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# Vulnerability, Environmental Security, and Adaptation Awareness in Samoa

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# **Vulnerability, Environmental Security, and Adaptation Awareness in Samoa**

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S.I.T. Study Abroad: Fall 2013

**Abstract:** Climate change remains a prevalent problem for today's international community, particularly for Pacific Island countries. This study examines the current influence of climate change on Samoa by looking at the three tenets of vulnerability: exposure, sensitivity, and adaptive capacity. These aspects of climatic change correlate and build off one another, ultimately elucidating the basic vulnerability of any given region. It also analyzes how environmentally secure Samoa is and will be, using Thomas Homer-Dixon's theory on climate change and conflict. Finally, this paper seeks to outline the current system of adaptation awareness that exists between government, community and foreign aid components, and propose future strategies. Quantitative data collected from Samoan government resources, international databases, and non-governmental organizations explained the basic environmental impacts while articles and interviews highlighted the anthropogenic reaction. Analysis proved high exposure, medium-high sensitivity, and medium-high (improving) adaptive capacity. Additionally, Homer-Dixon's theory illuminated an environmentally secure nation where an adaptation awareness system exists but lacks depth, remaining a work-in-progress. Collectively, this research illuminated a viable foundation for positive adaptation and comprehensive mitigation of climate change in Samoa.

Key Words: Geography, Environmental Studies, Climate, Natural Hazards

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*Dedication*

I dedicate this project and all of my time in the Pacific to John B. Bean without whose advice,  
I may never have come.

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## Introduction

Climate change remains a prevalent problem for today's international community, particularly for Pacific Island countries (PICs). For the most part, the countries most responsible for anthropogenic climate change and climate variability catalysts (i.e. greenhouse gas emissions and air pollution) are not the nations suffering the effects. PICs, based initially on size and location, are the most impacted by some of the most prevalent meteorological and geological threats. The current classification of PICs as less developed nations also factors in to the overall ability of a given island country to combat issues of climate change; it calls into question the capacity of successful mitigation and adaptation strategies. .

The problem of climate change is not going to disappear, and adaptation looks to be the best coping strategy, especially for vulnerable PICs such as Samoa. Sea level rise, temperature and precipitation rates, water resources and natural disasters in particular consistently impact a multitude of sectors (economic, agricultural, urban, etc.) and continue to do so at a faster rate. An all encompassing understanding of vulnerability to climate changes from a global perspective “needs to account for a range of risks, thresholds and institutional responses and resources, given that vulnerability will manifest itself differently at different scales” (Adger p.277, 2006). Environmental security and the potential for conflict resulting from these issues of climatic change also play an important role in the country's future well being as it bridges the gap between adaptation and insecurity. Simply, “from the *environmental security* perspective, policies should be targeted at both human behaviour and natural processes, as each of these contribute to environmental insecurity for humans” (Detraz, p.307, 2009). Addressing different components of vulnerability and environmental security elucidate adaptation strategies that could be useful for both governmental and grassroots levels of implementation, in particular a focus on raising awareness. As a result these two issues of vulnerability to climate change and potential for conflict must be looked at in tandem in order to understand how best to mitigate and adapt.

## Methodology

In terms of the approach taken when writing this study, I chose to incorporate a variety of sources in order to garner a broad perception of Samoa's overall situation with climate change. Beginning quantitatively, statistics available from international organizations such as CIA World Factbook, World Bank, and United Nations Development Project (UNDP) offered grounding information on different rates of climate change and demographic trends unique to Samoa. Coupled with official reports issued in Samoa such as the Ministry of Natural Resources and Environment's (MNRE) 2013 State of the Environment (SOE), the Samoa Development Strategy (SDS) and the South Pacific Regional Environmental Program (SPREP) meeting proceedings helped elucidate statistical vulnerability in Samoa.

Complementary of the quantitative data collected, much of the qualitative information set initial framework for this study. Definitions available for vulnerability emerged in scholarly articles available online, while an understanding of environmental security emerged in journals published by various environmentalists and geographers. A Geographic theory, the environmental security theory developed by Homer-Dixon offered a lens through which to analyze Samoa's potential for conflict based on the limited resources highlighted in the vulnerability analysis. It appropriated Samoa's vulnerability to climate change with potential anthropogenic reactions to environmental degradation.

In order to understand the adaptation awareness component of this study, field work based on interviews became an integral part of my research. First, I interviewed government officials involved in the MNRE to gain a sense of what the government is doing, how it approaches issues of climate change, and how it interacts with other organizations focused on adaptation and mitigation. Narrowing the playing field to three actors, (government, community, international aid) I sought interviews with individuals involved at each level. These perspectives allowed me to compare and contrast what is being said, and what is actually being implemented to better Samoa's adaptation awareness to climate change. The communal area of study became Saleapaga and Lalomanu, two villages hit the hardest by the 2009 tsunami. Using the tsunami and subsequent aftermath as a focal point, I spoke to

community members and resort owners in order to better comprehend how well the government and non-governmental organizations (NGO) practices came to fruition at the grassroots level.

As climate change is a global issue, information was readily available for my study. However, as Samoa is a small, developing country, in some instances statistics were published regionally rather than country by country. Sifting through Pacific data in order to siphon out Samoa-specific information took some time but was still possible. Individuals at all levels of my study, government and community members alike were open and willing to answer my questions. As I was comparing adaptation awareness, the lack of information at the community level was actually beneficial, highlighting room for improvement in future adaptation strategies. Overall, the process of completing this study was engaging and relatively straightforward, yielding interesting results on Samoa's vulnerability, environmental security, and adaptation awareness programs.

## **Vulnerability**

Vulnerability, or the “state of susceptibility to harm from exposure to stresses associated with the environmental and social changes and from the absence of capacity to adapt,” (Adger, p. 268, 2007) offers a key lens to understanding the impacts of climate change on any given region. Though a myriad of definitions exist, the most concise way to analyze and understand vulnerability is to look at its three main components: exposure, sensitivity, and adaptive capacity. These three pieces of the vulnerability puzzle elucidate “the extent to which a natural or social system is susceptible to sustaining damage from climate change” (Schilling, 2013). In categorizing exposure, sensitivity and adaptive capacity, one can preliminarily predict the vulnerability of a country, such as Samoa. Interrelated, many of the factors positively or negatively impact one another, ultimately elucidating the extent of vulnerability in a given region.

### *Exposure: Assessing environmental impacts*

The first aspect of vulnerability is exposure. Defined as “the nature and degree to which a system experiences environmental or socio-political stress,” (Adger, p.270, 2006) exposure depicts the magnitude, rate, and pace of change of a given environmental factor on a region. Simply, exposure looks at the basics of climate change impacts, taking a more statistical or quantitative perspective. For the purpose of this study, sea level rise, precipitation and temperature fluctuations, water resources, and natural disasters presented the most prevalent data and rates of exposure in Samoa

### **Sea Level Rise**

For island nations, the environmental changes as a result of rising ocean levels include, but are not limited to, coastal and lowland flooding, erosion, salination of fresh water rivers and aquifers, and the alteration of soil consistency and deposition (Hay, 1999). In terms of Samoa, compared to many of the Pacific atolls, the country’s high elevation and somewhat mountainous terrain act as an advantage in the face of sea level rise (Hay, 1999). The most recent projected sea level rise falls “between 2.7 – 8.3 mm a year” (SOE, p.16,

2013), however this estimate is not stagnant. As a result, “long-term, systematic changes in the average climate for Samoa indicate that by 2050, sea level is likely to have increased by 36cm” (SOE, p.29, 2013). According to the SPREP’s “National Vulnerability Assessments,” the sectors of Samoa most vulnerable to climate change include agriculture, biodiversity, water resources, coastal areas, and human health (Hay, 2000). Clearly, the presence of sea level rise is blatant, and the impacts only continue to emerge across multiple spheres of Samoan society.

