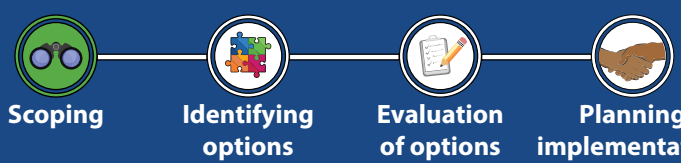
Assessing adaptation options for climate change: A guide for coastal communities in the Coral Triangle of the Pacific

2. Climate analysis



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Introduction

Assessing options for adapting to climate change is an important part of building resilient fishing and farming communities.

This brochure is part of a series that collectively detail how a community-based assessment of climate change was used in partnership with coastal communities and provincial and national-level stakeholders in Timor-Leste and Solomon Islands. The assessment contains four distinct, but related, steps (Fig 1) focused on supporting community-level decision-making for adaptation through a series of participatory action research activities. Each brochure in this series details a specific activity in the four-step assessment.

This series of eight brochures is primarily aimed for use where resources are limited or where it is more appropriate to use a rapid, qualitative and non-data intensive method of assessment. Community leaders, local NGOs and regional and national-level government representatives in developing countries may find this series useful.

In this brochure we provide details of an activity relating to the 'Scoping' step of the assessment, namely analysis of long-term observed climate data. This analysis is aimed at identifying climate-sensitive farming and fishing practices that may need to be adapted in response to changes in climate.

More specifically, the following questions were posed:

- Using both observed data and community members' experiences, is there evidence of medium- to long-term changes in climate and sea level over the past decades?
- How have fishers and farmers adapted their practices to respond to these changes?
- If past trends in climate and sea level continue, what options do communities have to make ongoing adaptations to their livelihoods?

