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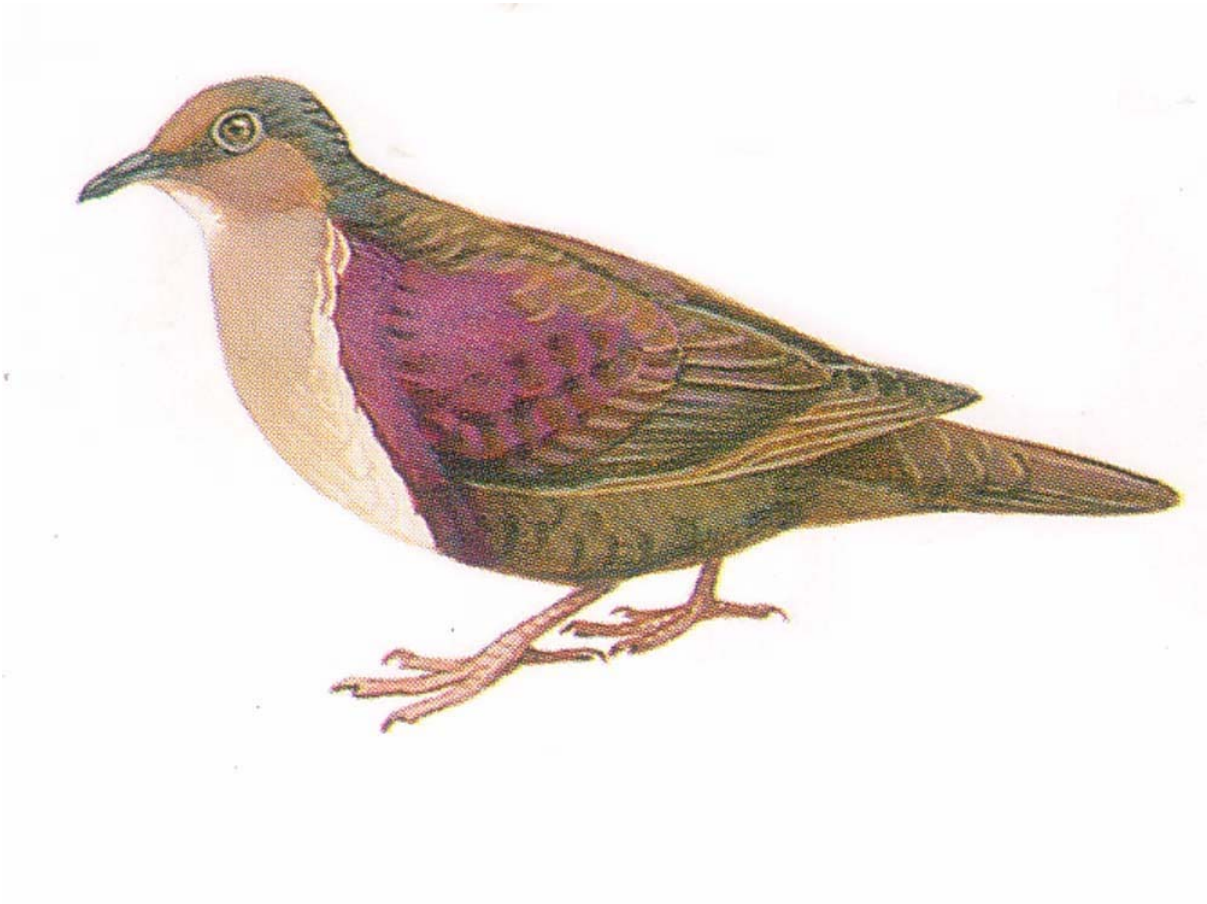

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Cover
Tu'aimeo, friendly ground dove (*Gallicolumba stairi*) - a native bird of Samoa that is under extreme threat of extinction (Source: MNRE)

The *fact-or-myth* of Samoan cultural heritage: personal reflections on family oral history

Tu'u'u Ieti Taule'alo*

Samoan oral stories have been handed down by word of mouth over many generations. These stories describe family origins - where they come from, who they are and their places or status in their villages or districts. Some relate to ordinary chores like travel, hunting and fishing while some tell extraordinary events dealing with wars, spirits and the supernatural. This paper is about three such stories from my own family at Tuana'i, Safaato'a and Saanapu. The main focus is to explore how these oral stories have continued to shape our lives and beliefs and how they have influenced our attitudes as Samoans over the years.

The first story relates to my family of the Saga title at Tuana'i where my father's mother came from. Tuiaana Tava'etele married Sivalavala Fotumaleavega and issued a son Tuiaana Lelaolao and daughter Sinaletava'e who married Pili and issued four sons - Tua, Ana, Saga and Tolufale. These four inherited the original divisions of Samoa – Tua in Atua (eastern Upolu), Ana in Aana (western Upolu), Saga in Tuamasaga (middle Upolu) and Tolufale at Manono and Apolima Islands. Saga then married Lupe and issued Saga Fuaoletauloa who married Sauopuala'i from Nofoalii and issued Saga Masefau and his sister Sinamamala.

News of Sinamamala's beauty spread far and wide and reached the God Tagaloaalagi in the Ninth Heaven. Tagaloa was smitten and wanted to marry Sina so he sent his people to woo her. Sinamamala however did not want to have anything to do with him, thus the origin of my village's name of *Fatuatuana'i* or *Tuana'i* (passed over). Tuifiti (King of Fiji) also heard of Sina's beauty and he too came with his ship's crew to Samoa to win her heart. Sina was impressed and wanted to marry Tuifiti. Masefau however was worried about his sister's rejection of the Tagaloa's wishes and tried his best to change her mind but to no avail. Thus the Samoan saying *Ua ta lago a Masefau*, literally translated to mean Masefau preparing props for his boat to secure it, but signifying someone's good deed to achieve peace and security.

As expected the Tagaloa was extremely unhappy with Sina's rejection. While Sina prepared to sail away with the Tuifiti, Tagaloa called upon his spirits and demons to revenge Sina's unkindness. The thunder roared, lighting flashed like day; the wind blew fiercely and the rain poured heavily. Hence the origin of Saga's site of residence (*maota*) of *Uilaao* or *Uilao* (lighting flashed like day).

Sina with the Tuifiti and his crew perished and turned into stones. There is to this day a coral formation in the lagoon at Tuana'i, near the Catholic compound at Tofamamao, known as *Papa Seugogo* which is believed to be the unfortunate Sina, Tuifiti and his crew. And when the people from Savaii escaping the volcanic eruption in 1905 settled west of Tuana'i their village was named *Leauvaa* (boat crew) remembering the Tuifiti's crew.

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The second story is about my family of the Tuimuaiava title at Safaato'a village in Lefaga district, where my grandmother on my mother's side came from. Chief Losivalevale (or Losi) was a *sau'ai* (half man-half sprit), lived in Lefaga and controlled the whole bay. He guarded the first or main reef opening (*ava*) at Safaato'a so no boats passed through without his approval - hence Losi was also known as *Tui-mua-i-ava* (king of the first reef opening).

Losi on his first visit to the god Tagaloa in the heavens stole a taro shoot, hiding it in his body. Tagaloa's celestials suspected him and searched him but found nothing so they gave him a hiding and kicked him back to earth. Losi vouched revenge and sent his *aitu* (spirit) Vae'aumoana to spy on the heavens. Vae'au was known for his speed and hence the saying *Ia e vae ia Vae'au* (may your legs be quick like Vae'au).

Vae'au reported back on the sleeping habits of the Tagaloa people, that they slept late and took some time to be fully awake. Losi then caught some stingrays as 'gift' for Tagaloa. He arrived at dawn and laid the fish out between the house posts. When the celestials woke up and stepped over the fish they slipped and hurt their heads. Thus the saying *Ai ma le foa mea a Losi* (they ate Losi's food with sore heads).

The celestials then planned their own revenge on the humans and invited Losi to visit for a sports competition. Losi organised his friends to go with him which included Vaatu'utu'u of Falelatai, Teleiai of Samatau, Tuimulifanua of Mulifanua, Pei of Satuimalufilufi and Soaalo of Samauga.

First there was a sliding competition where Losi and his friends were to float down a waterfall straight back to earth and to their death. However Losi's other *aitu*, Fulufuluitolo, caught the humans as they came down the waterfall and were saved. Hence the saying *O le lave a Fulufuluitolo* (saved by Fulufuluitolo).

Second the celestials wanted an eating competition with a huge feast hoping that the humans would eat themselves to death. However Losi's other *aitu*, Mosofaofulu, ate all the food including the empty baskets so Losi and the humans were again saved. And thirdly a club fight was arranged where the celestials hoped to killed the humans. However the *aitu* Fulufuluitolo and Mosofaofulu broke the celestials' clubs and were defeated.

Tagaloa and his people at last admitted defeat and gifts for the victors they surrendered to the visiting humans their *Ao* (paramount chiefly titles) to take back to earth. When they returned Losi distributed the titles among his friends at the *paepae* (rock formation) – Lavasii stayed with Losi, Tagaloa to Vaatu'itu'i, Fiame to Teleiai, Taimalelagi to Tuimuifanua, Tuifaasisina to Pei and Fetafune to Soaalo. The paepae was thus named *Ta'ape pāpa* (allocation of titles).

The third story is about my family of the Lesā title at Saanapu village, where my grandfather on my father's side came from. The family geneology went from Fiji to Savaii to Tonga and back to Saanapu in Upolu. Sao from Fiji married Futiafu and had a daughter Sina who married Lauifanua of Safotu and issued a son Muasautele. He married Sinalalotava of Samauga and had a son Taumatamu who married Mualepuso daughter of Taemanutava'e of Sili and issues a son.

Taumatamu with his wife and their son travelled from Sili to visit his family at Samauga and at Amoa they came upon a *poula* (night dancing) between the village people and the crew of a visiting Tongan ship. When they stopped over to watch the boy went and slept under the

sails of the ship. Later when the couple continued their trip the boy was left behind, each parent had thought he was with the other. The ship sailed with the sleeping boy on board and was only discovered out at sea. He was named *Samoa-na-galo* (the Samoans that was forgotten).

It rained while the Tongans made a call at Mulifanua so the boy sheltered under a rock. When the Tongans set sail again the boy was left behind a second time. He ran along the shore after the ship and finally near Samatau village he managed to attract the crew's attention. Hence this place was called *Le-one-saa* (the sand where the boy danced).