### Temperature and Precipitation

Aside from sea level rise, fluctuating temperature and precipitation rates also present examples of climate change dangerous for Samoa. Looking initially at general trends across the Pacific, the catalyzed greenhouse effects project a warming “between 0.6 and 3.5°C in this century” (Hay, 2003). While a rather large projected range, the increase is clear. Similarly, the projected change in both annual temperature and precipitation rates for the Pacific region depict an upward trajectory; the former anticipates +1.63° C while the latter projects a +4.90% increase in rainfall (Hay, 2003). As the 2013 State of the Environment recognizes, “the changes in climate and climate variability predicted in the previous SOE 2006 are now a reality. These include: increased maximum air temperatures, increased frequency in extreme daily rainfall events” (SOE, p. 16, 2013). Statistically, rainfall is predicted to increase by 1.25% and maximum temperatures by 0.7° Celsius by 2050 (SOE p.29, 2013). Furthermore, the intensity of rainfall is also projected to increase, including “a rainfall event of 300mm, which used to be extremely rare, being projected to occur on average of every 7 years by 2050 which is consistent with trends over the past 20 years if significant intensification of rainfall in the country” (SOE, p.29, 2013). As with sea level rise, changing temperature and precipitation rates also indicate Samoa’s exposure to climate change and overall vulnerability as a nation.

### Water

Water resources combine aspects of sea level rise and precipitation fluctuation, synthesizes into a vital piece of the vulnerability puzzle for Samoa. Looked at most

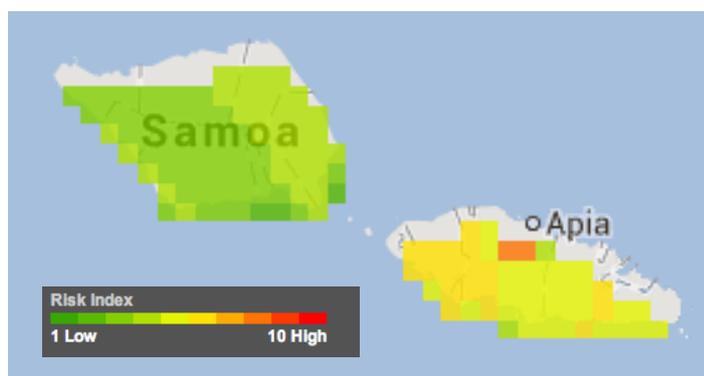
frequently with respect to quality and supply, drought becomes the largest threat to water resources. In turn, sea level rise “increases the possibilities of seawater intrusion into underground water aquifers,” (SOE, p.27, 2013) contaminating coastal communities’ drinking water supplies. Groundwater as a whole also suffers from the threat of sea level rise, along with unstable rainfall and “unsustainable watershed management practices” (SOE, p.107, 2013). Simply, the population suffers from insatiable water quality and quantity, catalyzed by climatic change. This overlap between environment-induced effects and the impact on humans is imperative to recognize in order to understand the extent of Samoa’s vulnerability to climate change.

### Natural Disasters

As with water resources, natural disasters also present an instance of natural forcings having both physical and anthropogenic impacts. The mistake is often made that warming trends indicate a higher frequency of storms, thus it is imperative to recognize that correlation does not mean causation. The Intergovernmental Panel on Climate Change (IPCC) recognized this, noting “conflicting evidence has led the IPCC to conclude that nothing definitive on their response to global warming can be stated at this time” (Hay, 1999).

Simply, as temperatures rise and weather and climate patterns shift, the frequency of storms cannot be projected, however, the magnitude of said disasters could. Even so, the impact of

**Figure 1: Cyclone Mortality Risk**



(World Bank, 2012)

natural disasters is not up for debate.

Cyclones and flash flooding “pose the biggest immediate threat to Samoa’s biophysical environment as it is to its social and economic aspirations,” (SOE, p.16, 2013) and the most recent storms, such as the

2009 tsunami and Cyclone Evan in 2012 “saw the undoing of years of economic gain in infrastructure development and hard earned livelihood sources, loss of human lives and severe degradation of native habitats and species populations” (SOE, p.17, 2013) (Figure 1).

As with the general effects of climate change, the aftermath of most natural disasters “will be concentrated amongst the poorest nations, who do not have the ability to prepare for these chances or recover from extreme events” (Jordan 2012). With a largely coastal population, Samoa maintains a high-risk impact when confronted with natural disasters.

### *Sensitivity: Understanding anthropogenic consequences*

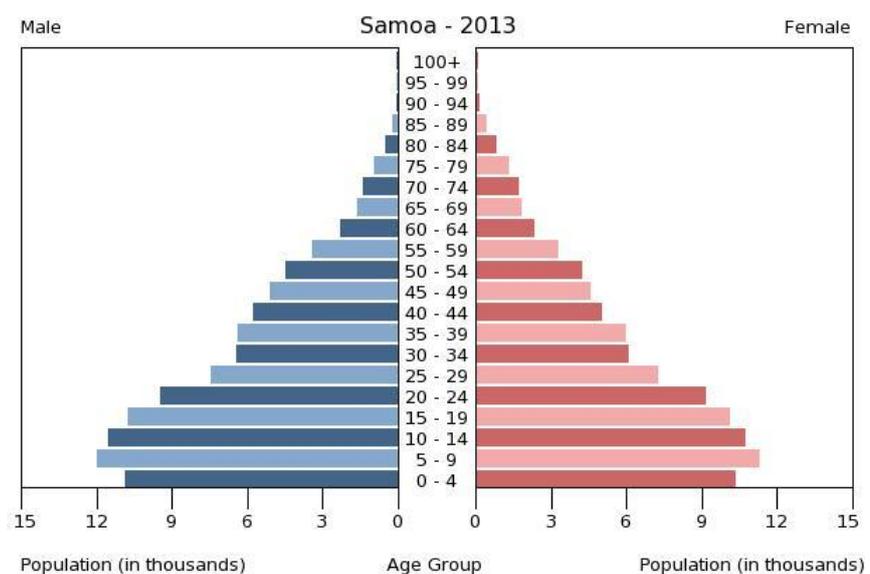
Building on exposure, sensitivity looks at the “degree to which a system is modified or affected by perturbations” (Adger, 2006). The IPCC goes further and determined sensitivity to be “the degree to which a system is affected, either adversely or beneficially, by climate variability or change” (IPCC, 2007). In general, sensitivity looks at resource dimensions of a given population, taking into account different demographic indices in order to determine what anthropogenic factors will be affected (complimenting the physical and natural factors impacted from the exposure perspective). When attempting to understand Samoa’s sensitivity to climatic change and variability, population statistics, water availability, and economic sectors emerged as the best indicators.