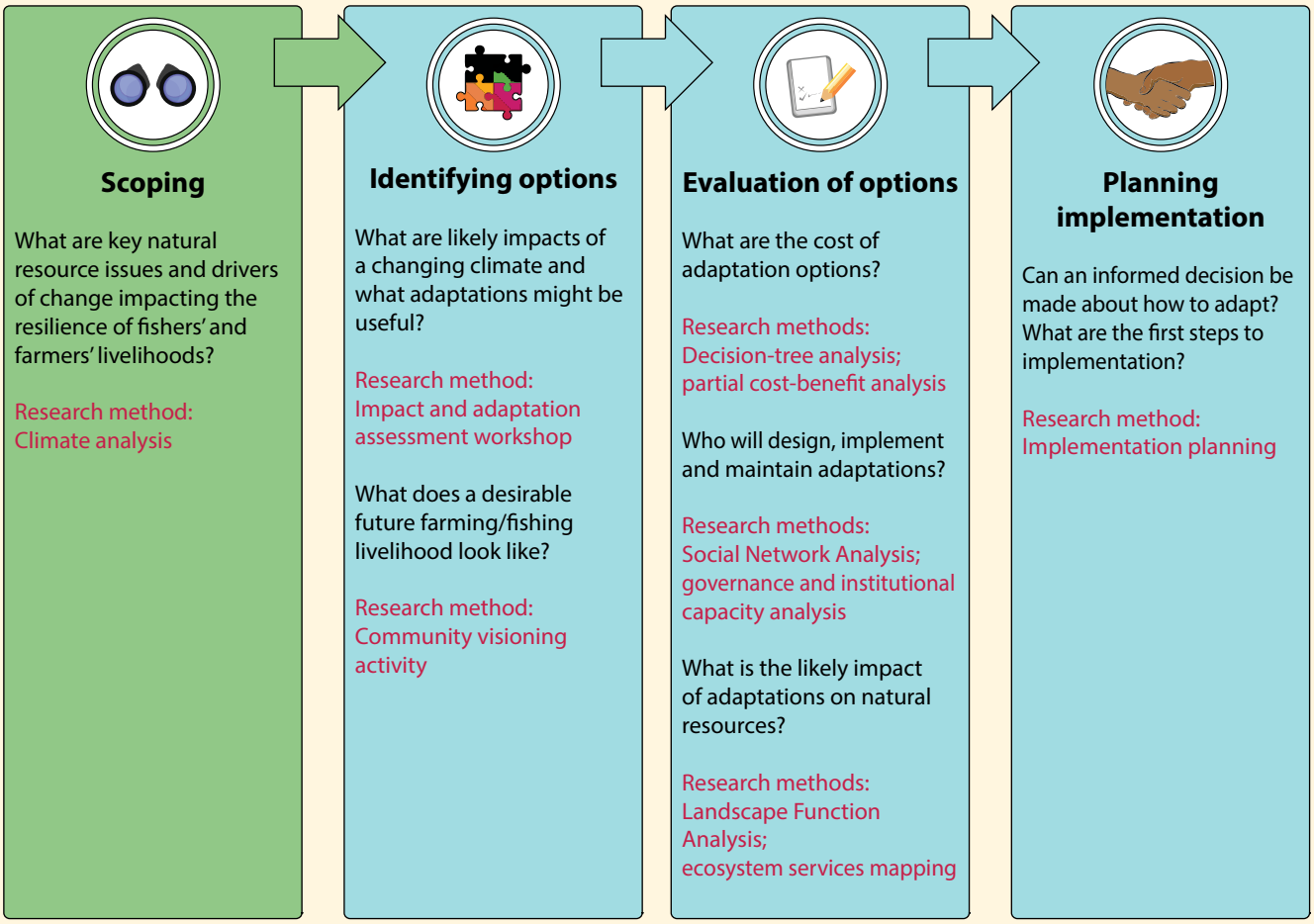

Fig 1: The four steps taken by community, local NGOs and regional and national government representatives in developing a plan to respond to climate change. Each step addresses specific questions likely to be asked by community members needing to adapt.

What Is Climate Analysis?

Climate analysis involves looking at sets of observed data from recent decades to see if there has been change happening over time (referred to as trends). This analysis generally focuses on temperature and rainfall data, due to the climate-sensitive nature of natural resource-dependent activities like farming and fishing.

Climate data extending over long periods of time is likely to reveal natural variation. That is, changes in such factors as temperature and rainfall happen regularly from year to year, month to month, and even daily. These are part of an ongoing cycle in the climate system.

Climate change occurs where human activities are altering the climate and its natural variation. In some locations, it may be possible to identify these human influences within past data. Changes in climate may result in, for example:

- Long-term trends – e.g., average daily temperatures may slowly increase over a period of decades.
- Changes in seasonal or cyclical patterns – e.g., the duration of the dry season may increase by two or three weeks over the lifetime of an older member of a community.

Climate analysis of observed data can be used in discussions with community members to explore their personal experiences of climate over their lifetimes. Changes in climate can then be considered in terms of community livelihood activities, how changing climate might affect these, and the need for adaptation (Fig 2).

Time:	Past	Present	Future
Level of Certainty:	High		Low
Key Question:	How has past climate changed?	How do past climate trends match with livelihood activities?	How will future projections of change affect livelihood activities and how will people adapt?
Example of assessment methods:	Temperature and rainfall data collection and analysis	Seasonal calenders considered in terms of present climate	Impact assessment on key livelihood activities and identification of adaptation actions

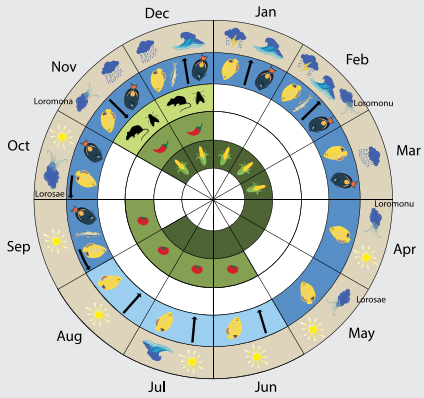

Fig 2: Conversations with community members about climate change and the necessity for adaptation of climate-sensitive fishing and farming activities can be guided through three steps. First, community members are encouraged to consider how past climate has changed (using climate analysis and the sharing of life stories) and how fishing and farming practices have been adapted in the past. Second, those livelihood activities that are sensitive to climate are identified and provide a basis for understanding potential vulnerability. Third, climate change projections provide a scenario of what future climate may look like and assist community members to consider whether present livelihood practices will be sufficiently effective in the future.