The boat then sailed to Tonga and stopped at Vava'u Island in the Tongan Group where they were the guests of Lesā, the paramount chief of the Island. When the ship left for the capital Tongatapu the boy was left behind for the third time because he was spending the evening talking with Lesā. He was given a another name *Lesā-na-alala* (one that spent the evening talking with Lesā).

Lesānaalala married Tunaifitimaupologa, daughter of the Tuitoga (king of Tonga) and issued a son, Latuivai, who married the daughter of Seiulialii from Sataoa and issued a son, Latuivai (the origin of my Lesā family at Saanapu) and a second son, Lesānaalala, who married the daughters of Malietoa Laauli of the Malietoa family.

The stories I have presented above are three examples of many that have been passed down through successive generations of my family. As with any oral traditions questions have been raised on how really genuine they are. It would not be uncommon for people to adjust their stories to make them look good with greater influence while their opponents weak and less significant. While these stories may be part fact and part fiction and at times seem far-fetched, the important point is to understand the reasons or purposes behind them and what they represent (e.g. was it to gain status or acquire lands and titles or to seek revenge or retribution). Is there evidence today of any past achievement or historical connections to other families or places? What effects if any do those past events have on the way that my family operates at the present time? And how do these stories compare to those of other families or Samoan oral traditions generally – in other words how universally accepted are they in the Samoan context?

The story of Tuimuaiava Losivalevale is still the basis of the Tuimuaiava title today. The paramount chiefly title of Lavasii is bestowed by Tuimuaiava who is addressed honorifically as *tafa'i paia* or esteemed spokesperson (for Lavasii). Tuimuaiava is also the head of the orator group of *Tuisavailuu* for Safaato'a and Lefaga. He also bestows the title Tuiluluu, the origin of Tuisavailuu. The super natural aspects of this story would enhance Tuimuaiava's status as warior and group leader. Likewise the story Saga Masefau is the basis of the Saga (or Luafatasaga) title explaining the origin of the name of the village Tuana'i and Saga's place of residence of *Uilao.* The crew of the Tuifiti's boat is also remembered with the naming of a later settlement west of Tuna'i as Leauvaa. Both stories provide the background to a number of proverbs that are still widely used by orators in the speeches.

At Saanapu the story of Samoanagalo Lesānaalala describes the origin of the Lesā title. The titles Lesamoanagalo, Lesālatuivai and Lesānaalala are bestowed by Lesā and the name of Lesā's site of residence (*laoa*) of *Malaesaili* (place to seek wisdom) reflects the status of the title Lesā and how Lesālatuivai's counsel was sought by many as well as his connection to

various important families including the Tuitoga. This story also links various places and people with such names still in use today.

So as well as the physical connections that these stories provide there are also personal feelings and emotions that they create. These stories have helped me to understand my past and where I came from, making me appreciate my own place in Samoan society and how I can negotiate where I go from here on. They provide the linkages between my past, present and future, creating a sense of belonging to and security within my family and community. This for me was best illustrated by my wife, Dr. Vanya Taule'alo, in her art exhibition for her PhD where she explored the concept of her genealogy, the objects and stories that connect her grandchildren to her ancestors.

Finally the fact-or-myth question over my family oral stories really does not matter. Their legitimacy and relevance have been reinforced as they were passes down through family generations. They have filled many gaps in my family history and confirmed our connections (*faiā*) to others. And the Lands & Titles Court has also ruled in our favour based on some of these stories proving their critical role in understanding Samoa's traditional past generally and unraveling my own family's history in particular.

Some useful reading

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Samoa and Japan - concerns over mangrove development[1]

Juliet Boon-Nanai*

Abstract
The community based conservation (CBC) paradigm predicts that sustainable biodiversity can only be achieved if local people perceive benefits from conservation. Through interviews, the situation in Samoa portrays that the CBC of mangroves was received with apprehension because the mangrove biodiversity was more significant than sustaining the livelihood of the local communities. In contrast, Iriomote Island residents were able to achieve maximum socio-economic benefits but to the extent that they were over commercializing the mangrove ecosystem. More research is imperative to find out how biodiversity conservation can be married with sustainable development objectives to sustain the local communities' livelihood.

Introduction
Local perspectives and the achievement of development objectives are of fundamental importance to any resource management effectiveness or sustainability. Just at the turn of this century, community-based conservation (CBC) has gained much attention as a tool for achieving the twin challenges of biodiversity conservation and sustainable development. It is based on the assumption that by increasing the value of biodiversity to local communities and by empowering them to participate in the development or management of natural resources, local communities will take this as an incentive to conserve "their" biodiversity. Eventually, sustainable type of development will be achieved.

However, in this paper, an evaluation of CBC in mangrove development has shown some mixed results. In the mangrove conservation development at Sataoa-Saanapu the success in putting those concepts into practice has often been well below expectations. On the contrary, the CBC development of mangroves in Iriomote Island of Japan shows some success but also potential disadvantages. Samoa may be able to learn something from the CBC management of the Japanese.

This paper also argues that one of the reasons for some of the failures of CBC in mangrove development is attributed to the flaws and limitations of the sustainable development concept itself. Before dwelling on the results of this study, it will first highlight these limitations and define CBC to understand how these attributes have had mixed results in the CBC development of mangroves.

Sustainable development
Sustainable development seems to be the 'in-thing' of the twenty-first century. It has become so fashionable in the social science disciplines of geography, environmental science, and science that, in fact, the United National University declared January 2005 as the start of the 'decade of education for sustainable development.' In retrospect, the same scholars in these

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disciplines have argued that sustainable development has certain flaws and limitations for instance, in the definition itself.

Sustainable development is defined as the `sustainable or effective utilization of resources so that its supply can be maintained for the future generation.' In countries like Africa where famine is widespread and resources are meagre, the nation struggles to ensure that the inhabitants can make ends meet with the limited resources at hand. In such a case, how can one ensure that the supply for the future generation is maintained when the needs of the current population are not being met?

Second, sustainable development as opposed to economic development lacks a unit of measurement to ensure its progress. In economic development, the gross national product or GNP is used as a yardstick to measure a country's economic progress. In sustainable development there is none.

Third, since sustainable development does not have any measurement, it does not also have a blueprint or guidelines to show one method or approach on how sustainable development can be achieved. Despite these limitations, development planners has tried to adapt certain approaches such as CBC to try and achieve sustainable development. Sustainable development and CBC has some similarity in its definition as follows.

Community-Based Conservation (CBC)

CBC is defined as the "organized efforts to increase control over resources" (Pearse & Stiefel, 1979; Paul, 1987).[2] The approach implies a bottom's up approach as opposed to the top-down approach that has been blamed for a lot of the developmental failures within the last two decades. It can happen in four ways, that is: pressure from individuals, sometimes landowners; initiated by private charitable or commercial organizations; grassroots pressure from indigenous people; and direct intervention by central government.[3] Most of the CBC programmes imposed upon mangrove environments are directly intervened by the central government. Such has been the case portrayed in the two contextual areas of Samoa and Japan.

CBC of mangroves in Samoa

CBC of mangroves in Samoa has already been examined in Boon (2003).[4] To reiterate its findings the CBC mangrove project was short-lived because the conservation of the mangroves was at the expense of the socio-economic livelihood of the local dwellers. When the project stipulated a 'no enter no use' approach to the mangroves local people were disatisfied because the mangrove ecosystem and its surroundings were the basis of the local people's livelihood. They relied on it for: marine products daily not only for food but cash income and family, village and even church obligations occasionally, mangrove wood for construction; firewood daily; domestic activities when water supplies are cut occasionally; recreation such as swimming for the young ones occasionally and decoration for many festivities; and many other uses.[5]

Second, a change of mangrove use for ecotourism was new. Many were not inadequately skilled to pursue it but also the Ministry of Environment conservation area officer as well as the Tourism Authority personnel did not have follow up to ensure ecotourism is sustained and well maintained. It was clearly evident in this case that since the CBC was not initiated by the local people there was very little committment to ensure its development.

By way of summary, any development project should come from within the community and if it is initiated by them they will ensure that the beneficial outcomes of the projects will be for them and not to meet international aid stipulations. Local government bodies as well should maintain follow up monitoring of any new project to ensure its sustainability. Park et al. (1992)[6] distinctively wrote, 'if you want to protect the Samoan environment you must rely on the villagers to do the job.' A more effective implementation and follow up programme is imperative to ensure that there is continuous particiaption, interaction and sustainability of the programme until the villagers are convinced that there is a holistically beneficial effect from the ecotourism project. The case somehow differed in the Iriomote Island case in Japan.

CBC on Iriomote Island, Japan

Iriomote Island, with a population of only about 2000 people, is the second largest island approximately 289 square kilometres in Okinawa Prefecture. Because of its position around the 24°17 north latitude and 123°53 east longitude in the Pacific Ocean, the climate is subtropical with heavy typhoons during the months of June to October. About 90% of the island is state-owned, half of which is a national park with a total mangrove forest area of about 400 hectares (Figure 1).[7]

In the same year when Okinawa was returned to Japan in 1972, the national government designated Iriomote Island as their national park to protect in particular the Iriomote wildcat (*Felis iriomotensis*) as evident in Plate 1. Before 1967, this cat was unknown. In 1996, this wildcat is now proven endemic to the island and it is categorized as an "endangered" species in the International Union for Conservation of Nature's (IUCN) Red Lists. Later on, in 1998, the Japan's Environment Agency (JEA) has proven through their annual green survey that there is only about 100 cats survive.[8]

Plate 1: The Iriomote Wildcat[9]

In protecting the wildcat, there was a concern not only to conserve the scenic beauty of forested areas but also protect the mangrove forest and some endangered species including the crowned or crescent serpent eagle (*Spilornis cheela perplexus*), emerald doves, and the

Cuora falbomarginatas. Through the JEA's green survey it was discovered that the endemic flora or plant species is important and rare not only to the island but also in Japan and to other subtropical areas in the world, as Ota eloquently puts it, a 'world treasure-house of untouched nature'.[10] However, the main reason for preserving the mangroves was because during low tide and at night time, the wildcat wonders through these areas to find food as identified through traces of its footprints as found in a research study. By monitoring these footprints, the same sizes and traces of it were also found in the forest areas during the day time when there is high tide.[11] Through these research findings, the governmented controlled the infrastructural developments of the island by using zoning measures. In effect, the Ministry of Environment zoned the park into three areas, known as the *special, ordinary* and *marine reserve* park sections.