### Population

One of the primary indicators of sensitivity is population. Samoa, though technically classified by the United

Nations as a “less developed country” shows population statistics indicative of a positively developing nation. As the population pyramid depicts (Figure 2), the population growth rate has changed. The most

**Figure 2: Population Pyramid**



(CIA World Factbook, 2013)

recent census discovered an annual growth rate of 0.64% per year, but also noted that the population “has been growing at a declining rate in large part due to a high level of outmigration” (SOE, p. 14, 2013). Furthermore, the future maintains these positive trends, because even as “predictions of population growth is difficult because of the widely varying influence of migration...growth over the next ten years is expected to be between 0.7% and 1.5%. Within this range, an annual growth rate of 1.0% would be within sustainable limits for Samoa” (SOE, p. 85, 2013). The “sustainable limit” can be determined in part based on the carrying capacity, a statistic that “capacity dictates that our [Samoa’s] biophysical environment has limits and exceeding those limits will lead to irreversible environmental degradation and break-down in the ecological services that support life on our island environment” (SOE, p.84, 2013). The declining growth rate indicates that Samoa’s population will not exceed capacity, and thus is capable of adapting and reacting to the aforementioned components of exposure.

### Economic Sectors

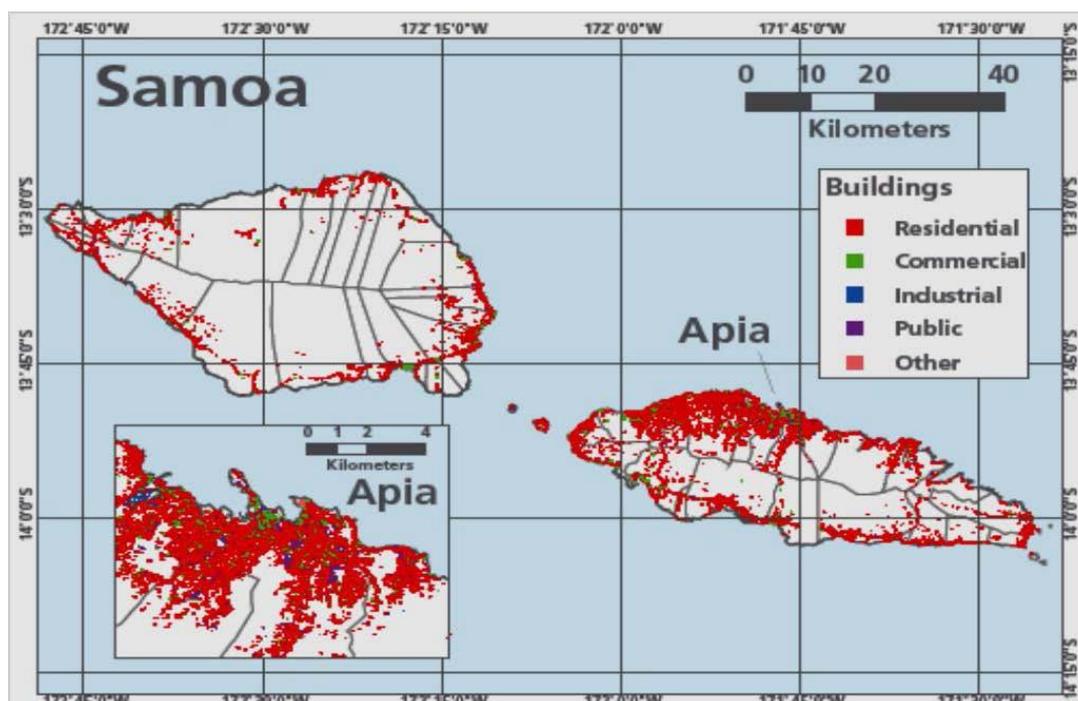
Complementary to population sensitivity, multiple sectors of the Samoan economy are vulnerable to climate change. Those sectors must be studied in order to understand sensitivity. The tourism and urban-based economic sectors are the most prominent, and face the greatest risk of degradation as a result of climatic variability. Looking first at tourism, “the impacts of climate change on the tourism sector is directly related to the loss or degradation of tourism resources such as beaches, pristine forest habitats, coral reefs, coastal infrastructure and scenic villages. Causes are inundation, flooding, heat related stresses, wind damage, and saline intrusion.” (SOE, p.28, 2013). With high exposure impacts, the economic inflow supported by the tourism industry, “gives rise to government revenue, encourages entrepreneurial opportunities, and helps promote and revive culture and branding” and consequently, “has a multiplier effect at all levels directly and indirectly from the individual up to the macro level.” (SDS, p.7, 2012). A large portion of Samoa’s economy stems from the tourism industry, and the lasting effects of events such as the 2009 tsunami are pervasive;

“tourist arrivals and tourism earnings [were] heavily impacted in the subsequent years given that an estimated 13% of the sector was destroyed. (SDS, p.7, 2012).

Aside from the tourism industry, the urban sector also remains vulnerable and highly sensitive. Statistics from a 2010 survey designated 20% of the total population as urban (CIA World Factbook 2010). The projected rate of urbanization between 2010 and 2015 is a projected 0% (CIA World Factbook 2010). Though further along in terms of urbanization when compared to other PICs, the stagnant projection is a positive when considering the damages urban areas suffer after natural disasters. In layman’s terms, less infrastructure and development equates less damage. However, “the increase in urbanization of population means the increase in the demand for natural resources and for environmental services. In synergy with increasing incomes, urbanization and changing consumption patterns and lifestyles, an increasing population exacerbates the problem of waste proliferation” (SOE, p. 25, 2013). Furthermore, the distribution of the urban population also indicates sensitivity as environmental stress stems from heavy human activity characteristic of urban areas. Compounded with the fact that “70% of Samoa’s population and infrastructure is located within the coastal area and the combined impact of their land use, sanitation and waste management habits” (SOE, p.25-26, 2013) all point to higher levels of sensitivity to climatic variability (Figure 3).

**Figure 3: Coastal Population**

(SOE, p. 83, 2013)

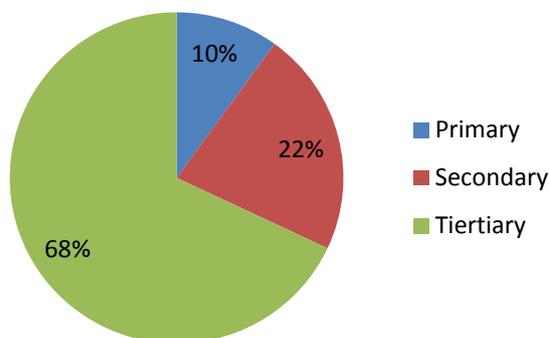


### *Adaptive Capacity: Addressing capability*

The final component of vulnerability is adaptive capacity, “the ability of a system to evolve in order to accommodate environmental hazards or policy change and to expand the range of variability with which it can cope” (Adger, 2006). It takes the physical exposure and the anthropogenic sensitivity, and focuses on how a region or country will be able to combat those current and future issues. The IPCC often divides adaptive capacity into two categories, generic and impact specific, as a means of distinguishing adaptive capability. Generic adaptive capacity consists of general statistics that influence a country’s ability to adapt to climate changes and impacts. Similarly, impact specific adaptive capacity is shaped by the performance of institutions and the availability of knowledge and technology. Looked at together, a region’s chance of successful adaptation to its climate change vulnerability can be understood.

