part of the day?** was to do with communicating climate change, including hearing and learning from others' experiences.

Very few participants nominated a least useful part of the day. Perhaps the most noteworthy of these responses was that the session on applying climate change projections was too fast and so not useful.

The full list of responses to Q2 and Q3 is included in Appendix 4.

How new skills and information will be used

All respondents identified ways they would use the information from the workshop in their answers to **Q5. How will you use and apply the new skills/information you learnt today?**

The full list of responses to Q5 is included in Appendix 4.

Others who would benefit from this information

Many potential guideline users were identified in answers to **Q6. Are there other sectors/countries that you think would benefit from using these guidance materials and carrying out a similar case study?** Sectors identified were agriculture, fisheries, health, tourism, forestry, water, disaster risk reduction and energy. More specific responses were vanilla, taro, coffee, coconut oil and kava.

The full list of responses to Q6 is included in Appendix 4.

Other comments

Other comments thanked the workshop organisers and noted the value of the content to the range of sectors across the Pacific. Comments included:

- "It was great! Really enjoyed the GP analogy and discussing communicating science."
- "Should be promoted in-country and adapted for other sectors."
- "It was very informative and practical."
- "Maybe build on the PCCSP (PACCSAP) materials in Pacific Island Countries and develop specific sector materials. This would be a good project to get into and partner with National Met Services."
- "Need more examples and exercises to familiarise with sectoral application of climate science to services."

The full list of responses to Q7 is included in Appendix 4.

Recommendations for future workshops and activities

Allow more time for the workshop so the steps can be worked through slowly, with time for activities for participants to practice each step.

Devote less time to ‘background’ climate information (discussion of climate variability and change). Perhaps a more effective way of dealing with this content is to offer an explanation as it comes up in the guidance steps.

The communicating climate change science session was well received with high levels of engagement. Allow more time for participants to identify challenges and share their opinions, experiences and solutions, and include a practical activity for participants to plan a communication product or activity.

Appendix 1: Workshop agenda

Turning **climate science** into **services**

Demonstrating sectoral application of climate change science (data and information) to inform climate vulnerability and risk assessment

WORKSHOP AND FIELD TRIP PROGRAM

Australian Government
Department of Foreign Affairs and Trade

Australian Aid

CSIRO

SPREP

Date:	Thursday 10 and Friday 11 August 2017
Venue:	The Heritage Hotel, Honiara (and field trip)
Coordination:	Solomon Islands Meteorological Service, SPREP and CSIRO
Facilitators:	Alick Haruhiru (SIMS), Azarel Mariner (SPREP) and Jodie Kane (CSIRO)
Participants:	Participants will be from the Pacific National Meteorological Services across the Pacific, including the Solomon Islands (SI), sectoral agencies within SI, Universities, Regional Organisations and Australian Government Agencies.

Objectives:

Workshop

- To promote the sharing of knowledge and understanding of regional climate projections and to build capacity for sectoral application of climate change science (data and information) to inform climate vulnerability and risk assessment, and
- To trial and demonstrate such application in the agriculture sector through a case study on plantation cocoa in the Guadalcanal Plain, Solomon Islands.

Field trip

- To hear directly from cocoa farmers how weather patterns or climate factors have affected their cocoa trees in the past.
- To learn about other (non-climate) threats to cocoa trees
- To learn about the farmer's perspective on future likely climate-related impacts on cocoa.

WORKSHOP & FIELD TRIP PROGRAM 1

Workshop Program – Thursday 10 August

Time	Session	Responsible
8.45 am	Registration	Azarel Mariner (SPREP)
Session 1	**Introduction**	
9 am	Opening Prayer Welcome Remarks Opening Remarks	Noel Sainao (SIMS) Lloyd Tahani (SIMS) Permanent Secretary Chanel Iroi (MECDM)
	Introduction to Workshop	Geoff Gooley (CSIRO)
	Roundtable Participant Introductions	All
Session 2	**Climate Variability, Extremes and Change in the Pacific/Solomon Islands**	
9.30 am	Understanding Climate Variability and Change	Lloyd Tahani (SIMS)
9.40 am	Current, Changing and Future Climate of the Solomon Islands	Alick Haruhiru (SIMS)
9.50 am	Discussion	Lloyd Tahani and Alick Haruhiru (SIMS)
10.00 am	Morning Tea	All
Session 3	**Developing Climate Change Information – Introduction of the Case Study on Cocoa in the Solomon Islands**	
10.30 am	Introduction on how to use science-based Climate Change services to do an assessment (Activity included)	Michael Grose and Dewi Kirono (CSIRO)
11.30 am	Introduction to Case Study	Alick Haruhiru (SIMS)
11.45 am	Cocoa in the Solomon Islands – A Snap Shot	John Konam (University of Sydney)
12 noon	Lunch	All
Session 4	**Developing Climate Change Information – Seven Step Demonstration**	
1.00 pm	Steps 1–4 – Overview of: - Determine Climate Change Information Needs - Find Climate Change Information - Collect Observed Climate Data - Collect and Evaluate Climate Projections Data	Alick Haruhiru (SIMS), Philip Malsale/Sunny Seuseu (SPREP) and Michael Grose (CSIRO)