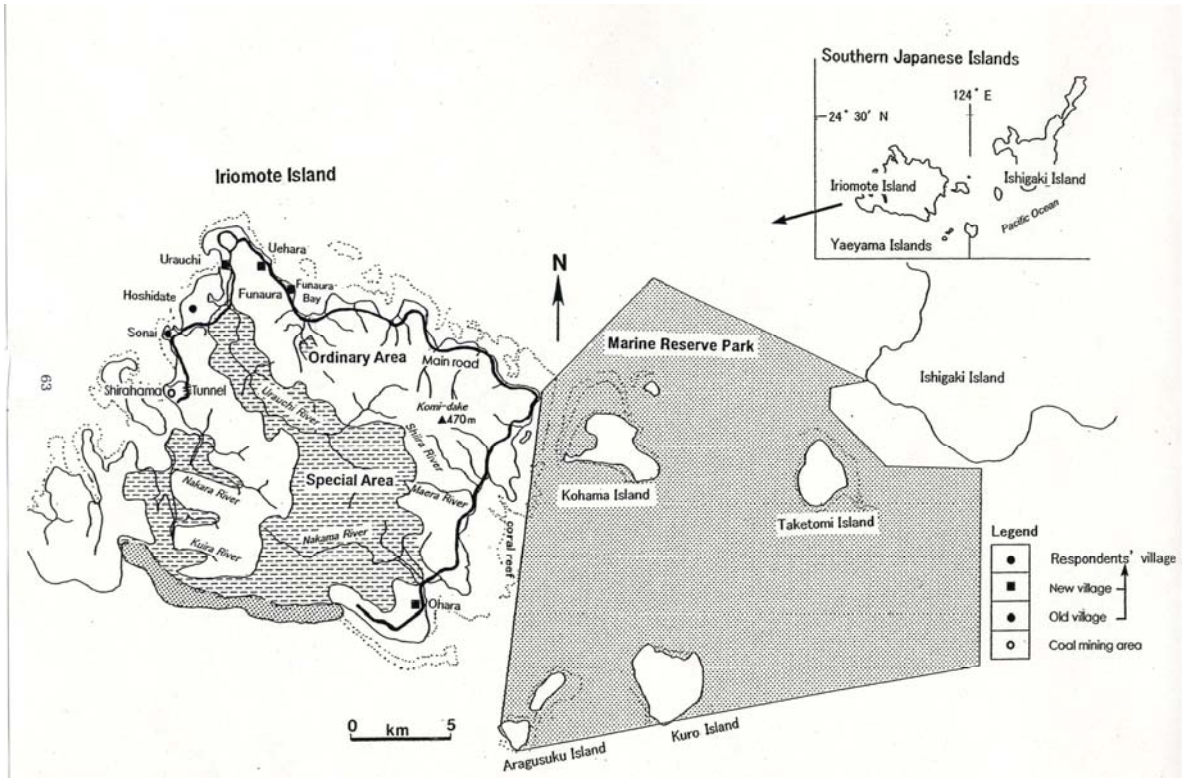

Figure 1: Iriomote Island Park Zones, Okinawa, southwest Japan[12]

In the special and marine park areas almost no developments are pursued while the mangrove areas, the Sekisei Lagoon as well as the entire settlement villages are ordinary areas. Development activities can progress in the ordinary areas with the Ministry of Environment's approval. All mangroves are national forest managed by the Forestry Department whilst construction activities are controlled and managed by the Ministry and the Taketomi Town Office. The approved infrastructure constructions support nature-based activities in particular ecotourism. For example, only one main road surrounds the island with limited footpaths. Travelers to Iriomote Island can only be reached via a 45-minute ferry from Ishigaki Island where the main airport is located, the only other evident constructions are the ship transport and mooring facilities. Picnic areas and related facilities are sparsely found in the area to serve the ecotourism industry while the locals are given fishing permits only to fish far out in the sea within October to March for the sake of regeneration in summer..

Interestingly, through interviewing, those who were monitoring these controlled development on the Iriomote Island national park had introduced another type of industry which was somehow in its embryonic form but could perhaps be an appropriate model for sustainable development to achieve, that is an education based industry.

Education-based industry in Japan

Within the last three decades, the Faculty of Agriculture of the Ryukyu University set up an Iriomote Station to utilize the area as a 'living laboratory' to conduct research on subtropical animals and plants in the region, building a research base amidst the abundant surroundings. Since 1994, it has been renamed as the Tropical Biosphere Research Centre. The Centre has extended its affiliations to the Ministry of Education who assists in promoting research via funding provisions.

As a living laboratory, the Director of this Tropical Biosphere Research Centre has promoted vast research not only in mangroves but in all other flora and fauna. The studies are numerous. Mangrove ecosystems dynamics in all aspects – human and physical – have been researched published for instance in the *Galaxea* journal, which is dedicated just on mangroves. The GLOMIS – Global Mangrove Information System – websites are filled with many other articles on mangroves. This goes to say that many who have interaction with mangroves are mainly researches.

In a study conducted on fifteen Iriomote Island residents, six mangrove-related activities (MRA) were identified by simply asking *what do you do when you enter the mangroves*?[13] Figure 2 portrays these type of activities which includes: research/education, kayaking, sightseeing, leisure, food extraction, and dyeing. The study also showed that not all those who had interaction with mangroves were inhabitants. Four groups of people were identified. They were the: 1) Iriomote Island indigenous (or inhabitants), 2) second-generation residents of earlier migrants to Iriomote Island before it became a National Reserve, 3) newly established immigrants to Iriomote Island after it became a national reserve, and the 4) seasonal visitors. These people were all Japanese and although came from different places within Japan. Although they had diverse Japanese origins they all had a bearing on the maintenance of these activities on Iriomote Island in general.

Education based industry relies on the information and results of the research studies conducted in the Iriomote Island flora and fauna. The idea is that when a group of researchers have completed their researches, the Centre will then publicize a seminar on the website. Hopefully, the results will attract interest from other researchers all over the world and within Japan. When the recipients are intrigue about the results and are encouraged to visit Iriomote Island, they will attend and participate and would have to pay registration. When these seminars are held, local inns will have guests. Those involved in the primary agriculture will be able to supply the local inns with fruits, vegetables, and meat or marine products while transport tours will be arranged and the socio-economic status of the people will improve. With this type of industry, there are only footprints within the ecosystems. As long as the island is used in this way, the environment is maintained and preserved for further research.

In this sense, the education based industry is based on information and by sharing it via seminars it becomes like a business where you pay registration, accommodation and food like a business venture. Such a type of industry aims to strengthen the local people's knowledge on their environment as well, by desimanating these research results and findings. In this way, the education based industry ensures that it has a multiplier effect to all other sectors.

Already there are local people of the second generation on the Island who are conducting kayaking, ecotour guiding, sight-seeing and self-guided tours as indicated by Figure 2 findings. Within the Urauchi River (see location in Figure 1) where there are mangroves, a motorboat sightseeing with a self-guided tour in the mangroves cost an adult 1,500 yen (~ $15USD), while the child half of this (750 yen or $7.50 USD). According to the owner, the Urauchi River Ecotour Company receives an average of 300 visitors a day. On a yearly basis, 50,000 was reported, a number that has tripled since it begun. Compared to the national statistics of 1998, there are 250,000 tourist arrivals to Iriomote Island which means one fifth visits the Urauchi River mangroves for either sightseeing or kayaking to this company.[14] A more accurate reporting on the statistics for those visiting the island for such seminars and sightseeing for these flora and fauna will manifest the success of this venture.

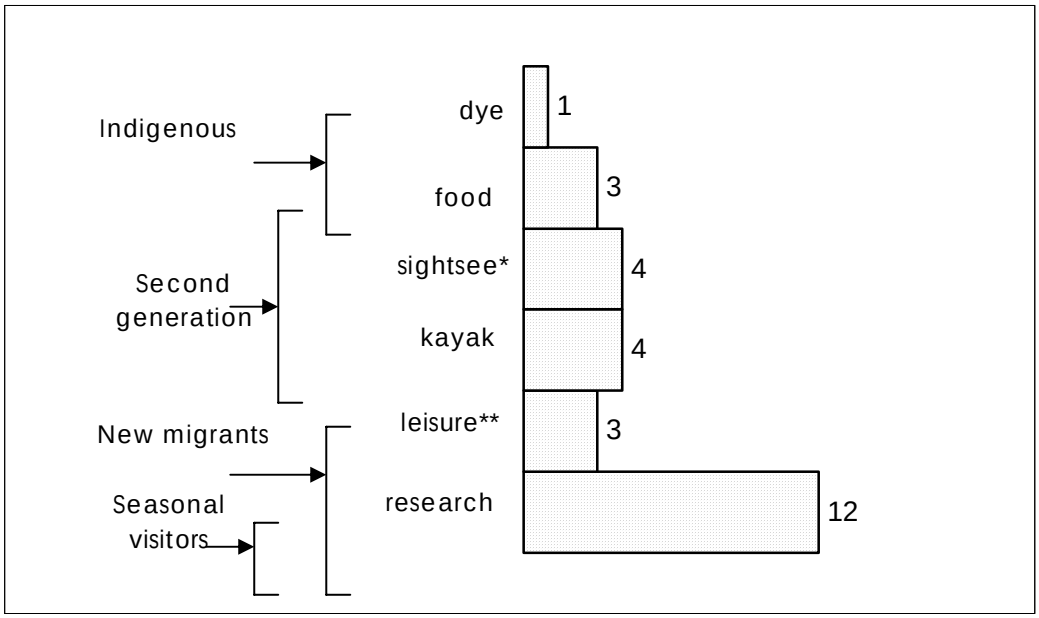

Figure 2: Iriomote Island respondents MRA
*includes motorboat rides and nature trekking; **leisure includes bird watching, nature walks, wildlife photographing

Conclusion

In conclusion, those who have interaction with the Iriomote Island mangroves were mainly the academics who were grouped as seasonal visitors in particular the researchers. The residents do not rely solely on this ecosystem for a subsistence livelihood as the Samoans. Therefore, the balance in maintaining their socio-economic status as well as preserving the biodiversity of the area seems to have some success in such a CBC. In Figure 2, there is evidence that Iriomote Island people maintains the aesthetic and leisure way of lifestyle which assures the quasi-naturalness of the local ecosystems and are deemed appropriate for what is left of Japan's wetlands in the context of an overcrowded and congested mainland already environmentally polluted and destroyed. However, Shackley (1996) has noted that if the number of tourists increases to more than a 100,000, they will eventually develop the `Galapagos effect' where the ecosystem will be destroyed because too many will tramp on the various ecosystems. More research is therefore needed to strike the right balance on maintaining environment and socio-economic status of the locals concerned to attain sustainable development.

