

Climate change and Samoa - sustainable development

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Introduction

Weather and climate play a major role in our lives. Weather often dictates the type of clothing we wear while climate influences the type of clothing we buy. Climate determines when to plant crops as well as what type of crop can be planted. Weather determines if these same crops will grow to maturity. Although weather and climate affects our lives in many ways, perhaps their most immediate effect is on our comfort. We build shelters to keep away from the sun; we collect water from rain to take us through dry spells and drought.

With growing evidence of climate change there lies the paradox of weighing out environmental conservation against sustainable developments especially for the small sized, limited resources, sensitive economic capability islands in the South Pacific. What is it that we are to monitor, what will cause the impacts and what we will need to adapt are remaining unanswered questions that Pacific islands are left with. While global climate systems enlightens the interrelationships between climates of different scales which impacts and affects each other, certain climate indicators are monitored in terms of their importance in the sustainable development of island countries. For instance, with most tropical countries having strong water-based economies, natural water quantity and quality are good indicators of changes in the climate.

This paper provides a personal overview on the issue of Climate Change in Samoa. What are the underlying questions and how they can be addressed?

*WHETHER THE WEATHER...
Whether the weather be fine
Or whether the weather be not
Whether the weather be cold
Or whether the weather be hot
We'll weather the weather whatever the weather
Whether we like it or not.*

The simple interpretation that we can draw on is that climate is part of our everyday existence whether we like it or not; there is a sense of unpredictability in its performance and response; it exists in some form of pattern implying a certain system; there is no boundary and affects everyone.

Climate

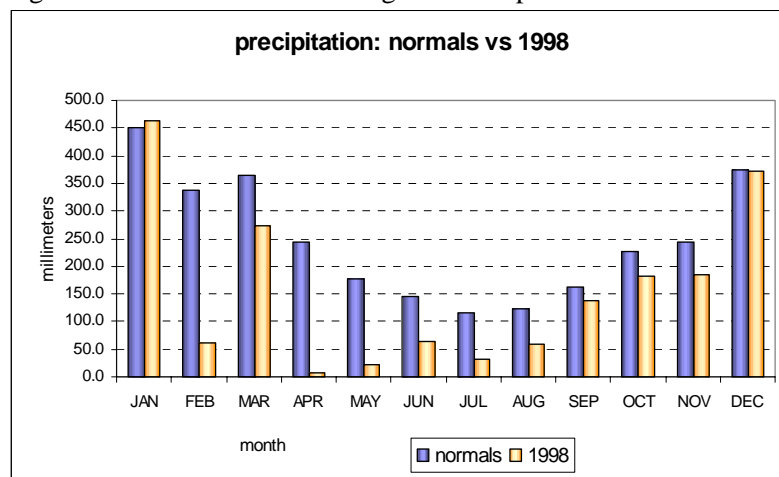
Climate in Samoa has two profound seasons, which is the dry and wet season. Seasons are characterized by rainfall and temperature seasonal trends. Dry season is from May to September with an average humidity of less than 90% and often experience rainfall that are below average while the wet season is often very humid with excessive rainfall often referred to as the Tropical Cyclone season which is from October to April.

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El Nino episodes

While there is local variability in climate due to Samoa's location and topography, researchers have indicated regional seasonal and inter annual variability associated with El Nino Southern Oscillation (ENSO). Strong El Nino has significant effect on rainfall patterns and duration in Samoa. When sea surface temperatures and pressures are higher to the western part of the Pacific, this implies a higher convection activity, which enhances the possibilities of tropical cyclogenesis. To the Eastern part, drought and below average rainfall is experienced. The following graph compares rainfall observed during El Nino episode of 1997 to 1998 and the normal.

Figure 1: Rainfall observed during El Nino episode 1997-1998



The El Nino phenomenon, which is explained as the difference between pressure between Darwin and Tahiti, has a return period of 2-7 years while La Nina, the normal condition, comes around every 4-7 years. El Nino and La Nina are large scale climate phenomena that originate from the Pacific, with their effects reaching around the global climate

Rainfall

Like other Pacific island nations, of the many climate indicators that affect development, being a water-based economy, water quantity and quality is a critical element not only in meeting the limited commercial and subsistence activity of the communities but their safety and mortality. While water levels are appreciated for agricultural produce, often islands are not prepared for excessive rainfall which causes, flooding and contamination of water supplies. Across the country, average rainfall ranges from 2000mm in dry areas to 5500 mm in wet areas. El Nino and La Nina events often affect this general pattern in rainfall. Generally La Nina or normal conditions favour cyclogenesis around Samoa, producing average rainfall to above average rainfall while El Nino brings dryness and below normal rainfall.