Time	Session	Responsible
1.45 pm	Step 5 – Apply Climate Change Projections	Michael Grose (CSIRO) and Philip Malsale/Sunny Seuseu (SPREP)
2.30 pm	Step 6 – Conducting an Impact, Risk or Vulnerability Assessment	Dewi Kirono (CSIRO)
3.15 pm	Afternoon Tea	All
3.30 pm	Step 7 – Communicating Climate Change Information	Alick Haruhiru (SIMS), Philip Malsale/Sunny Seuseu (SPREP) and Karen Pearce/Mandy Hopkins (CSIRO)
4.15 pm	Summary – Where to from here?	Philip Malsale/Sunny Seuseu (SPREP)
4.45 pm	Evaluation and Close	Azarel Mariner (SPREP), Lloyd Tahani (SIMS) and Geoff Gooley (CSIRO)

Field Trip Program – Friday 11 August

Time	Activity	Responsible
8.00–9.00 am	Bus to Metapona (departs from Heritage Park)	
9.30–9.40 am	Introduction and issuing value added product	
9.40–10.30 am	Tour around the plantation	
10.30–10.50 am	Planting a cocoa plant	
10.50–11.00 am	Word of thanks	Lloyd Tahani (SIMS)
11.00–11.50 am	Depart Metapona and travel to Mendana	
12.00–1.15 pm	Lunch at Café El-Shaddai, Honiara	All
2.00–4.00 pm	Meeting/discussion	CSIRO, SIMS, Ag

Appendix 2: Workshop participants

Pacific Met/Weather Service Directors

- Arona Ngari (Cook Islands)
- Ravind Kumar (Fiji)
- Ueneta Toorua (Kiribati)
- Rossy Mitiepo (Niue)
- Sam Maiha (Papua New Guinea)
- Mulipola Titimaea (Samoa)
- Tauala Katea (Tuvalu)
- Ofa Fa'anunu (Tonga)
- Jerry Timothy (Vanuatu)
- Loia Tausi (Tokelau)

Solomon Islands participants

- Chanel Iroi (Ministry of Environment, Climate Change, Disaster Management and Meteorology)
- Alick Haruhiru (SIMS)
- Noel Sainao (SIMS)
- Jenny Davson-Galle (SIMS)
- Jules Damutalau (MAL)
- Raymond Vava (MAL)
- Helen Tsatsia (MAL)
- John Wale (University of the South Pacific)
- Samantha Maeke (Pacific Horticultural and Agricultural Market Access)
- John Paul Alasia (Solomon Islands Chamber of Commerce & Industry)
- Joanne Pita Aihunu (Community Resilience to Climate and Disaster Risk Project, CRISP/Ministry of Health and Medical Services
- Samuel Pitakaka (Ministry of Forestry and Research)
- John Kanai Ta'amora (Solomon Islands Chamber of Commerce & Industry)
- James Kana (Cocoa Export Program–Australian Volunteer International)

SPREP/Australian Government and other participants

- Geoff Gooley (CSIRO)
- Mandy Hopkins (CSIRO)
- Dewi Kirono (CSIRO)
- Michael Grose (CSIRO)
- Karen Pearce (CSIRO)
- Azarel Mariner (SPREP)
- Philip Malsale (SPREP)
- Scott Power (Bureau of Meteorology, Australia)
- Agata Imielska (Bureau of Meteorology, Australia)
- Louise Scott (Australian High Commission/Department of Foreign Affairs and Trade, DFAT)
- Brown Onahikemi (Australian High Commission/DFAT)
- Graham Elley (NIWA, New Zealand)
- Jennifer Lewis (NOAA, USA)
- Lina Sjaavik (World Meteorological Organization, WMO)
- Henry Taiki (WMO)
- Charles Carlson (Emergency Management Cook Islands)
- Viliame Vereivalu (Fiji Meteorological Service)
- Barassi Botelanga (Nauru National Emergency Services Department)
- Tile Tofaeono (Samoa Meteorological Service)
- Kevin Luana (Department of Transport, Papua New Guinea)

Appendix 3: Participant expectations

The following responses identify what participants hoped to get out of the workshop, and are useful indicators of information needs and interests.