Notes

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Status of hawksbill turtle nesting in Samoa, 2003/2004

Mauigoa Lui Bell, Malama S. Momoemausu, Juney Ward & Malaki Iakopo*

Abstract
Globally marine turtles are experiencing serious threats to their survival and are considered internationally as species of conservation concern. Due to this status, they are listed in the World Conservation Union "Red List of Threatened Animals"; listed in the Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); and are a priority for conservation under the Convention on the Conservation of Migratory Species of Wild Animals. Over-hunting for their shells and meat and the collection of eggs from turtle nests are some factors attributing to the endangered status of turtles. In the South Pacific, turtle declines are worsened by the breakdown of traditional conservation practices, the use of powered boats in turtle hunting, commercial sale, large scale harvesting of eggs in the rookeries and habitat destruction. Of the seven species of turtles found worldwide, three occur in Samoan waters. The most common species are the hawksbill turtle (*Eretmochelys imbricate*) and the green turtle (*Chelonia mydas*), while only a few specimens of the leatherback turtle (*Dermochelys coriacea*) have been caught tangled in long-line fishing lines for tuna in Samoan waters. The Hawksbill turtle is the only species known to nest in Samoa. Records from previous surveys indicate its nesting season in Samoa to occur from September to July, with most nesting activity occurring in January and February. A study conducted in 1994 noted that turtles in Samoa waters have declined.

Background
During the 2003/2004 nesting season the Division of Environment & Conservation conducted the third ever survey on turtle nesting at the Aleipata Islands. In addition, a preliminary national survey was conducted on the extent and current status of nesting sites for turtles through-out Samoa. Results of these surveys are presented in this paper. The paper compares results of previous surveys and the 2003/2004 survey, and analyses methodologies used. It also discusses factors, such as development and natural, which are impacting on the suitability and extent of turtle nesting sites in Samoa. The paper also provides recommendations for turtle conservation in Samoa.

Globally, populations of sea turtles are declining. All species of sea turtles are listed in Appendix I of the CITES. This means that all turtle species are considered endangered by international trade to such an extent that if commercial trade is not eliminated with respect to these species, they will become extinct. Nesting density of hawksbill turtles is low throughout its range.

Over-hunting of marine turtles for their shells, meat and over-collecting of eggs from nests are some factors attributing to the endangered status of turtles. It is believed that the declining turtle populations in the South Pacific has been accelerated by the breakdown of traditional conservation practises, the use of powered boats in turtle hunting, commercial sale, habitat

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degradation, incidental by-catch in fishing gear, and the large scale harvesting of eggs in rookeries.

A study conducted in 1994 noted that turtles in Samoa waters have declined (Schuster *et al*, 1994). The lack of statistics concerning the utilization of the turtle resource in the country has made it impossible to trace trends in effort and landings, thus the status of turtles. However, anecdotal information from catches made by villages that traditionally fish for turtles indicate declining catches.

Three species of marine turtles have been recorded to occur in Samoa waters. The most common species are hawksbill and green turtles while only a few specimens of leatherback turtles have been caught tangled in longline fishing lines for tuna in Samoan waters. The Hawksbill turtle is the only species known to nest in Samoa although the green turtles forage within Samoan waters but migrate elsewhere to nest.

Previous nesting turtle surveys in Samoa

Two surveys have been conducted in Samoa involving hawksbill turtle track and nest counts. These were during the breeding season periods in 1971/72 and 1993/94. Records from these surveys indicate the hawksbill turtle nesting season in Samoa to be from September to July, with most nesting activities occurring in January and February (Witzell & Banner, 1980).

The survey on the Aleipata islands during the 1993/1994 nesting season did not find any "measurable decline in nesting activity over this period of time with a total of 94 tracks/nests in 1971-72 and 109 tracks/nests in 1993-94" (Schuster *et al*, 1994). However, it is noted that October and November data for the 93/94 survey were "calculated from their first track and nest count totals (December) using the proportions derived from the 1971-72 data" (Schuster, *et al*, 1994). However, the accuracy of this method is questionable.

The 2003/2004 survey

Very limited effort has been specifically directed to turtle nesting surveys with only two so far conducted within a period of 30 years. While this reflects the irregularity of gathering turtle information, the 2003/2004 survey was initiated in an effort to continue assessment and monitoring of the status of turtles nesting in Samoa.

The main aim of the survey was to assess the present nesting levels of marine turtles (hawksbill) in Samoa. It was envisaged that the findings of this survey would indicate trends in turtle populations that nest in Samoa as well as the overall population and likely impacts of other factors on these breeding populations. Furthermore, the outcomes would i) contribute to improving the Samoa National Marine Biodiversity Database through incorporating information on marine turtles as one of the species of conservation concern; ii) provide guidance for developing a monitoring plan that include establishing proper guidelines and methodologies, accommodating specific local situation, etc. to improve the collection, compilation and analysis of data for nesting turtles in Samoa; and iii) serve as a basis for determining effective means of protecting, conserving and managing the population of marine turtles in Samoa.

Methodology

The survey was carried out in two phases of activities – a questionnaire survey of turtle nesting and a field survey at Aleipata. The questionnaire survey was conducted with pulenuu from 101 coastal villages selected throughout Samoa mainly to obtain information on how

widespread turtle nesting occurrences were in the past and that of current. These villages were selected in terms of coastal location and the likeness of the presence of adjacent beaches. The survey would indicate the status and trend of turtle breeding grounds in the country. The questionnaire has 17 basic questions that fall under three main categories on: i) General information on turtle occurrence in village adjacent sea; ii) Current turtle nesting; and iii) Previous turtle nesting (Table 1).

A field survey was conducted on the Aleipata islands from July 2003 to May 2004 mainly to obtain information on the current level of hawksbill turtle nesting. For comparison with previous nesting turtle surveys, the field survey was concentrated on the islands of Aleipata: Nuulua, Nuutele and Namu'a. The beach at the village of Vavau was also visited once.

Daily visits

The original plan was to visit all target beaches on the Aleipata islands once every second week during the nesting period (October 2003 – May 2004) with the field visit frequency increasing to once a week in the peak months of January and February 2004. However, circumstances encountered (e.g. rough weather making it impossible to visit Nuulua/Nuutele, late processing of payment for the hired boat etc) restricted the number of field visits.

Schuster *et al* (1994) reported that turtle tracks through the cover of vines above the high tide mark on beaches at Aleipata remained visible for at least one month. An effort was made to assess the reliability of this assertion. Tracks and nests found during one visit were recorded in the prescribed Form and marked with sticks and stones to avoid re-counting in the next visit.

Overnight visits

Overnight visits were also conducted to look out for turtles that come up to the beach to nest. Any turtles visiting to nest during the field visits were tagged (if untagged) and basic data was recorded. If the turtle was already tagged, the tag identification basic data were also recorded.

The field survey also attempted to assess the suitability of the beaches for turtle nesting. This was prompted after cyclone Heta, which affected Samoa on 3-5 January 2004, and resulted in dramatic change in the beach and nesting area formation. The assessment only looked at the surface level of the beach area at high water mark (through which the turtle would crawl) and the nesting area (above high water mark).

Results of the field survey at Aleipata

Numbers of tracks and nests

The numbers represent the actual tally of records recorded during the surveys, some of which may not represent a good estimate for the month due to limited surveys conducted on some beaches during some months.

Nuulua - For the November survey, of the 13 tracks, only 10 were linked to confirmed nests. Three other tracks were linked to 3 undetermined nests. Three of the confirmed nests did not associate with any tracks. Two additional nests were abandoned (incomplete) ones and were not associated with any tracks. Nests made in December 2003 and January 2004 would have been picked up during these surveys.

Subject	Results
Turtle occurrence	Turtles were found to occur in the marine environment of all the 27 villages surveyed on Savaii island. However, of this total, turtles are often seen or plenty in 25 but reported to be occasionally seen in two villages. On Upolu island, turtles occur in 81 of the 83 surveyed villages. Of the 81 villages, turtles are often seen in only 61.
Turtles caught in fishing	On Savaii island, turtles are often caught in fishing activities in only 23 villages. On Upolu, 54 villages reported that turtles are often caught during fishing activities.
Specific fishing method for turtles	On Savaii, only six of the surveyed villages claimed to have or have had a special fishing method which include nets, spears and loops. Seven villages on Upolu were recorded as having special fishing methods for turtle hunting.
Time of year turtles are abundant	10 villages on Savaii experienced turtles to be abundant all throughout the year, three villages indicated the end of the year (Oct-Dec) while the majority had no idea.
Turtle activities when abundant	The majority of the surveyed villages on Savaii had no idea while only a few indicated nesting as the activity associated with turtle occurrence.
Types of turtles	The vast majority of respondents on Savaii did not know the types of turtles that occur in their waters while only a few know the 2 types. On Upolu, very few know of only 1 or two types while the majority had no idea.
Village rules concerning turtles	On Savaii, most claimed that their villages have no rules concerning turtles while the rest either have rules or had no idea. On Upolu, some villages have while some don't.
Awareness of legislation on turtles	The vast majority of the villages surveyed on both Savaii and Upolu were and are aware of national legislation concerning turtles. Very few were either unaware or had no idea.
Existing beaches and current turtle nesting occurrences	On Savaii, 21 villages have beaches and although turtle nesting activities occurred in the majority of these villages in the past years, only a few have had recent nesting activities. In two villages, it was unknown whether turtle nesting still occur because the beach is quite further off. The majority of villages surveyed on Upolu have beaches and turtle nesting still occur in few villages. Similar to Savaii, turtle nesting activities have been frequently seen in the past in almost all of the villages.
Time of turtle nesting	In both Savaii and Upolu, turtle nesting is mostly observed to occur at the end of the year especially October during the Palolo season. Some villages believe that there is no specific time but this particular turtle activity is associated with a particular type of lightning.
Estimate of nesting turtles	The survey found out that a large number of turtles still come up to nest in the majority of the villages.
Turtle eggs consumption	On both Savaii and Upolu, turtle eggs were and are still consumed in a few villages. Turtle eggs were heavily consumed in the past.
Turtle nesting in the past	On both Savaii and Upolu, turtle nesting occurred in the majority in the past however, this has no longer been observed in some villages. This is attributed to beach modification for tourism, settlement, sea wall construction and cyclones.