#### Generic

**Figure 4: GDP Composition**



(Williams, 2013)

In terms of generic adaptive capacity, the primary indicator is Gross Domestic Product (GDP). The larger the GDP, the greater the capacity a country maintains to adapt. With Samoa, the GDP in 2011 sat at SAT\$1,546.5 million, equivalent to roughly US\$505.8 million (SDS, p.4, 2012). With a 1.2% growth rate, (WorldBank, 2012) this upwards

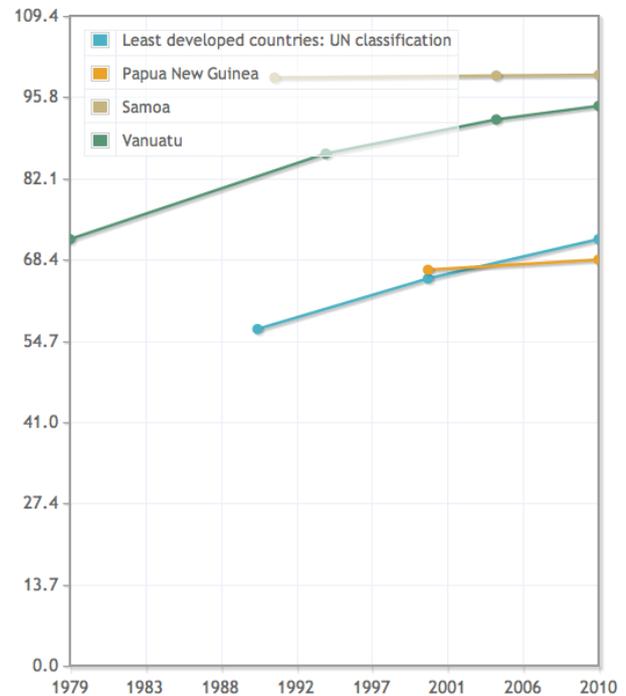
trajectory indicates stable sensitivity for Samoa when considering vulnerability. Similarly, the breakdown of the GDP also encourages a strong adaptive capacity (Figure 4). Primary, secondary, and tertiary sectors, synonymous with agriculture, industry, and service sectors follow the trend of developing countries. The progression through these economic sectors often indicates greater development, and with Samoa’s expanding tertiary economy (supported in large part by the strength of the tourism industry) this percentage breakdown is

a positive indicator of a strong adaptive capacity.

In tandem with GDP, education statistics also indicate strong generic adaptive capacity levels. Defined as individuals over the age of 15 who can read and right, literacy rate is often one of the key statistics

necessary for understanding the educative abilities of a given region Samoa maintains a high average literacy rate for both males and females, with a national average of 98.8% (CIA World Factbook 2010). In addition, as Figure 5 illustrates, Samoa has maintained prowess in terms of literacy rate, particularly in comparison to its peer countries in the Pacific. These high and improving statistics imply Samoa's positive generic adaptive capacity, and put the country in a good position to combat climate change.

**Figure 5: Literacy Rates**



(World Bank, 2013)

A final and imperative indicator for generic adaptive capacity is human development index (HDI). Introduced by the United Nations Development Project (UNDP), the HDI categorizes countries into different development groupings “by combining indicators of life expectancy, educational attainment and income into a composite” (UNDP, 2012) and quantifying the indicators to a number between 0 and 1. Its intended purpose, beyond statistically elucidating a nation's vulnerability, is “to serve as a frame of reference for both social and economic development” (UNDP, 2012). Samoa currently places 99<sup>th</sup> of a total 187 countries surveyed for the HDI, with a ranking of 0.688 (SDS, p.4, 2013). To put this in context, Australia, the country with the highest HDI in the Pacific, has an HDI of 0.938, and the Solomon Islands falls with 0.530 as one of the lowest HDIs in the Pacific. This medium to higher HDI is a solid statistic that supports Samoa's stable generic adaptive capacity.

## Impact Specific

It is imperative to measure the country's impact specific adaptive capacity with respect to its ability to adapt to and mitigate exposure impacts. The primary indicators for impact specific adaptive capacity are the Knowledge Index (KI) and the Knowledge Economy Index (KEI). The former, by definition, “measures a country's ability to generate, adopt and diffuse knowledge. This is an indication of overall **potential** of knowledge development in a given country” (Knowledge Economy Index, 2012). It generates a score for a given country or region based on the innovation system, information and communication technology, and education and human resources available in the location of interest. Similarly, the KEI configures “whether the environment is conducive for knowledge to be **used effectively** for economic development” (Knowledge Economy Index, 2012). Used correspondingly and generated regionally, the KI for the Pacific is 5.17 and the KEI is 5.32. In comparison, as outlined in **FIG**, the Pacific region hits a medium range KEI and KI.

**Figure 6: KEI & KI Comparison**

Region	Knowledge Economy Index	Knowledge Index
Pacific Region	5.32	5.17
South Asia	2.84	2.77
Middle East & North Africa	4.74	4.51
World	5.12	5.01
Low Income	1.58	1.58
Low-Middle Income	3.42	3.45

(Williams, 2013)

These statistics could be pulled further towards the high end of scale in part because of the inclusion of countries such as New Zealand and Australia, yet the region still stands stronger than many less developed regions. Simply, these are standard rankings, average calculations for a region characterized by both developed and developing countries.

However, these indices can often be generalized. As a result, Samoa's best source of impact specific adaptive capacity evidence lies in its primary government documents, the Samoa Development Strategy (SDS). In conjunction with the U.N. Millennium Development

Goals, the SDS cites the most important factors of development as Samoa continues to grow, and illuminates the preliminary goals of the nation as a whole. “Key Outcome” numbers 13 and 14 pertain to the environment, and have been re-evaluated in the new 2012-2016 SDS, dictating that “To ensure sustainable development, there is a need to be updated on the state of the environment so that issues, challenges and risks could be assessed and addressed in a timely manner and appropriate interventions made” (SDS, p.58, 2012). The Samoan government’s awareness that such a program should exist and be improved upon underscores strong impact specific adaptive capacity because it speaks to the active performance of institutions within the country when facing climate change vulnerability.

The outcomes themselves demonstrate Samoa’s strong impact specific adaptive capacity in their definitions, respectively. Outcome 13 encourages engagement at the community level, recognizing ‘the importance of balancing their [community members’] needs against environmental sustainability” (SDS, p. 19, 2012). It goes further and recommends “mainstream[ing] environment considerations into sector plans and programs, policies and budgetary processes,” (SDS, p.19, 2012) so as to “enhance public awareness of the impact of agriculture development around watershed areas [that] will result in better land use and conservation practices” (SDS, p.19, 2012). With a strong focus on adaptation awareness at the local level, the SDS narrows its focus with Outcome 14.