- Disaster management.
- Communicate climate change information in regards to social and economic development.
- How to apply climate change science to sectors: coastal inundation and storm surges.
- Climate science finding with application in preserving our indigenous crops and agriculture.
- To understand the linkage between climate vulnerability and risk assessment.
- Better understanding of how climate change affects the cocoa/related industry in the short to long term.
- How climate science can be used to improve livelihoods.
- How to apply climate information to climate services in the health sector.
- Learn how to use climate change information for smart plans in agriculture research.
- To understand the latest climate projection models in PICs at the moment, how climate change will impact food security, and the impacts of climate change on agriculture.
- Application of climate change science in sectoral planning and programming in development programs.
- Access to information on climate change science/services.
- How to explain climate science to farmers (cocoa, coconut and other crops).
- To learn how sectors (e.g. agriculture, fisheries, health, etc.) apply climate science and how information is used by communities.
- Learning about this project to bring its learning points into other projects in other regions.
- Increased knowledge about stakeholder needs in sectors in the Pacific.
- Differences between climate variability and climate change and their implications.
- To meet new people and understand issues facing the Pacific.
- Understanding real-time information/science of climate impacts on agriculture sector.
- To learn more about how a climate service in the Pacific should be to be effective and impactful.
- What are applications I can apply in my island, especially sectors.
- To understand and have knowledge of the climate and climate impacts, and to build capacity.
- Understand the science behind climate change.
- I want to be familiar with the guideline and tools for projecting climate variables.
- Find out how Tokelau can benefit from this program.
- Develop climate change information to different sectors and the easiest way to communicate this information to everyone.
- How to convey the extreme climate change issues to the communities.

- To learn scientific techniques to communicate scientific climate information to non-scientific communities and making those information useful in planning and decision making.
- How climate change science can be effectively communicated at community level.
- To meet new people.
- To get to know the PMC's needs.
- To learn and share experiences on communicating/using climate information
- To enhance my capacity in communicating climate change information to community level.

Appendix 4: Detailed workshop evaluation responses

Following are the comments received on the workshop evaluation form.

Q2. What was the most useful part of the day?

- Hearing and learning from others on challenges faced communicating science
- Linking info and services
- Gaining understanding of efforts made so far to effectively pass climate change messages
- Alick's first presentation
- Developing climate change information
- To be able to understand climate change concept as an analogy to a GP – session by Dewi Kirono
- Climate variability vs climate change
- Discussion and experience sharing
- Every session
- I found the whole day very useful
- Communicating climate change information services
- Listening to other participants sharing experiences of communicating uncertainty
- Cocoa optimum growth temperature and rainfall
- The climate projections practical application exercise – cocoa
- Sector application and seven steps
- Communicating climate science for end users (step 7)
- Communicating uncertainties, rapid assessment, seven steps
- Sharing information on dealing with science communication
- Afternoon part – discussing climate science information to non-technical way
- Conducting an impact [assessment]
- The discussion on the areas in the possible impact of cocoa plantation due to rainfall, temperature, etc

Q3. What was the least useful part of the day?

- Morning tea
- Nothing in particular
- All good/useful
- Silence
- Applying climate change projections – too fast forward presentation
- Not applicable
- Nothing – all is important
- Cocoa case study

Q5. How will you use and apply the new skills/information you learnt today?

- I'll use it for future workshops and work in the Pacific
- Use it at home

- Make contact with useful case study leaders to get extended information
- Apply it to work
- Skills and information learnt will encourage us in getting such information readily available for my country
- Compare the climate impact assessments, climate vulnerability assessment, climate risk assessment with climate change vulnerability and adaptation assessment
- Have to further discuss with HQ how to simplify the comm part
- Will be presenting the lessons learnt to my staff back home
- Assist formulating strategy within our sector
- By using given documents/notes
- I would use this to help when given opportunity to contribute to such policy development
- Make decisions and plan for future projects related to my work
- To apply to health sector
- Share with community/colleagues/research scientists/legislators
- I will use this information at the organisation I work for and to do my own trainings
- Use it for sector-specific products
- The use of skills and information is in my climate–farming systems research
- Communicating to my audience
- Take up good ideas and implementation
- Work with international partners in future related research activities
- My sector
- Through awareness and met products

Q6. Are there other sectors/countries that you think would benefit from using these guidance materials and carrying out a similar case study?