Table 1: Results of the questionnaire survey for both Upolu and Savaii Islands, 2003-2004

For the January surveys, of the 9 tracks, only 5 were associated with confirmed nests, 3 with undetermined nests, and 1 with no nest. Four other confirmed nests were not associated with any track. Three of the tracks recorded during February 2004 were associated with confirmed nests, 2 with no nests and 1 with an abandoned nest. Two other determined nests did not associate with any track (Table 2).

Date	Tracks	Nests
November, 2003	13	13
January, 2004 (2 surveys)	9	9
February, 2004 (2 surveys)	6	5

Table 2: Number of tracks and nests recorded, Namu'a Island

Date	Tracks	Nests
November, 2003	0	5
December, 2003	12	22
January, 2004 (4 surveys)	8	7
February 2004 (4 surveys)	9	5
May 2004	0	0

Table 3: Number of nests and tracks recorded on Vini beach, Nuutele island

Vini Beach (Nuutele Island) - Only 1 survey was also possible on Vini in December given Cyclone Heta and the Xmas holidays. Of the 12 tracks, 11 were associated with nests while 1 did not link to any nest. 11 other nests were found which did not associate with a track. For the January 2004 surveys, four of the tracks were linked to nests, 2 to no nests, 1 to an undetermined nest, and 1 to an abandoned nest (actually the same turtle tried digging at 2 different places before giving up). Three of the 7 nests identified had no links to any tracks. For the February surveys, five of the tracks were linked to the 5 nests located, while 2 tracks linked to no nest, 1 to an undetermined nest, and 1 to an abandoned nest. The survey did not locate any new tracks or nests on Vini beach in May (Table 3).

Nuutele Beach (on Nuutele Island) - Two surveys were possible on Nuutele beach throughout the survey period. A total of 5 tracks and 8 nests were recorded in the one survey in December 2003. Three of the tracks were associated with corresponding nests while the other 2 were linked to undetermined nests. Additionally, five other nests as well as 1 undetermined nest were found that did not have tracks. Only one track and a corresponding nest were recorded in the only survey possible on Nuutele beach in January 2004.

Namu'a Island - Only 2 surveys were conducted on Namu'a island in February, 2004 during which a total of 4 tracks and 4 associated nests were recorded.

Vavau Village - One track and a corresponding nest was recorded in a visit to the village beach on 27 February 2004. In addition, a resident of Vavau village at the time took to the Fisheries Division hawksbill hatchings which were later on brought to Division of Environment & Conservation by the Fisheries Division. Measurements were taken and hatchlings were released off Vaiala beach.

Beach suitability for turtle nesting - The assessment was very limited in that only the top layer (surface) was considered. It was later discovered that this was insufficient as discussed

under the Discussion section of this report. The results of the assessment, using the surface only, are summarised in Table 4.

Beach Name	Estimated Beach Length (m)	Access Area				Nesting Area			
		Suitable		Unsuitable		Suitable		Unsuitable	
		Length (m)	%	Length (m)	%	Length (m)	%	Length (m)	%
Nuulua	444.3	195.4	44	249.0	56	207.3	47	237.0	53
Vini	711.2	273.8	38.5	437.4	61.5	262.3	37	402.5	57
Nuutele	381.6	289.6	76	92.0	24	160.4	42	221.2	58
Namu'a (north)	201.5	173.5	86	28.0	14	181.5	90	20.0	10
Namu'a (south)	80.0	80.0	100	0.0	0	80.0	100	0.0	0

Table 4: Estimated access and nesting area suitability for turtle on Aleipata Islands

In relation to the total estimated beach length, Namu'a and Nuutele beaches are fairly suitable in terms of access area compared to Vini and Nuulua beaches. In terms of nesting area, Namu'a remains suitable for turtle nesting while Nuutele, Vini and Nuulua have been noted to be degraded hence unsuitable.

Comparison of the 71/72, 93/94 and 03/04 survey results

The first two surveys only recorded tracks while the third one was able to identify tracks, nests, undetermined and abandoned nests. In comparison, more tracks were recorded during the second and first surveys (Figure 1).

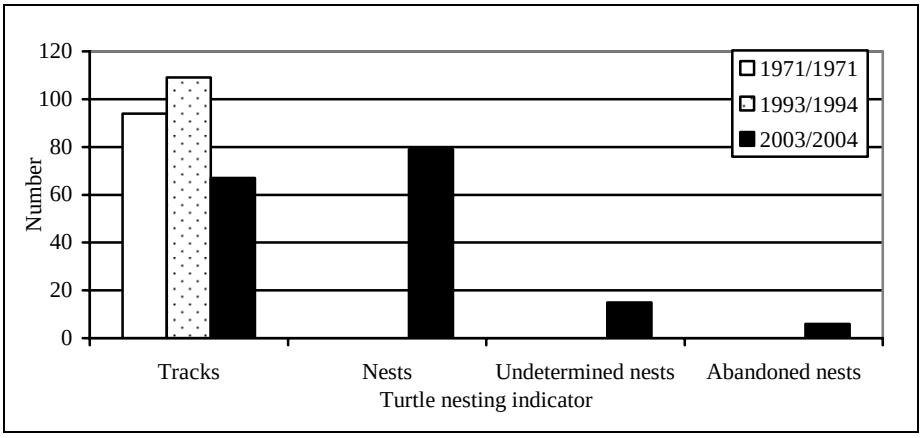

Figure 1: Comparison of the three turtle nesting surveys, 1971-2004

Discussion

National turtle nesting survey

Turtle occurrence: Turtles still occur in the marine environment of most villages and are seen frequently in higher numbers in some depending on the village beach locations and conditions. Turtle occurrence is widespread in Savaii compared to Upolu which is further supported by the fact that turtles are often caught in fishing activities. Unfortunately it was not possible to quantify this in terms of the estimated number of turtles caught per month or year.

Special fishing method for turtles: Having a special fishing method for turtles can be used as a measure of the traditional value placed on turtles by a specific community. It can also be an indication of the abundance of turtles in the area. Special fishing methods for catching turtles include nets (including special nets made of local materials and have been used in the olden days), spears and bamboo poles with large hooks. With the technological changes, some of these are no longer used.

Current turtle nesting: Turtle nesting currently occurs on beaches in villages on both Savaii and Upolu that were included in the survey. Although this seems to be more than previously recorded, this is limited given the small sizes of most of the beaches and the dramatic decline in the number of beaches where nesting occurs. It is believed that there are other beaches where turtle nesting may still exist in villages not included in the survey, e.g. Asau as reported in Schuster *et al*. (1994).

In villages where turtles currently nest, people know that turtle nesting occurs towards the end of the year. However, the respondents that did not know when turtle nesting occur is most probably a reflection of the unfamiliarity of the individuals with the subject. An interesting belief, as recorded for Savaii is that turtle nesting is associated with a particular type of lightning. This belief is common through-out the country as also relayed by respondents in Aleipata (Upolu).

Diminishing turtle nesting areas: The results of the national survey, using the questionnaire, clearly confirm the diminishing areas available for turtles to nest in Savaii. The data indicates that, in terms of numbers, half of the turtle nesting areas have been "eliminated" as nesting areas due mainly to infrastructural activities along the coast involving developments such as seawall construction, tourism facilities and settlement.

Field survey at Aleipata

Numbers of tracks: The highest number of turtle activities (tracks and nests) recorded on Vini beach indicates that turtles more often visit this particular beach to nest during the season although it was noted to be at a diminishing state. Nuulua beach is also known to be another favorable and major nesting area given its location (easy access) and white sand. There are also turtles visiting to nest on Nuutele, Namu'a and Vavau beaches meaning these are also favourable nesting sites. Tracks and associated nests were found amongst the bush, vines, clear sand and areas with some rubbles.

Although the frequency of visits to the targeted sites varied, the results have indicated that Vini has served to be the major nesting beach for the hawksbills followed by Nuulua, Nuutele, Namu'a and Vavau beaches. At the same time, these beaches had some areas unsuitable for nesting as indicated by the discovery of few abandoned and undetermined nests.

Human-related and natural events such as cyclones can significantly affect the physical make up of the beaches and thus its suitability for nesting. As a result, turtles from time to time move from one beach to another until it finds a suitable area to nest. In other words, the environmental conditions are one of the major determinants of turtle nesting activities. This explains why turtle activities vary with nesting beaches and season.

The attempt to assess the suitability of beaches for turtles to nest was initiated after observation of the impacts of cyclone Heta which affected Samoa on 3-5 January 2004. The

assessment noted that using the surface area only is insufficient to determine the suitability of the nesting area. This was obvious after discovery of an abandoned nest in an area where the surface was rated as suitable but beneath were course rubble making it impossible for the turtle to dig a deep enough nest.

Combination of the questionnaire and field survey in 2003/2004

The questionnaire and field surveys as one obviously shows the following major trends:

i) There have been more turtle nesting occurrences in the past than that of current both on Savaii and Upolu Islands.

ii) The number of nesting beaches has declined and thus possibly turtles nesting activities as a result of some destructive human activities as well as natural impacts on the coastal environment, and

iii) Turtle nesting mostly occur on the beaches at Aleipata district and vicinity but there are some other possible ones on both islands.

Comparison of the 71/72, 93/94 and 03/04 survey results

The first two surveys only recorded tracks compared to the more detailed 03/04 which spells out tracks, nests, abandoned and undetermined nests. This prevents an accurate comparison however based on the data obtained so far, it is possible to say that tracks and nests have declined over the years hence turtle nesting activities due to the impacts of a combination of human and natural related factors on the marine environment which subsequently affect the turtle population.

Conclusion

The 2003/2004 nesting turtle survey shows that although there is seasonal variation as per survey findings, there are still nesting turtles within the waters of Samoa which are utilizing the beaches of Aleipata for nesting activities. Besides, there are still but very few other possible nesting beaches on both Savaii and Upolu Islands.

It is becoming clear that turtle (hawksbill) nesting in Samoa is declining mainly as a result of human activities causing degradation of the coasts and nesting beaches.

The Survey overall suggests the need for a more site/beach specific or site-level approach to turtle conservation in Samoa.