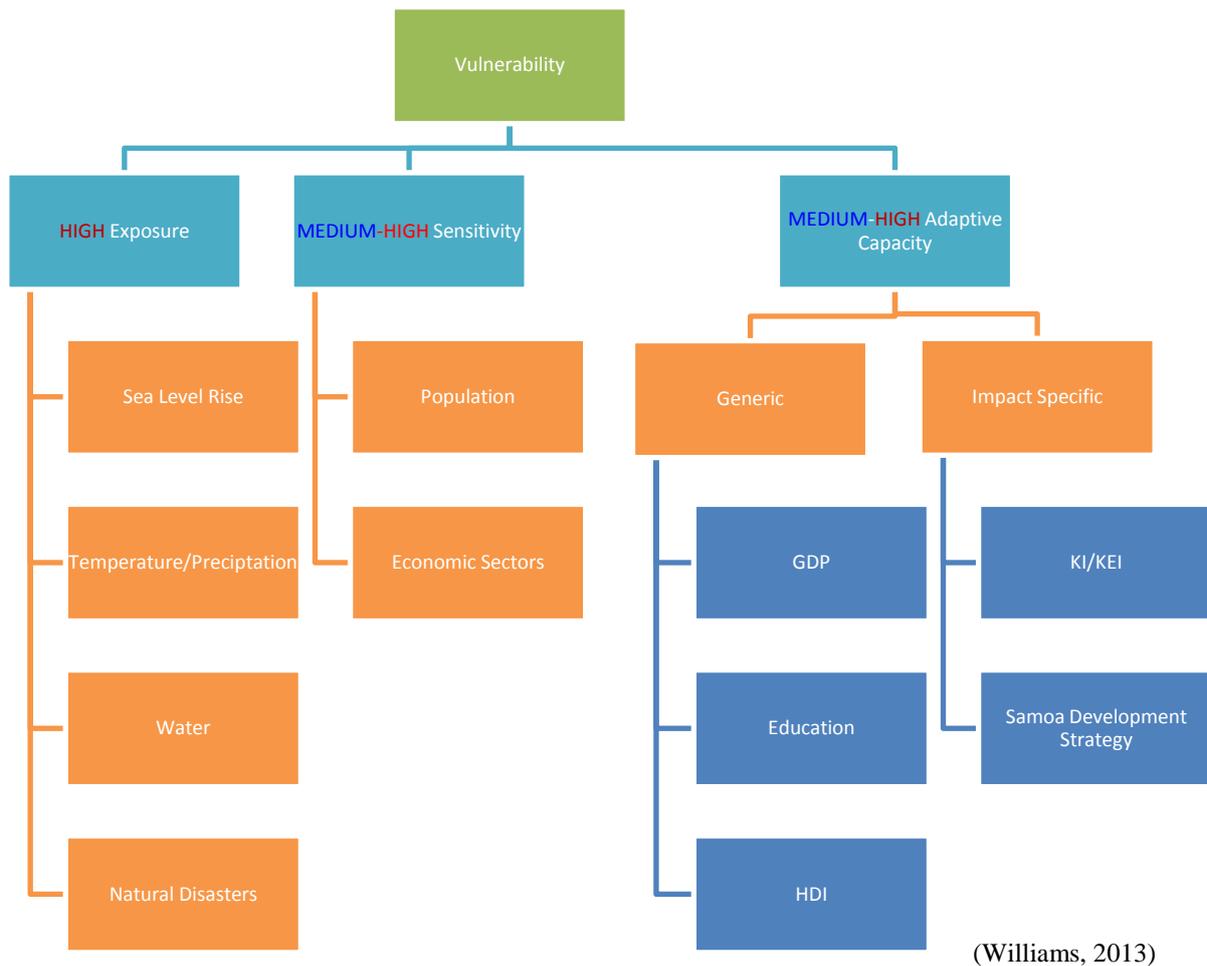
Simply, Outcome 14 does a similar job in acknowledging the issues the climatic changing, taking a more focused perspective by looking directly at natural disasters. It highlights “the importance of integrating climate change and disaster risk management into core national and sector plan policies” (SDS, p.20, 2012) as well as the need to “emphasize the importance of strengthening awareness and consultations on climate change and disaster risk management at all levels, so as to improve community engagement and understanding of future potential impacts and proposed adaptation and risk reduction strategies” (SDS, p.20, 2012). The fact that the Development Strategy incorporates not only the basic ideas of climate change mitigation and adaptation but also understands the need to integrate appropriate strategies strengthens Samoa’s impact specific adaptive capacity. In short, the

nation recognizes the problem and understands that something must be done, a mindset that indicates positive approach to vulnerability.

*Extent of Vulnerability: Conclusions*

Overall, Samoa's vulnerability to climate change is clear. As depicted in Figure 7, the exposure, sensitivity, and adaptive capacity factors all contribute to Samoa's current vulnerability in different ways. Compiling initially climate change statistics, Samoa emerges

**Figure 7: Vulnerability Summary**



as a highly exposed nation. Susceptible to a variety of climatic variability impacts, the future of Samoa looks bleak as it faces solely these environmental factors. An island nation already at risk based on geographic location, the bold presence of sea level rise, fluctuating temperature and precipitation levels, minimizing quality of water resources, and aggravated nature of natural disaster, all confirm that Samoa maintains high exposure to climate change.

Similarly, as stress of each climatic impact on the various sectors within Samoa varies, the island's sensitivity maintains a medium-high status. With a steadily stagnating population growth rate, Samoa will not exceed its carrying capacity. However, the coastal location of much of the population does put a large majority at risk, in particular to natural disasters. Furthermore, the economic breakdown does distribute mainly across those sectors most impacted by climate change. The emphasis on the tourism industry, in addition to the urban sector, indicates high levels of sensitivity on behalf of Samoa's economic system. The degradation of the environment by the urban population puts Samoa at even higher exposure and ultimately high anthropogenic sensitivity. Thus, especially when looked at in tandem with the island's high exposure, Samoa's relatively high sensitivity increases its vulnerability to impending climatic changes.

Collectively, the generic and impact specific adaptive capacities are strong. In terms of generic adaptive capacity, the growing GDP and developmentally sound distribution amongst economic sectors asserts that financially, Samoa will feel the effects of climate change, but continue to build resilience. Similarly, the continually positive literacy rates, coupled with the medium human development ranking further validate Samoa's ability to combat its own climate change vulnerability. In addition, the impact specific factors, namely knowledge indices and adaptation awareness manifest in the Samoa Development Strategy, prove Samoa's comprehension and ability to understand its vulnerability to climate change. Collectively, Samoa's relatively high adaptive capacity helps counteract the extreme vulnerability evidenced with exposure and sensitivity, creating a viable foundation for successful adaptation practices.

### **Environmental Security**

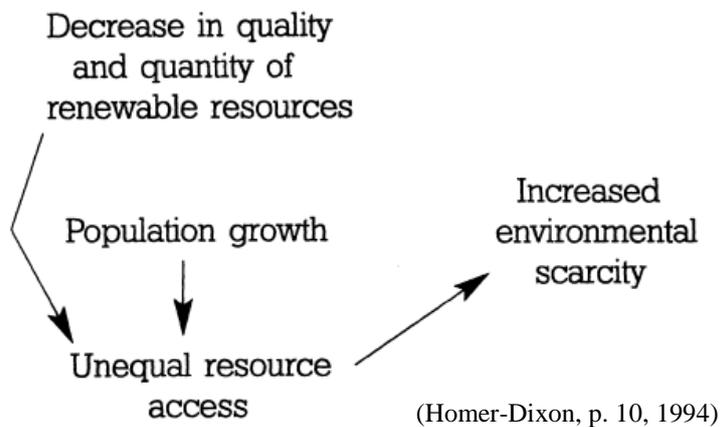
Environmental security is a term new to the international sphere. Combining two aspects of society often looked at completely separately, environmental security "looks specifically at those environmental issues that present a security risk for human populations" (Detraz, 2009). It presents a platform for analyzing conflict as a catalyst for environmental degradation and climate change, and vice versa. Thomas Homer-Dixon published a

renowned theory on environmental security that offers an interesting lens through which to analyze the environmental security of Samoa. Samoa's current vulnerability standing supports the country as an ideal region for studying environmental security because of the future risks purported by climate change. It is Homer-Dixon's theory that will help elucidate Samoa's current situation and enable future predictions regarding the island's environmental security.