Climate variability

Any changes in climate will certainly impact on Samoa in one way or another. Changes in climate will include extreme rainfall periods as well as drought periods. Erosion along the coastline from cyclone generated sea swells and potential sea-level rise due to thermal expansion in the ocean as a result of global temperature increase is to be expected. Enhanced volcanic activity is predicted as the system struggles to provide a cooling effect on the atmosphere to balance the increase in temperature. There is already disturbance in biodiversity as the flora and fauna respond to changes in habitat conditions. Agriculture

production will also be affected as the soils become exposed to extreme dryness, thus reducing their capacity to hold during extreme rainfall periods. Corals and marine life will be exposed to extreme fluctuations in sea surface temperatures. Many vector-, food-, and water-borne infectious diseases are known to be sensitive to changes in climatic conditions. Dengue fever is a vector-borne disease that is increasingly being observed in Samoa. Small islands like Samoa will feel these, among many other adverse indicators of climate change.

Tropical cyclones

Tropical cyclones are severe weather phenomena experienced on the islands. On average there are about eight to nine tropical depressions in every cyclone season. Of this total, some are formed and diminished on the sea while some have the energy to cross the land causing devastation on infrastructures, residents and the environment. There have been no clear predictions on when and where these tropical depressions favour but studies on the rise and fall of El Nino given thermal variations on the sea surface temperature have assisted some efforts in predicting their possible occurrence. During El Nino periods, SST is warmer than normal across eastern places, for example the Cook Islands; higher probability of TC are expected for these areas whilst the west pacific experience dryness and cooling temperatures.

Table 1: Relative percentages of both coastline length (A) in kilometres (km) and land area (B) in hectares (ha) covered by the 4 different types of CHZ around the 573km-long coastlines of Samoa, determined by GIS from the 1999 Rectified Orthophotomaps.¹

Type of hazard zone		Savai'i	Upolu	Manono	Apolima	Aleipata Islands
A	CEHZ	131.12 (49.9%)	224.13 (78.6%)	8.79 (100%)	0.36(7.6%)	1.69 (14.2%)
	CFHZ	126.81 (48.3%)	235.45 (82.69%)	8.79 (100%)	0.36 (7.6%)	1.8 (15.2%)
	CLHZ	27.92 (10.6%)	49.37 (17.3%)	0	4.36 (92.4%)	10.19 (85.8%)
	ASCH	103.07 (39.2%)	7.08 (2.5%)	0	0	0
	Total island perimeter (km)	262.77	285.09	8.79	4.72	11.88
B	CEHZ	710.38 (0.4%)	1,221.77 (1.1%)	38.42 (13.4%)	3.19 (3.2%)	7.48 (5.2%)
	CFHZ	1,655.06 (1%)	2,960.64 (2.6%)	39.4 (13.7%)	3.25 (3.3%)	7.31 (5.1%)
	CLHZ	191.93 (0.1%)	449.96 (0.4%)	0	43.77 (44.5%)	63.18 (43.8%)
	ASCH	1,103.53 (0.6%)	72.10 (0.1%)	0	0	0
	Total island area (ha)	170,210.48	112,265.26	286.99	98.46	144.15

Having this information in place plus other research and anecdotal data, Samoa had developed a Coastal Infrastructure Asset management Strategy.

Concerns and response

As stressed earlier, the extent of Samoa's involvement in mitigating climate change is merely confined to preparedness as they play a minimal role in matching the global increase in greenhouse gasses that have affected the climate system. There should be continual efforts through international and regional forums on policy directives to bring major players in the cause of climate change to participate and recognize the impacts. Given the limited resources and size of the country, care should be taken in weighing conservation against development, recognizing the potential impact of climate change and the extent of their contribution to mitigate it.

The demand for water is increasing as a result of rapid population growth and economic development. The limitation on water supplies implies Samoa's high level of vulnerability to the impacts of climate change.

Adaptation efforts

There are currently many efforts under the UNFCCC plus others to mitigate and minimize causes of climate change. They have developed regional forums and projects to assist countries not only to understand issues of climate change but also to develop response measures that are appropriate to island countries. Samoa along with many other Pacific island nations have been strong advocates on the issue of climate change due to their isolation and small sizes.