Recommendation

For the improvement of the survey in terms of methodology and the quality of the data collected, as well as the conservation of turtles in Samoa, it is recommended that:

- The national nesting beaches survey via questionnaire needs to be expanded to cover all coastal villages and interviewing more than 1 person in each village. The high number of "don't know" answers provided by those interviewed indicates the level of knowledge of the person interviewed on the subject or of the village. Either the number of people be interviewed in each village be increased, or a knowledgeable older fisherman be sought to obtain more complete data.
- Survey methodology, including frequency of surveys on nesting beaches, needs adjustment to obtain more reliable and accurate data. This survey confirmed that not all nests associate with turtle tracks and vise versa. The former assertion that tracks remain visible for up to a month through the vines is unreliable to be used for the number of nests and/or nesting females. Both tracks and nests in the sand can be obscured due to rain,

wind, tide etc, after even a short time. Thus the more often the surveys are conducted, the higher the possibility of obtaining accurate and wholesome data.

- Turtle nesting grounds be a factor for consideration in development and EIAs involving the coastline. The loss of turtle nesting sites in several areas both on Upolu and Savaii due to development has been confirmed by this survey.
- Turtle nesting surveys need to be repeated and expanded. Given the nature of the breeding cycle of turtles, the need to obtain an accurate estimate of the numbers and trend of breeding turtle population in Samoa, as well as the need to tag and take measurements of turtles to determine their migratory routes, repeated surveys are required. Effort should also be made to target other areas confirmed to be nesting sites for turtles in Samoa.
- Conservation arrangement with traditional landowners. Most of the turtle nesting areas in Samoa are on traditional lands making it difficult to conservation effort to be enforced. Traditional landowners can be encouraged to be involved in conservation effort and in enforcing existing legislation.
- Increase turtle education and awareness campaign. The high responses of "don't know", e.g. on the types of turtles, is an indication of the need to increase public awareness. In addition, it was noted that some of the respondents were not aware of the turtle subject. It is important to conduct education and awareness programs in the communities and should involve the different groups.
- It is necessary to link local researches and surveys results to regional and international efforts to collaborate and share information on these valuable but threatened resources.

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Participatory approaches for environmental initiatives – community consultation in Samoa

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Can participatory approaches be fully realised in Samoa given the formal village fono system?

Participatory approaches (PAs), or consultation where community input is a major part of the project, share a common emphasis on enabling local people to play an active role in their own development. Local people can and should appraise and analyse their own situation and look for solutions to problems.

Samoa has a strong tradition of respecting local knowledge and allowing village fonos (councils) to undertake the role of local governance. When projects arise that affect more than one village, outsiders are often brought in to facilitate discussion and consultation amongst villages and districts and to bring their expertise and experience to the project.

There have been several recent projects in Samoa that have undertaken community consultation and that have required community involvement and agreement for success. This includes the Coastal Infrastructure Management Plan project, fisheries reserves projects, various Samoan Water Authority projects and the establishment and development of the Planning and Urban Management Agency and some of these will be discussed here. Different approaches to consultation have been undertaken in these projects with different goals to reach. The findings show mixed results as to the extent and value of consultation tools used.

What options are there to widen the 'net' of consultation and community participation in projects that will directly affect village life and Samoa's environment? Can community consultation in Samoa be more gender-sensitive? Must consultation be undertaken in a group format? How can the marginalised be assured of a voice?

This paper will examine the participatory approach theory and address these questions as they relate to Samoa.

Participatory Approaches (PAs) for environmental initiatives seem logical, sensible, humane even. It does make sense to listen to local knowledge. To allow decisions and plans to be made and undertaken by local communities who know their own environment intimately. Emphasis with PAs is placed on empowering local people to assume an active role in analysing problems and drawing up plans, with outsiders mainly acting as "facilitators". Initially, participatory approaches were created as malleable and changeable approaches to project design and implementation in contrast to top-down imposed ways. It encouraged innovation and experimentation to mould the approach to suit the local conditions (Chambers

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1992). Empowerment, or the shift in power from the powerful to the powerless and helping people to recognise their own strengths and skills, requires a sense of humility and a humanistic approach. Many conventional (and perhaps top-down) development approaches view outsiders as experts and the beneficiaries as passive recipients of outsider's expertise. Participatory work aims to alter these power dynamics and challenges notions of outsider expertise.

Samoa has a strong tradition of respecting local knowledge and allowing village fonos (councils) to undertake the role of a decentralised 'local' government. It has been recognised that local people, or at least the matai (village chiefs), are normally in the best position to conduct their own appraisal and analysis of their circumstances and problems. Customary tenure plays a significant role in the preservation of traditional lands and local power over those lands. Samoan culture is based on the communal lands and title system where families can live on communal lands owned and managed by their forefathers (ADB 2001a). Customary land remains the main source of wealth for Samoa representing family, identity, history and security and not surprisingly attachments to and within the village are strong. The Village Fono Act 1990 recognises traditional law for maintaining law and order within the village and allows for the enforcement of the preservation of the village environment including land use and planning of development (Jones et al 2002). This fact bodes well for community consultation using a community development approach.

Participatory approaches can be undertaken in many ways and are encouraged as part of the principles of Agenda 21, the Rio Declaration on Environment and Development. In particular Principle 10 outlines the importance of participation of all concerned citizens in the handling of environmental issues and Principles 20, 21 and 22 espouse the vital role that women, youth and indigenous people play in environmental management and development and the achievement of sustainable development (WCC 2005). In the community development approach, people are assisted to identify their own needs and the means to address them, focusing on giving people choices that may lead to their empowerment. This approach asserts the notion of trying to ensure that communities maintain ownership and control over their own resources and is one of the more popular approaches used (Casey 1999; World Bank 2003).

Participatory approaches can and should also be used to consider gender issues and impacts of a development intervention if appropriate conditions are created. The potential for participatory approaches to be a catalyst for significant changes and improvements in gender relations and equity is immense. The reality is that a lot of work is required to ensure gender-sensitive participatory approaches are used in development interventions and there are many limitations standing in the way of achieving this, not the least being the traditional culture of many countries.

Issues with participatory approaches

There are concerns about many of the approaches used for community consultation. The use of the community development model can result in priorities that may arise during a workshop or meeting being skewed towards the more powerful people's opinions. Gujit and Kaul Shah (1998) relate concern that the myth of community cohesion underlies many participatory exercises. Such a reliance on communities and households has meant that much participatory work has failed to take account of inequalities and power dynamics that occur within communities and households. There is often a failure to be aware of conflicting interests between and within groups (Akerkar 2001).

Many authors lament the simplistic or mythical notion of ‘communities’ as homogenous and cohesive groups and the somewhat unchallenged assumptions of community harmony (Cooke & Kothari, 2000; Gujit & Cornwall, 1995; Gujit & Kaul Shah, 1998; Stadler, 1995; Mohan 2000). There is, possibly intentional, ignorance of the fact that people living in the same area do not necessarily share similar opinions nor have the same priorities. Working with the idea of a homogenous community can conceal power relations and hides a bias that favours those with more power (Cooke & Kothari, 2000; Gujit & Kaul Shah, 1998; Mohan 2000).

Some authors feel that failure to deal with the complexity of community differences, such as age, economic status, religion, caste, ethnicity, employment status, political affiliation and gender, can render much participatory work defective (Gujit & Kaul Shah, 1998; Stadler 1995). Using groups rather than individuals can ignore the hidden conflicts in social life and research results in some projects often assume consensus where in reality a dominant group may bias the results (Stadler 1995; Mohan 2000). The majority of tools and methods of participatory development are based on group gatherings, which may cause facilitators to miss out on obtaining possibly valuable individual knowledge and risk the non-participation of certain individuals. Manifestations of power, and the subordination of women, embedded in social and cultural practices are often difficult for an outsider to determine. Local control of the process can often serve to exacerbate existing forms of exclusion and cement existing relations of inequality with the voices of marginalised individuals and groups barely being raised (Cornwall 2003).

When women are present at village meetings alongside men it is often assumed that their issues are being included but some authors feel this may ignore the dynamics of gender relations (Gujit & Kaul Shah 1998; Sarin 1998; Cornwall 2003; Akerkar 2001). There may be much information that cannot be shared in a ‘public’ environment. The reasons for this are manyfold and may include the fact that women are uncomfortable about discussing certain issues with men present, or that traditional custom gives preference to men in group discussions. This reticence to share knowledge in the public domain is not restricted to women, as many community members, particularly the marginalised, may also feel private information cannot be discussed publicly. Knowledge that is restricted to the private sphere is missed when concentrating on the public domain. Many people will not say important and relevant things in public or to strangers they don’t trust, so much of what is important is left unknown (Bevan, 2000; Stadler 1995; Mohan 2000).

In many developing, and even some developed countries, marginalised people, particularly women, tend to have less access to knowledge and information and are said to have less power in knowing what knowledge and information is useful. The less powerful often accept the superiority of the knowledge of the more powerful and, according to some authors, in many cases women are not even aware of their subordinate position (Leurs 1996; Murthy 1998). The participatory process should encourage people to accept the worth of one’s own knowledge and empower the marginalised to proffer all information they have at hand. Particularly important is the empowerment of women who hold vitally important information about their local area and social customs.

It has been suggested by some authors that ‘local knowledge’ and the decisions made by locals are actually structured by what the locals perceive the visiting agency or organisation can and might offer or deliver (Cooke & Kothari, 2000; Leurs 1996). In support of this view, Townsely et al (1997) points to the case of a customary marine tenure project in Vanuatu where many responses of the villagers were influenced by fact that researchers were taking

notes. They stress that the presence of outsiders must be taken into consideration as it can significantly alter that outcome. As Townsley et al (1997, p,39) argues, "[t]here is a risk that decisions reached by local people are aimed more at the outsiders and their assumed objectives, than at the real needs and priorities of local people". There can also be seen in many pacific countries, a sense of cynicism due to the myriad of projects involving consultation that have come and gone without any real ongoing, sustainable effect (Tellus 2005).

The Samoan experience with community consultation

In Samoa, the village system appears to present a 'community' that is homogenous and cohesive, with close ties between families, the church and the village fono. This is a long-standing tradition that has helped to ensure the longevity of the Samoan culture (Macmillan 1998). Such close community ties has seen Samoan's deal with cyclones, droughts and other natural disasters with impressive resilience. The strong leadership of the village matai, the use of extensive discussion to reach consensus and extended family commitment cements the community group, and its leaders, as the main consultation audience. This community based model can encounter difficulties as Taule'alo (2000, p3) argues, "[i]t is extremely difficult to reconcile the public interest against the family interest… the co-existence of both modern and traditional authorities is rather complex and not readily conducive to the application of conventional planning methods and concepts". Further there is strong respect for authority in Samoa often leading to less democratic practice which tends to exclude the lowly ranked from consultation and decision making (Taule'alo 2000).