Method of Analyzing Climate Data Used in Timor-Leste

In the case of Timor-Leste, analyzing climate data involved answering three questions:

1. How has past climate changed?
   - We obtained long-term climate data (e.g., monthly rainfall and temperature measurements) from the government meteorology department and several global data sets that were available for download from the internet.
   - The data was arranged in a spreadsheet. Daily and monthly data is helpful for identifying changes within the year's cycle, but annual data is better for looking at changes occurring over decades.
   - After plotting line graphs of the data we were able to look for trends (Fig 3), such as gradually increasing temperatures over the lifetime of the community members, or shifts in the amount of rainfall occurring annually.
   - The observed patterns in climate were discussed with community members in a participatory workshop and compared to their stories and experiences of climate since their childhood (Fig 4).

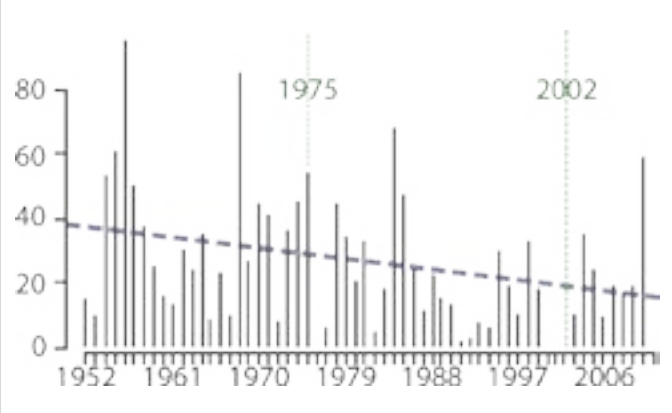

Fig 3: Adding a trend line to a graph can help to make sense of the very variable readings that can occur among years, and help you see if there is a trend over time. This graph shows dry season rainfall at Dili airport 1952–2011.

Fig 4: Senior members of the communities on Atauro, Timor-Leste, said they had experienced similar changes in climate to those identified in the project team's climate analysis. This agreement between scientific data and the communities' experiences enabled the climate change assessment to move forward with a shared sense of understanding.

2. How do climate trends influence livelihood activities carried out during the year?

- The communities we worked with in Timor-Leste had previously produced seasonal calendars that depicted their fishing and farming livelihood activities throughout the year. We used these in a participatory workshop to consider how the changes in past climate had impacted the activities they undertook and how they had adapted these activities to the climate (Fig 5).

3. How might a future change in climate impact livelihoods and how can communities adapt?

- In participation with farmers and fishers, we reviewed projections of future climate change for Timor-Leste and discussed how a change in climate might impact fishing and farming activities for them and their children.
- We then compared the projections of future climate to the past changes in climate to identify if any of the past changes were likely to continue into the future. Where there was a past trend that was projected to continue, the fishers and farmers reflected on how they had previously responded and if these adaptations would be sufficient to enable their fishing and farming activities to continue in the future (Fig 6). Where new approaches and adaptation were likely to be needed, details of these were discussed.

Fig 5: Researchers and community members discussing the climate and how it influences the fishing and farming activities that can be undertaken.

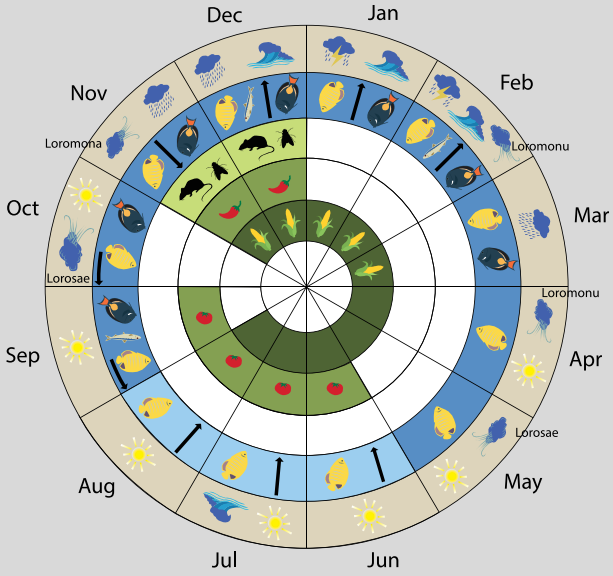

Fig 6: This seasonal calendar of livelihood activities was produced by the communities in Timor-Leste in a prior project, but used again here to consider the impacts of a change in rainfall, temperature and sea conditions, to emphasize the need for adapting their farming and fishing activities. Many of these activities are sensitive to climate and future changes may require small- and large-scale adaptations to livelihood activities.