### *Homer-Dixon: Violent Conflict and Environmental Scarcity*

When understanding conflict theory and its relationship to climate change vulnerability, Thomas Homer-Dixon's model of violent conflict and environmental scarcities

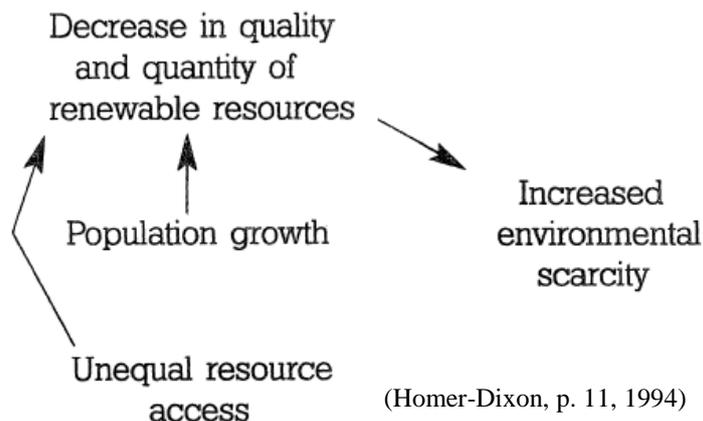
**Figure 8: Resource Capture**



provides for an interesting analysis. Published in 1994, Homer-Dixon's theory is the pioneer structure for understanding environmental security as it uses population growth and declining quality and quantity of renewable

resources to catalyze unequal resource access and thus increase environmental scarcity (Homer-Dixon 1994). He introduces the concept of "resource capture," (Figure 8) a situation where "resource depletion and population growth cause unequal resources access," (Homer-Dixon, p.10, 1994) and overlays this theory with the idea of "ecological marginalization"

**Figure 9: Ecological Marginalization**



(Figure 9) where unequal access to resources, along with population growth, causes a decrease in renewable resource quality and number (Homer-Dixon 1994). All, of course, result in heightened

environmental scarcity, which in turn fuels conflict.

### *Homer-Dixon in Samoa*

It is imperative to use approach as a lens for understanding the situation in developing regions, particularly those highly vulnerable to climate change such as island nations. It is relevant to the current vulnerability in Samoa because of Homer-Dixon's focus on access to resources. Overlaying Homer-Dixon's theory for Samoa, it is clear that, as an island nation, the resources are limited. He recognizes that "environmental scarcities are already contributing to violent conflicts in many parts of the developing world. These conflicts are probably the early signs of an upsurge of violence in the coming decades that will be induced or aggravated" (Homer-Dixon, p.6, 1994). Homer-Dixon adds, with much conviction, that "the violence will usually be sub-national, persistent, and diffuse" (Homer-Dixon, p.6, 1994). For a small, communally founded population such as exists in Samoa, this conflict theory stands with much viability. And it lies in particular with Samoa's water resources.

Within the realm of environmental security, water resources often present a spark for present or future conflict all over the world. The series of events, begins with climate change as it "gives rise to a reduction in the regional availability of water, leading to a water crisis; the ensuing destabilization may lead to conflicts involving the use of violence" (Tanzler, p.696, 2012). Turning this lens on Samoa, its growth and development as a country with already limited resources could be an issue should it fail to properly mitigate and adapt. The government recognized "that any increase in demand as a result of increasing population and households, coupled with changing lifestyles, will contribute significantly to the increase in water takes to satisfy the growing water and energy needs. This will place increasing pressures on the quantity and quality of water resources available in the environment" (SOE, p.102-103, 2013). When understood with Homer-Dixon's theory, the aforementioned pressure would likely catalyze conflict based on unequal access to water resources and particularly resource capture. However, Samoa's growing resilience to vulnerability present in its growing adaptive capacity denies any immediate conflict implications.

Yet, the general decrease in quality and amount of water correlates with another problem unique to Samoa. With resources already limited, the deeply ingrained land tenure system emerges problematic; a “stumbling block” on the road to positive development (SOE, p. 25, 2013). In general, basic accessibility is sometimes denied as the “access to environmental resources is intricately linked to the traditional land tenure system which controls over 80% of Samoa’s land resources” (SOE, p.25, 2013). Ideas regarding the implementation of the land tenure system differ between the government and community levels, and this disconnect has begun to agitate somewhat the environmental security of Samoa. It is illuminated with the access to water as “some resources that by law are state-owned, such as rivers and streams, are often disputed by villages with access to them through village-controlled lands needing protracted negotiations” (SOE, p.25, 2013). The Uafato Conservation Area Project exemplifies an instance where disputes at the local level caused the village to “withdraw its commitment for the conservation of this forest area” (SOE, p.25, 2013). Homer-Dixon determines that internal conflict and disagreement initially indicates further conflict, and this instance in Uafato is not immune. Where the government aims to securitize resources, the internal disagreements at the community level seek to counteract. This disconnect must be overcome in order for Samoa to fully prevent potential conflict stemming from access to basic resources.

Fortunately, in a review of the last Samoa Development Strategy, the 2012-2016 SDS noted that “more effort is needed to ensure sustainability of the resources as well as improved access to quality water services. The water sector is a good example of where careful and considered decision making is crucial to sustainable development” (SDS, p.14, 2012). If acknowledgement such as this corresponds with implementation strategies regarding water quality, quantity and access, Samoa stands a positive chance of avoiding future conflict. Thus, in using Homer-Dixon’s theory on resource access and violent conflict, Samoa, though susceptible based on its overall vulnerability and limited resources, is environmentally secure as it stands to effectively combat resource issues. However, future conflict will be imminent if stronger ties between the government and community levels are not forged through mutually beneficial adaptation practices.

## Adaptation

In order to combat its high vulnerability and potentially changing environmental security, adaptation strategies are necessary to stabilize Samoa's future with climate change. The Samoan government, and in particular the MNRE, approach adaptation and mitigation strategies with hard and soft approaches. Hard adaptation strategies include tangible mitigation approaches such as sea walls, rockwalls, raising ground levels of homes, etc. (Bartley, November 18, 2013). Correspondingly, soft adaptation, "seeks to increase communities' knowledge and awareness of environmental transformations and therefore support communities to embed this knowledge in their decision making processes and institutions" (Ambani, p.2, 2012). The tandem implementation of these measures touches all reaches of adaptation strategies, and looks to be a viable approach. The levels of implementation and the way in which they interact require further analysis.

**Figure 10: Adaptation Actors**

### *Three Players*

Building awareness to adaptation strategies is key to reducing aspects of vulnerability and solidifying and environmentally secure future in Samoa. As outlined in Figure 10, the relationship between the government, community, and international aid presents a structure through which soft and hard adaptation strategies can be implemented. But how



(Bartley, 2013)

connected are these three actors, truly? This study seeks to better understand the ways in which the three players interact and overlap, as well as elucidate any weaknesses in the system so as to improve this ideally symbiotic relationship. Particular focus will be placed on the aftermath of the 2009 tsunami, an event that desired assistance at the community level from all other actors in the adaptation system, as it indicates the effectiveness of said system.

## International Aid Influence

International aid is not an alien concept in Samoa. As a developing nation, many programs, infrastructure, and support have historically, and continue to come from foreign aid programs. Major actors, such as Australian Aid and New Zealand Aid, provide financial support that is often directed towards development projects on the ground in Samoa. With regards to climate change mitigation and adaptation, there is quite a bit influence. According to MNRE Officer Filomena Nelson, “A lot of these projects are all funded externally...The bulk of the funding comes from foreign aid” (Nelson, November 13, 2013). Similarly, Climate Section Officer Luteru Tuavale recognized the presence of Japanese aid in providing the funds necessary for the “Improving Weather Forecasting System and Metrological Warning Facilities” project, designed to warn individuals about events pertaining to climate change (Tuavale, November 12, 2013).