Photo 1: Traditional village meeting in Savai'i

Samoa has many women in powerful positions in government and commerce, as well as women with matai titles and advanced educational degrees. However, the traditional role of women, particularly in rural villages, has largely remained[†]. This aspect of village life helps to preserve a rich culture in Samoa and the village women's committees have an important role to play in village affairs, social organisation and discipline, including village

[†] The traditional role of women in Samoan villages, according to the Encyclopedia of World Cultures, includes looking after the household, raising children, plaiting fine mats and fans, collecting edible wild plants and foraging the lagoon and reef for small sea animals (Macmillan 1998).

beautification and the appropriate entertainment of, and accommodation for, visitors (Grattan 2005). Many consultation activities undertaken in Samoa have made efforts to involve the women's committee such as in the examples outlined below.

The CIM (Coastal Infrastructure Management) Plan[‡] project is undertaking extensive community consultation using participatory approaches to ensure that villages and districts themselves formulate and therefore 'own' the plans being prepared. Each village and district will have an historical knowledge of the effects of natural disasters in the area, and will also intimately know the location, state and use of any important infrastructure.

However the formality of Samoan village culture, with dominant matai leaders, has the potential to lead to a process whereby only the already powerful members of the village have a part in the discussions. The project team's attempt to respect local culture and undertake the consultation activities through the traditional village meeting format sometimes results in little involvement of village women, untitled men and youth. It has been found in participatory approach exercises elsewhere, that where marginalised groups are identified, the local political structure may obstruct their empowerment despite all opportunities presented by the project team (Gujit & Cornwall, 1995). However, some villages in Samoa are very encouraging of the involvement of the wider community as witnessed during recent field trips.

Photo 2: A village meeting for the CIM Plan project in Savai'i

In Samoa, there are communities that ensure representatives of different demographics are a part of the consultation activity, even if only for a short time. At a recent village meeting for the CIM Plan project, a few women and a young man attended parts of the meeting. They did need to leave the meeting at different times in order to arrange and serve the food and drink to those of us in the meeting, however. Some other women and young men sat in a small fale behind the main one but it is unclear whether they were listening in or had the opportunity to actively participate in the process. At one point during the meeting, one of the women, one

[‡] The CIM Plan project is a component of the wider World Bank funded SIAM 2 project aimed at disaster risk reduction.

who had spent the most time in the meeting fale, took the map being used as part of the activity out of the fale, perhaps to show the others in the smaller fale. So while there was the formal village meeting with matai and a select few others, there did seem to be some opportunity for others in the village to be involved – or at least to know what was going on.

A representative of the women's committee will often attend a village meeting set up for the purposes of consultation on an environmental project. The CIM Plan project utilises a formal village meeting approach, followed by more informal 'walk through' of the area and efforts are also made to talk to the women of the village separately while this is occurring. Although the matai of the village work hard to represent the community as a whole, it is important that those who will be required to assist with the implementation of project outcomes are involved at the outset also. Meeting with the women in a more informal setting can result in important information being gained that may have been missed during the meeting or walk through with the male members of the village. Sometimes the information is simply an expansion or clarification of issues already raised but often there are points raised that are particularly relevant to the women, and children, of the village.

Photo 3: Informal meeting with village women for CIM Plan project in Savai'i

The Samoa Fisheries Extension and Training Project discovered that the best solution for controlling fishing activities is not the enforcement of national regulations, but to allow fishing villages to manage and control the fishing activities themselves (Chesher 1998). Limited funds also mean fishing regulations must be enforced at the village level and matai are encouraged to ensure that their village fishes in an ecologically sound way. Villages across Samoa requested assistance from the government's Fisheries Division to assess reef health and improve the reef to ensure ongoing fish stocks (Mollica 1999). The Fisheries Division undertook to provide advice and support to those villages willing to undertake the development of a management plan.

The Village Fisheries Management Plan project saw extension officers undertake meetings with villages based on status – separate matai, untitled men and women's groups – aiming for less inhibited discussion. These groups sketched out the key problems and recommended

solutions and it was found that most village groups knew the conditions of their fisheries, what might be causing problems and what the likely solutions would be, sometimes better than the fishery agents did (Mollica 1999). “By asking questions, everyone learned and the villagers gained a feeling of ownership of the program” (King 1999). Once the Management Plan was finalised, the Fisheries Division offered to provide any required technical assistance to the village provided the plan was adhered to. According to Mollica (1999, p27) “Samoan fishers are involved in making decisions to change their fishing grounds as well as their methodology, moving away from the reef in order to harvest some of the relative bounty of the deeper ocean”. This project successfully utilised participatory approaches to involve the whole village community and result in improved environmental conditions.

Questions for future community consultation in Samoa

How can you ensure all members of a community have a chance to participate in projects that affect them? Can consultation in Samoa be more gender sensitive? Is the group meeting the most appropriate consultation tool? Is the input of communities truly participatory? How can you ensure the community feels a sense of ‘ownership’ over the project and its outcomes?

A mixture of approaches may be appropriate in Samoa, not just formal village matai meetings, but also small group and one-on-one interviews, workshops and household surveys. There is a need to ensure that all members of a community are represented. This will require knowing the make up of the constituency and appropriate ways to reach the most marginalised members of the community. Ensuring that women are consulted appropriately and are empowered to contribute and take some ownership of the project is important, particularly if they are to be involved in the subsequent implementation of any plans. This may be difficult in some cases due to the presence of traditional cultural norms, so imaginative approaches will be required.

A sense of ownership will help to ensure the longer-term sustainability of projects but must be accompanied by a concerted change in behaviours to ensure ongoing and measurable improvements in the environment. For instance, the fisheries project encouraged a change in behaviour of the fishers in order to improve the health of the reef and fish stocks.

Conclusion and the way forward

Participatory approaches are meant to empower local communities to research, decide on and implement projects to improve their livelihoods and environment – a reversal of many past practices. The basic idea behind participatory processes is simple. When people co-operate to find answers to common problems, they come to understand the issues.

To ensure appropriate participation and consultation we need to take advantage of the natural tendency for Samoans to work together and solve conflict by negotiation and unanimity. The traditional village fono system can indeed be utilised effectively during participatory action as an important focal point for all communities. A focus on changing the physical behaviour of people is required to ensure that environmental projects are effective. That is, there needs to be a change in day to day habits and not simply a raising of awareness.

Ultimately, environmental initiatives will be more successful and sustainable if the people affected by them are intimately involved in their analysis, design and implementation and feel a sense of ownership and obligation. This requires effective participation of all community members and the limited influence of outside ‘facilitators’ where appropriate.

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Emotional intelligence, management concept: a contributing factor for effective service delivery

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Abstract
Emotional Intelligence (EI) is defined by Goleman (1998), as the capacity for recognizing our own feelings and those of others, for motivating ourselves and for managing emotions well in us and in our relationships. Success actually depends on a set of emotional and social competencies that builds on EI, in the same way that specific cognitive abilities may be linked to general intelligence as measured by the IQ test. The original model developed by Goleman (1995) and self-reviewed in 1998 was based on two hundred competency models, had identified twenty five social and emotional competencies that most strongly predict superior performance in many occupations. He organized these competencies into the five dimensions of *self- awareness, self- regulation, self-motivation, social awareness, and social skills.* Recent research using the emotional competence inventory, a measure of EI developed by Boyatzis, Goleman & Rees (1998), led to a refined version of the original model, consisting of four (4) dimensions and 19 emotional competencies: *self- awareness, self-management, social awareness, social-skills.* Today, this model is commonly applied to management within the public sector and more so in corporate business organizations; the belief also in the strong link in human resources development and effective delivery of service.

Introduction
Service performance can quickly slide to mediocrity unless the basic attributes are moored into a philosophy that recognizes the delicate balance of internal dynamics (e.g. competence and motivation of staff, shared values, leadership, authority relations, decision processes, (Nowanko & Richardson, 1994). These express and create patterns of behavior, create and awareness of where an organization is coming from; what it strives to achieve; its purpose, norms and values; and make a clear role of organizational members before, during and after service encounters. The above excerpt demonstrates the important role that interpersonal skills (patterns of behavior) contribute to the effective service delivery of any organization. Such skills include, win-win situation, be assertive and confident, be clear on parameters when making decisions, treat people with respect, treat conflict as an opportunity for improved relationships and manage emotions (emotional intelligence). This aim is to discuss the development and application of the concept for public sector effective service delivery, in the practice of EI.

Definition
EI is define by Goleman (1998) as the capacity for recognising our own feelings and those of others, for motivating ourselves, and for managing emotions well in us and in our relationships. Success actually depends on a set of emotional and social competencies that builds on EI, in the same way that specific cognitive abilities may be linked to general intelligence as measured by the IQ test.

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The original model developed by Goleman (1995), was reviewed by Goleman in1998 based on 200 competency models, had identified 25 social and emotional competencies that most strongly predict superior performance in many occupations. He organized these competencies into the five dimensions of EI Goleman (1995): *self- awareness, self- regulation, self-motivation, social awareness, and social skills.* Recent research using the emotional competence inventory was a measure of EI developed by Boyatzis, Goleman & Rees (1998) led to a refined version of the original model. This generic competency framework consists of four dimensions and 19 emotional competencies, condensed from a handful of studies (U.S. Office of Personnel Management 1996; Spencer & Spencer 1993).

Dimensions and competencies

Goleman reviewed his earlier paper and instead of five he proposed that the four broad dimensions of Emotional Intelligence are *self- awareness, self-management, social awareness, social-skills* – are interdependent and, to some degree, hierarchical.