In 2001, a national effort funded by the Government of Samoa and the International Development Association (IDA) through a project known as the Infrastructure Management Program (IAMP) mapped out hazard zones around the Samoa group. Induced waves and potential rainfall intensity were the bases for a 100 year planning horizon. The Coastal Hazard Zones (CHZs) adopted for this study include; Areas Sensitive to Coastal Hazards (ASCH), Coastal Erosion Hazard Zone (CEHZ), Coastal Flood Hazard Zone (CFHZ), and Coastal Landslip Hazard Zone (CLHZ). The lengths of the coastline and areas of land covered by the 4 types of CHZ (2000 Samoa CHZs) are listed in Table 1.

The CHZs Mapping showed that erosion and flooding from the sea are the most widespread coastal hazards on 'Upolu, Savai'i and Manono, and coastal landslip the most widespread on Apolima and the Aleipata Islands. The CEHZs cover on average, 76% of the coastlines of Savai'i, 'Upolu and Manono. The CLHZs cover on average, 89% of the coastlines of Apolima and Aleipata Islands, compared to an average of 14% on Savai'i and 'Upolu.

In that respect, the security for water resources is critical. National strategies and management plans are to be in place. Management efforts should not be confined to distribution but conservation of water as well. Already, water problems have been voiced from many districts on the island of Savaii. The 1997-1998 El Nino experience promoted water management and distribution rationalization. Rainfall is scarce in many areas especially the northwestern parts of the country. Households around these areas should consider water storage options, for example building water tanks to store water. Should water quantity and quality continue to be affected, means for water storage should be enforced as part of building permits for every application. Like wise, reservoirs that serve waterlines, should be well in place in areas where they can maximize collection and distribution of water. Clearance of vegetation from around these sites should be monitored to minimize contamination of water supplies.

Countries like Samoa with the least resources have the least capacity to adapt and are therefore very vulnerable. The ability of human systems to adapt to and cope with climate change depends on factors like wealth, technology, education, information, skills, infrastructure, access to resources and management skills. Communities and the general public vary in their endowments with these attributes.

Conservation areas such as forestry reserves and parks can be combined to enhance the sustainable management of resources. With 80% of the land under customary ownership, communities should be encouraged to allow land for conservation purposes. Government owned lands can also be utilized for government investments or be converted as freehold land

for the general public to purchase. The existing Parks and Reserve Act, allows areas not less than 1,500 acres to be used as reserves.

Most of the coastal areas will be affected by coastal erosion. The CHZ Mapping under the IAMP indicates that most of the infrastructure will be affected. Consultation with communities regarding proposed relocation as an option is recommended. In some areas of extreme vulnerability there were options of looking at hard solutions like rock or cemented sea walls depending on the level of vulnerability. While these are adequate response measures, they are quite expensive. On the other hand, soft solutions like beach replenishment and re-vegetation along coastlines are promoted to minimize the impacts of these hazards. The implementing agencies for the IAMP are compiling a CIM Program that would assemble and prioritise those options agreed upon by the communities to enhance resilience to impact on the coastal resources by climate change.

Agriculture and food security are important issues for Samoa because of its limited resource base and high level of vulnerability to climate change. For example, climate change would prompt prices of imported goods to increase, this would promote the importation of genetically modified goods to meet the demand. However, genetically modified goods are still under research and are therefore considered a health hazard until proven otherwise.

In the case of relocating government infrastructures and homes away from coastal location, the issue of land ownership is critical. Since 80% of lands in Samoa are under customary ownership, any relocation would need to have a clear understanding between the government and communities involved. Under the IAMP, this issue has been recognized and a framework for land acquisition, relocation and resettlement will be developed. The framework will not only look at land but also its contents i.e. vegetation, buildings, roads, fences and other assets.

The commitment from the Government of Samoa under the IAM project to develop the information base and consider adaptation measures is an example of a national commitment to look at climate change. There are a number of regional projects driven through regional organizations like SPREP and SOPAC, but these can only reach out to regional issues and agenda. In most cases, key country priority issues are not well addressed. Countries should be made clear of this and be supported to take the leading role.

Summary

Climate change should be considered with the utmost care. While the physical implications will substantially affect the physical makeup of Samoa, the responding attitude will be equally intruded. The rate in which climate is changing is slow but it shouldn't displace the timing that we need to respond to it. The cost will be high but will be effective when good, coherent, integrated management and response plans are in place.

Suggested readings

BECA IAMP, Coastal Hazard Mapping Report 2001
 Climate Change, The IPCC Impact Assessment 1990
 BECA IAMP Coastal Hazard Mapping 2001