Seasonal calendars adapted from: Mills, D.J., Abernethy, K.A., King, J., Hoddy, E.T., Larocca, P., Teoh, S.J., Fernandes, A., and Park, S.E. (2013). Developing Timor-Leste's coastal economy: Assessing potential climate change impacts and adaptation options. Final report to the Australian Government Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security National Initiative. WorldFish, Penang, Malaysia. 142 pp.

Tips for Analyzing Climate Data

- Consult local meteorological agencies to obtain the most up-to-date data and seek to use their analysis if it is available. Alternatively, data may be available for free download from the Internet; e.g., http://www.worldclim.org/
- Think about the resolution of your data, i.e., has it been measured at hourly, monthly, quarterly, or annual intervals? If you have monthly data, but want to look for changes over many years, it is helpful to sum monthly data into years.
- Long-term climate data can be complex – averaging by year or month, for example, might produce artificial patterns.
- Trends can be easier to find if you calculate a 'running average' of five years; e.g., for average annual temperatures over 50 years, calculate the average temperature for each year and the previous four years. This smooths out the high variation that can occur from year to year. Examples of how to do running averages can be found on the Internet.
- A changing climate is not new for communities – they have been dealing with climate change for a long time. Therefore, it is important to consider whether variability in climate (year-to-year and within years) is greater than what they currently encounter, and whether they will need to change their practices further.
- When discussing graphs with community members, take care to explain clearly what the graphs show.
- It is important to discuss any trends in terms of what they might mean for livelihoods – if the climate is changing, how might that impact fishing, farming and infrastructure (Fig 7). The seasonal calendars (Fig 6) are very helpful for this.

Key Climate Data and Analysis Documents

Individual countries often have their own climate data sets. For instance, the Solomon Islands data used in this project was obtained from the Solomon Islands Government Meteorological Service Division: http://www.met.gov.sb/

There are videos on YouTube showing how to access and plot climate data:
https://www.youtube.com/watch?v=1MdBhgYFexs
https://www.youtube.com/watch?v=E8wHLYDMHRc

Fig 7: Climate change can lead to sea level rise and more damaging impacts from storm surges. This home on Atauro, Timor-Leste, once stood back from the sea front, but has more recently been damaged by increasingly high tides.

Results in Timor-Leste and Solomon Islands

Analysis of past climate in Timor-Leste showed the following:

- Dry season rainfall has declined in recent decades, thereby reducing the amount of water stored in the soil profile at certain times in the year, restricting plant growth (Fig 8).
- Wet season rainfall has slightly increased over the last few decades. This has the potential to increase the size and number of flooding events, but it may also be an opportunity to harvest and store water for the dry season.
- The duration of what was typically referred to as the 'cooler season' has shortened between 1900 and present day and the duration of the 'warm season' has increased.
- Marine temperatures (sea and air temperature) have increased over the past century, for most months.

An alternative to analyzing data is to use that supplied by local meteorological services. In Solomon Islands, the Solomon Islands Meteorological Service (Ministry of Environment, Climate Change, Disaster Management and Meteorology) provides good-quality data analysis of past temperature and rainfall. These show that the annual minimum and maximum temperatures at Auki, Malaita, have increased over the past few decades.

In Timor-Leste, regional partners such as Seeds of Life, operating within the Ministry of Agriculture and Fisheries, also provide up-to-date climate data.

Fig 8: A reduction in rainfall, or an extension of the dry period, may mean that bore holes, wells and water pipes become even more important for supplying water all year round. Collecting and storing rainwater was one of the adaptations identified by communities in Atauro.

This research was conducted by WorldFish under the project "Responding to Climate Change Using an Adaptation Pathways and Decision-Making Approach", pursuant to the Asian Development Bank and Global Environment Facility cofunded initiative R-CDTA 7753-Strengthening Coastal and Marine Resources Management in the Coral Triangle of the Pacific (Phase 2).

Thanks to the partnering organizations in Timor-Leste and Solomon Islands for their collaboration and in-country support, and, most importantly, to the farmers and fishers who shared their knowledge and time in participating in this community-based assessment of climate change. Thanks also to the CGIAR Climate Change, Agriculture and Food Security Research Program for support.

For further details on this project, visit http://www.ctknetwork.org/ and http://www.worldfishcenter.org/ongoing-projects/adaptationpathways-responding-climate-change