With such influence, questions arise as to the efficacy of aid and how positively it influences Samoan climate change efforts. Nelson elucidated these questions, proudly highlighting Samoa’s ability to individualize the influx of aid. She noted, “When we started back then, early 2000s, when I started working at this ministry, what we did was we implemented things without waiting for an expert outside of Samoa to come in and say this is how you should do it” (Nelson, November 13, 2013). Labelling this hands on approach “ideal,” Nelson looked positively down the road with this mindset, asserting, “It’s doing it and learning from it to inform future programs” (Nelson, November 13, 2013). Beyond the government these positive relationships exist as well. Various organizations such as SPREP work directly with foreign aid in a symbiotic manner similar to the relationship between aid and the Samoan government. As SPREP adaptation planning officer Ben Leavai observed, “We interact through international meetings, regional meetings, national level meetings. We develop concepts and ideas together on projects and programs along with, together with, working with country representatives, governments, corporations, communities, private sectors on projects, plans, programs and funding”(Leavai, November 22, 2013). From these insider perspectives, it seems that Samoa’s myriad of interactions with foreign aid foster a beneficial and seemingly autonomous relationship.

## Government and Nongovernmental Organizations: Current Actions

Government and non-governmental organizations (NGO) are another set of actors in the adaptation awareness system, both maintaining the foreign aid focus on benefitting local level strategies. By definition, the MNRE “is entrusted with the responsibility of coordinating the monitoring and review of the state of Samoa’s environment with the cooperation and support of its stakeholders in line Ministries, Non-Governmental Organisations and the wider community” (SOE, p.9, 2013). The most effective strategy thus far, as detailed by Nelson, is “to go into the village communities and talk about it [climate change], and also to work with them to their exposure, you know “why are they vulnerable”?” (Nelson, November 13, 2013). Education of the youth population also proves a viable approach. For example, the National Science Fair has turned its focus to issues of climatic variability projects and the like, the goal being promotion of awareness “especially amongst the students, who will face worse when they grow up and become adults” (Nelson, November 13, 2013). With the government having deemed the biggest issue climate change in Samoa as a lack of “in-depth understanding of people about climate change...Not just from the individual perspective but also as a nation,” (Nelson, November 13, 2013). fostering basic understanding at the local and national levels is imperative.

Nationally, adaptation and mitigation programs emerge frequently across multiple sectors, not confined purely to the environmental sphere. Initially, adaptation and mitigation strategies focus on different sectors and “require consultation with all state quotas to actually work with them to plan adaptation programs” (Nelson, November 13, 2013). This then extends to further education in sectors, whether it be health, tourism, agriculture, etc. so that these government divisions develop the capacity to “come with adaptation measures that are more appropriate, to cater for adaptation needs within whatever particular sector they are working” (Nelson, November 13, 2013). Hard adaptation approaches span the local-national spectrum as well, and include, but are not limited to, “climate proofing of coastal infrastructure with seawalls, coastline revetments, mangroves replanting, reforestation of steep and erosion prone areas and catchments” (SOE, p.16, 2013). In addition, utilizing media resources has also proved useful “because people like watching T.V., they like to

visualize these things, to actually see some of these things” (Nelson, November 13, 2013).

This compliments disaster warning efforts put in place by the climate section of the MNRE: a texting system meant to disseminate disaster and climate change warnings through a disaster advisory committee (Tuavale, November 12, 2013). Many of these hard adaptation strategies come funded from foreign aid initiatives, but implementation remains entirely Samoan.

The government also works to incorporate NGOs, and in particular Samoa Umbrella NGO (SUNGO), in order to strengthen adaptation awareness. Complimentary to SUNGO’s founding principles as an organization meant to “assist in implementing regional assistance and projects” (SUNGO, 2011) the government utilizes SUNGO to strengthen adaptation awareness and integrate information about climate change at local and national levels with an understanding that, “we [the government] need to understand what is the core business. Unless we understand that, we cannot just give it to them and say “Do this””( Nelson, November 13, 2013). However, this relationship is not seamless. In fact, SUNGO recognized in its recent communication strategy report that though previously it “has been falsely perceived as anti-government, the organisation is working to change this image” (Haughton, p.4, 2011). Claiming to be ‘the voice of the people’ (Haughton, p.6, 2011), SUNGO recognizes its role as “working alongside government to improve the lives of Samoan people,” (Haughton, p.4, 2011) a role the government confirms as based mainly in “advocacy and training the communities” (Nelson, November 13, 2013). Assuming this relationship continues to grow, it will remain mutually beneficial and highly viable for the community level adaptation awareness.

### Community Reactions and Ground-level Perspectives

Where flaws arise in the adaptation awareness system is at the community level. Using the aftermath of the 2009 tsunami as a lens for understanding, the idealized government and NGO influence begins to lose its shine. Though the government, NGOs, and foreign aid organizations all strive for the best possible outcomes at the local level through strategic plans, the active implementation is not quite as visible. The 2009 tsunami highlights the disconnect, but also catalyzed awareness in the aftermath. The village of Lalomanu was

the hardest hit by the tsunami, and still shows signs of rebuilding. Individuals speak of the natural disaster with misty eyes but a refreshing confidence in resilience and rebuilding. Admittedly, prior to the tsunami, “no one knew, no one was educated about it, there was no warning system in place in the village other than the bell that was rung after,” (Taufua, November 15, 2013) and the population most affected was unaware of evacuation routes, most of which were overgrown and almost invisible (Faasii, November 15, 2013). As a result, when the tsunami hit, there was little preparation, and the rebuilding process only further elucidated the lack of awareness.

In terms of rebuilding efforts, the fale owners in Lalomanu offered insight to the aftermath and highlighted who was, or was not, involved. Maseiga Taufua, the manager of Taufua Fales reflected, “After the 2009 tsunami it was just total destruction. We had a lot of help from the Red Cross, and I think the majority of our assistance was from returning guests, not so much the government unfortunately” (Taufua, November 15, 2013). This same lack of visible action by the government emerged in an interview with Litia Sini employee and family member Tracey Faasii who recognized ““We didn’t get much help from the government or the aids, but they gave us money to rebuild the resort...But that money wasn’t enough” (Faasii, November 15, 2013). A wake up call for the entire population, the disconnect present between the government and the trickle down to the local became evident. Afterwards mandates for the tourism industry such as required evacuation routes were enforced. Similarly, “building back better” strategies promoted by the DMO encourage resorts to complete a disaster risk plan in order to qualify for funding in the event of other natural disasters (Bartley, November 18, 2013). However the communities most affected remain skeptical. Taufua reflected snarkily on the government efforts in the months following the tsunami, noting “I think about 3 months, there would be about 10 tsunami warnings at once. It felt at some points like they were covering their asses for the big one, the one that had really hit” (Taufua, November 15, 2013). Clearly, though the intentions are good, the implementation is shaky, and adaptation awareness stumbled when presented at the local level after the 2009 tsunami.