- Absolutely everyone! (Maybe vanilla and coffee? Taro? Fisheries?)
- Yes – farmers, water, health and even tourism
- More work in relevant sectors for more sectors
- Department of Environment – Division of Climate Change, Division of Fisheries, NOMO
- Agriculture, fisheries, health, tourism, village communities
- All sectors
- Health sectors, energy sector, agriculture, etc
- Pacific country
- Coconut oil (virgin), coffee, vanilla and kava
- Fisheries, forestry, tourism, farmers
- Ministry of Health, Fisheries
- Health and fisheries
- Fisheries, water managers (Joshua Martin 7410499, Water Resource Division), Solomon Islands National University
- Health, water, DRR
- All Pacific countries (Vanuatu)
- Fisheries, water, forestry
- Climate change cross cuts all sectors; therefore, all climate-sensitive sectors

- Fishing and health in atoll islands
- Fisheries
- Nauru water sector
- Met Services through climate products [?] every month

Q7. Other comments about the workshop and materials covered.

- It was great! Really enjoyed the GP analogy and discussing communicating science.
- Should be promoted in-country and adapted for other sectors.
- Hopefully PowerPoints are circulated.
- It was very informative and practical.
- Appreciate assistance in developing climate change information readily available for countries that were not part of the PACCSAP project.
- Maybe build on the PCCSP materials in Pacific Island Countries and develop specific sector materials. This would be a good project to get into and partner with National Met Services.
- Need more examples and exercises to familiarise with sectoral application of climate science to services
- Thank you for sharing your knowledge and expertise
- We need to have user-friendly access to scientific-based information to be useful for all aspects
- Excellent facilitator
- Excellent – about time to bring science to communities to help decision making
- The workshop is excellent. It's now to apply the skills/information in each sector – follow-up support from DFAT, CSIRO and meteorologists
- Yes – request for manual on producing projection map and assessments done followed by a two-day workshop to build capacity for Met Service staff
- Excellent and useful
- More case study short clips video before and after

Appendix 5: Workshop media clip

The following article appeared on page 4 of *The Weekend Sun* ([www.theislandsun.com)](http://www.theislandsun.com) on Saturday 12 August 2017.

'Turning climate science into services' meeting group

CLIMATE Change specialists, representatives from relevant ministries and other key spokespeople working at a community level, met this week in Honiara to discuss how science and community can form better working relationships to best safeguard our futures and livelihoods in the Pacific.

The meeting essentially asked the key question: what does climate change mean for me? A case study on the impact of Climate Change on cocoa in the region allowed for a more focused discussion.

A SPREP Climatologist, Phillip Malsale, said that everyone needs to turn climate sciences into something simple so that people can act on it. "It's time to connect climate science to the community".

"We need to be asking questions like: how can changes in temperature affect cocoa, what are the temperature range limits and what are the estimates for future changes so that we can prepare?" Said Michael Grose Research Scientist at CSIRO Australia.

There are a number of ways that this can be done and then communicated to a community level.

"We need to not just look at one possibility but look at them all. Today, tools exist like the Climate Futures Tool that allows us to get an idea of estimated changes in a region. But that only goes so far, then you need to take the information to a ground level," Mr Grose added.

Knowledge that science can directly help farmers and in reverse knowledge that farmers have can help scientists.

"Blackwort is a fungus that affects the growth of cocoa. We have many micro-climates in the Solomon Islands and we find that some cocoa hybrids are affected more than others. We are trying to encourage farmers to grow plants that are less susceptible to Blackwort," said Helen Tsatsia of the Solomon Islands Ministry of Agriculture and Livestock.

Climate Change is not just a discussion limited to scientists and farmers. We are all connected somehow.

"Climate Change will affect business in the Solomon Islands so it's very important for our planning. Businesses need confidence in their futures if they are not well informed in what the environment will be like in the near future then this will negatively affect their business decisions," said John Kanai Ta'amora of the Chamber of Commerce Solomon Islands.

"Cocoa is one of the major exports in the Solomon Islands. We would like our export sector to grow strong so we need to know our options. So some of the climate experts internationally came in during the recent Chocolate Festival and talked with the farmers too," said Samantha Maeke of the PHAMA Project, AusAID.

This week's meeting provided an opportunity for people from a variety of climate science backgrounds as well as spokespeople in pacific communities to meet together.

"We are using science to make decisions. It's really about learning from each other," said Karen Pearce, a Communication Specialist at the meeting.

--GOVERNMENT COMMUNICATION UNIT