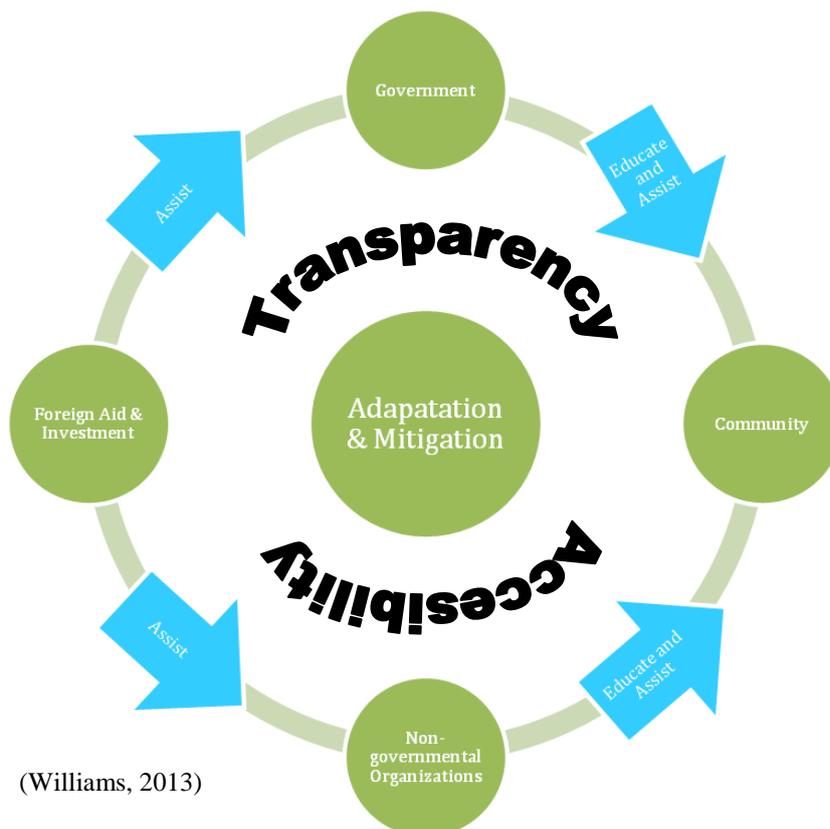
Looking forward, future adaptation strategies must be incorporated with greater drive from the government. Taufua, when asked what she hopes for most in the coming years as Samoa continues to combat climate change, answered simply, “Just more support” (Taufua, November 15, 2013). She went on to recommend a change of perspective by the government, offering, “I think they need to take into consideration more so the smaller businesses and that we can’t exactly come up with whatever they need us to come up with in a short amount of time because they sort of put us in the same category as hotels, but we are a completely different market.” (Taufua, November 15, 2013). Faasii also implored better execution of adaptation strategies, citing a proposal sent to the DMO for an early warning system siren, a system they find much more effective at the ground level. The use of the phone warning system exists, but the tsunami warning came ten minutes after the event had occurred, and a siren would enable early warning and inspire immediate evacuation (Faasii, November 15, 2013). Unfortunately, no one has yet installed the siren, even four years later.

Even so, in many ways, the inclusion of the local level has been successful, as evidenced by L. Falefala, the *pulenu’u* of Saleapaga. The next village over from Lalomanu, Saleapaga also suffered greatly from the 2009 tsunami. Having relocated the majority of the village up the mountain, Falefala recognized aftermath efforts by the government to install “awareness signage” and emphasize evacuation routes (Falefala, November 16, 2013). In addition, multiple representatives from the village, including the mayor and a member of the youth organization “who meet with the government to discuss natural disaster matters and...also have contact details if anything is required by the government from us” (Falefala, November 16, 2013). Overall, there are kinks in the current system, and these issues must be improved upon, but nonetheless, the government continues to improve upon adaptation strategies appropriate for community level implementation.

## Recommendations

So what does the future hold for Samoa? Highly vulnerable, at first glance, Samoa's size and status as a developing country call into question the nation's actual ability to adapt effectively. However, the government's strong focus on environmental issues illuminates positive expectations. As the State of the Environment acknowledges, a stronger focus has been given to issues of the environment, in particular because the impacts are so pervasive. What needs to happen is a strengthening of ties between the main mitigation and adaptation actors (Figure 11). As the system already exists, improvement is the next step. Samoa's success appears imminent because of the recognition by all levels of said system of a

**Figure 11: Adaptation Recommendation**



necessary adaptation awareness evolution.

The first step involves expanding accessibility of actions and plans. Key to successful implementation, active engagement between the government, community, and foreign aid will ultimately strengthen Samoa's adaptation capabilities. The State of

the Environment outlines this need for deepened accessibility, noting "The new status given to the environment in national planning inevitably demand a higher level of transparency and accountability in the way the environment sector is performing." (SOE, p. 10, 2013).

Similarly, SUNGO also recognized its own flaws of transparency and access, acknowledging the need to change its own image in order to promote a more symbiotic relationship with the other adaptation actors. In addition, SPREP also noted that lines of communication with the

government, and well as “accountability and transparency of project management” (Leavai, November 22, 2013) at the community level need to be improved upon.

Beyond deeper transparency, opening up more channels of information and building further bonds between the three adaptation strategy players will deepen Samoa’s environmental security as a nation. As potential conflict lies currently dormant in diminishing resources, the dissemination of information across all spheres of adaptation influence will counteract future environmental security issues. Similarly, openly informative systems help to counteract Samoa’s high vulnerability. A subset of impact specific adaptive capacity, heightened awareness across all sectors impacted, not just those designated for environmental purposes is key. Nelson pondered the information currently available in Samoa, noting “we already have the information, but sometimes it takes a while to pull together results of researchers...you need to be able to demonstrate the impacts in Samoa so that people can relate to it” (Nelson, November 13, 2013). She continued, adding, “it’s not just about the agency responsible for raising awareness, but also the public being able to connect themselves, to sit there and listen” (Nelson, November 13, 2013). Addressing the issues clearly at all levels of Samoan society will help strengthen the country’s environmental security both now and in the future.

The drive to complete these steps towards improvement is clear. Government officials and environmental pioneers alike all recognize the need to push ahead, and most maintain high hopes for Samoa. Tuvale observed Samoa’s current position in relation to other PICs, noting “I think Samoa is already in the lead for activities related to climate change. We want to push forward and continue to take the lead, and hope we will benefit more” (Tuavale, November 12, 2013). DMO officer Nelson echoed this statement with her own determination of Samoa as a “role model for climate change and also disaster risk management” (Nelson, November 13, 2013). With these positive attitudes, and the desire to improve practices across all sectors, Samoa’s future with climate change looks viable.

In conclusion, Samoa remains a country with high vulnerability to climate change, a currently stable environmental security status, and basic adaptation measures in place. However, the future contains further environmental degradation, and Samoa must build

greater adaptation awareness resilience. By implementing both soft and hard adaptation strategies, the country will be able to combat its vulnerability, and mitigate potential resource-inspired conflict. Ensuring transparency and accessibility of these adaptation awareness measures will be key, and the ties between the government, NGOs, international aid, and community levels must be strengthened to guarantee success. In doing so, Samoa will create a sustainable future for itself as it combats issues of climatic variability.

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### **Acronyms & Glossary of Terms**

DMO → Disaster Management Organization

IPCC → Intergovernmental Panel on Climate Change

MNRE → Ministry of Natural Resources and Environment

NGO → Non-governmental Organization

SDS → Samoa Development Strategy

SOE → State of the Environment

SPREP → South Pacific Regional Environmental Program

SUNGO → Samoa Umbrella for Non-governmental Organizations

UNDP → United Nations Development Project

*Pulenu'u* → Mayor