The four dimensions and the nineteen emotional competencies is exemplified as follows:
Self-awareness – knowing one's internal states, preferences, resources, and intuitions
(1) emotional self-awareness – recognizing one's emotions, *(2) accurate self-assessment* – knowing one's strength and limits, *(3) self confidence* – a strong sense of one's self-worth and capabilities;
Self-management – managing one's internal states, impulses, and resources to facilitate reaching goals
(4) adaptability- flexibility in handling change, *(5) keeping disruptive emotions and impulses in check, (6) conscientiousness and reliability* – taking responsibility for personal performance; maintaining standards of honesty and integrity, *(7) initiative and innovation*-readiness to act on opportunities, being comfortable with novel ideas, approaches, and new information, *(8) achievement drive* – striving to improve or meet a standard of excellence; persistence in pursuing goals despite obstacles and setback;
Social awareness – awareness of others' feelings, needs, and concerns, *(9) empathy* – sensing others feelings and perspectives and taking an active interest in their concern, *(10) service orientation* – anticipating, recognizing, and meeting customers' needs, *(11) organizational awareness* – reading a group's emotional currents and power relationships, *(12) developing others* – sensing others' developmental needs and bolstering their abilities; and
Social skills – adeptness at inducing desirable responses in others, *(13) leadership* – inspiring and guiding individual and groups; aligning with the goals of the group of organization, *(14) influence* – wielding effective tactics for persuasion, *(15) change catalyst* – initiating or managing change, *(16) communication* – listening openly and sending convincing messages, *(17) conflict management* – negotiating and resolving disagreements, *(18) collaboration and building bonds* – working with others toward shared goals; nurturing instrumental relationships and *(19) team capabilities* – creating group synergy in pursuing goals.

Case study and analysis

Take the example of a flight attendant, Sione on a Polynesian Airlines flight to Auckland who was confronted by an angry passenger. To deal effectively with the situation, Sione first needed to be aware of his own emotional reaction because the passenger's behavior could cause Sione to experience emotion ranging from apprehension to annoyance. If Sione was *unaware of his own emotional reaction*, it could interfere with his effective action. Awareness, though is rarely enough Sione also had to *control his emotional response*. By calming himself, he was ultimately able to help the passenger calm down. Once Sione became calm, he could tune in to the passenger. By understanding the passenger's feelings

and the reason behind the feelings, Sione was able to take action, he offered to hold the fussy infant squirming on the passenger's lap, and he did so in way that did not make the passenger more embarrassed and angry.

The flight attendant used competencies associated with each of the four dimensions of Emotional Intelligence. Although it happened very quickly and without conscious awareness, Sione's self-awareness made self-management possible, and self- management made empathy possible, all of the three of these abilities made it easier for the attendant to use effective social skills.

The case study also reveals a point suggested by Goleman (1998) that to be star performer, one needs a sufficiently high level of about six different competencies spread across all four dimensions. It is not enough to excel in self-awareness or self-management or even social skills. Furthermore, competencies needed for success differ with the nature of the job; depend on one's level in the organization and the organization culture and strategic focus.

Conclusion

1. EI and its competencies are learned; they are not innate. People are not born with a high-degree of self-confidence or achievement drive (Goleman 1998). From the example, Sione, the flight attendant underwent effective service delivery training with the company, whilst the response to the situation was effective;
2. EI dimensions and competencies are interdependent and, to some degree, hierarchical as again demonstrated in the case study presented – self-awareness, self-management social skills and social awareness skills were applied to the existing disagreement;
3. The case study also points to another important aspect of the model: A high degree of competence in just one of the four dimensions of EI usually is not enough to achieve superior performance, one needs a sufficiently high level of about six different competencies spread across all four dimensions; and
4. Finally EI has a far-flung application to communal environments and extended family culture. It is a concept that should assist in creating mutual understanding amongst conflicting parties.

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Tropical cyclone forecasting: theory and practical application - case study of tropical cyclone Olaf 2005

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Tropical cyclone is among the most dangerous of our natural disasters. Forecasting of its track and intensity is a business with high stakes. Within the last fifteen years, the communities throughout the Pacific and beyond have suffered devastating tolls of destruction from cyclones. Occasionally these cyclones also result in horrific casualties. Forecasts have to be accurate to enable responsive actions to minimise damage and loss of lives. Under-warning would mean inadequate preparation and consequently dramatic losses. Over warning would mean community wasting enormous time and effort in preparations?

This paper attempts to look at the evolution of tropical cyclone and mechanisms that influence their movement, a case study on Tropical Cyclone Olaf 2005 and what might be done to improve the capability of Samoa Meteorology Services to improve tropical cyclone forecasting

Introduction:
Tropical cyclone is ranked as one of the most destructive of all natural disasters, capable of destroying topography and infrastructures and causing major loss of lives and properties. Some authors have stated that tropical cyclones causes four times more damages than any other disasters. Tropical structural damages can be caused by damaging winds and storm surges, huge amount of rainfall dumping onto the land as it makes landfall, or when its convective cloud bands covers a huge land area.

According to certain authors such as Gray and Sara, a cyclone that swept through Bangladesh in 1970 killed at least 300,000 people, and a similar disaster occurred in the same region in 1991 when 140,000 people lost their lives. In 1992, at the United States territory, Hurricane Andrew caused widespread devastation in the southern Florida and Louisiana, recording 74 deaths; with damaged bill estimated to exceed US$26.5 billion dollars.

Samoa, a very small island nation consists of two main islands and four small islands had experienced a similar fade in 1990, 1991 and 2004. Seven casualties were recorded for the 1990 and 1991 tropical cyclone events and had a huge impact on Samoa's economy. The changes of sea surface temperature within the region and tropospheric winds lead to alterations in the frequency of TC occurs around Samoa. Most of the tropical cyclone that affected Samoa was emerges during an ELNINO period. The 2003-2004 EL NINO have produced five tropical cyclones within 300 nautical miles from Samoa and most were located to the northeast and east of the islands. The most notable and most threatening of them to Samoa island group is TC Olaf, a category five Hurricane system which Regional Tropical Cyclone Warning Centres (RSMC) found it difficult to analyse (RSMC, Nadi; Joint Typhoon Warning Centre (JTWS), Hawaii; NZ Met. Services; MNRE Meteorology Division).

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The public demand for the most precise track and timing of arrival of a tropical cyclone would not be fully met at due to lack of tropical cyclone research in this part of the region, limitations in the science of meteorology and other factors. This paper briefly discusses some of the areas that need explanation in order to get some understanding on why tropical cyclone Olaf changes its course.

Formation of tropical cyclone

The location of Samoa within the area (I always called it the pivot point) of the ENSO seesaw make it vulnerable to tropical cyclone during any ENSO conditions and more frequent during EL NINO period. The statistical analysis of past years tropical cyclones states that Samoa has been directly struck by a tropical cyclone in every five and half year. However, the 1997/1998 and 2004/2005 EL NINO period has shown the increased number of tropical cyclones emerging within 300 nautical miles from Samoa.

The formation of a tropical cyclone is complex and depends on the availability of dynamics (forces) and thermodynamics (energy) parameters (Gary, 1979: WMO, 1995). The dynamics parameters are - the existence of low-level vorticity (mechanical circulation), coriolis (planetary) force of the earths rotation and minimal vertical winds shears (differences of lower & upper level winds) or less than 25 knots (12.5 m/s). The thermodynamics parameters are very vital in the starting of the evolution of huge area of convective cloud band into a tropical cyclone. That is why TC originates from an ocean area with sea surface temperature of more than 26.5° degree Celsius with the depth of that warm ocean layer to be at least 60 metres. It also needs moist instability between the ocean surface and the 500-hpa level with at 40 to 60 percent moisture at the middle atmosphere.

The purpose of the low-level vorticity is to transports low level moist air into the atmosphere and condensed into clouds and has to support by two stages of wind surge in order to develop into a tropical cyclone within five days if all other mechanisms are favourable. The winds surges can originate at any side of the convergence zone or both and some time calls trade wind surges. The first stage of wind surge helps to accelerate the convection inside an existing cloud band of the convergence zone and evolutes this cloud band into a disturbance. This process continues when a vertical circulation is increasingly well and condensed vapour released latent heat and drives the wind system. An extreme convective cloud would form a chimney if vertical wind shear between the low levels (850-750 hpa) and upper level (300-100 hpa) were below 26 knots or 13 m/s.

The second wind surge supports the upward forcing for an exhausted mechanism of high-altitude, low levels would fill up the chimney and slows down the process and ending in dissipation of the system. In nature, an existing upper level high or high-altitude anticyclone act as the exhausted mechanism which transports the upward air well away from the disturbance, before sinking occurs further away from the tropical cyclone. The latent heat released by the ascending moisture when condensed at cooler upper air contributes in dropping of surface pressure and completes the vertical circulation. This produces the steep pressure gradient along which winds reach gale, storm and hurricane proportions. The Coriolis force initiates and maintains the tropical cyclone rotational movement while the weak wind shear is needed for sustaining the vertical chimney or structure.

Theoretically, it is easy to know how a system organises itself but in practical forecasting, there are a lot of complications ranging from interpretation on how the variable fields affect each other, including its evolution and steering. Many authors have identified several

difficulties in predicting unusual systems and these researches have helped in improving models output.

Tropical cyclone forecasting

The Weather Services Section of the Meteorology Division has three main principles for its tropical cyclone warning operations: First, the collection and analysis of the necessary observational data and guiding products, and the production of a consensus model; Secondly, the preparation of warning forecasts, and finally, the efficient distribution of advisories, warnings, and all other relevant information.

Tropical cyclone forecasting demands a good meteorological and analytical background, vast amount of climatological knowledge, a keen mind's eye that can observe the most minute deviation in a mass of nearly homogeneous data, diligence and dedication in the approach to the forecast. The meteorologists or operational forecaster assesses the output from various models and based on present and historical performance of the models, as well as personal experience, arrives at the official forecast and more complex when less information is available especially with the lack of real time surface data.

The evolution of technology enables the forecasters at the Meteorology Division to practically issue daily forecasts. However, reliable assistance of a Meteorologist with vast experience and knowledge in tropical cyclone forecasting is needed during the tropical cyclone season. There are many rules in tropical cyclone forecasting which requires a lot of theoretical knowledge.

Estimation of intensity and locating of tropical cyclone centre

The availability of satellite images in every thirty minutes makes it useful to find centre location and the intensity of tropical cyclone, using the Dvorak Technique. One huge limitation is increase of error if no surface data is available to confirm the exact location of the centre at the surface. The only surface data that are more meaningful for locating centre at the surface are the quick scat winds from various NOAA websites and its disadvantages is the limited number of passes a day.

Finding Tropical Intensity at night is more difficult due to lack of visible satellite images and Enhanced Infrared Images (EIR) is available only on SATAID systems that need downloading from the Bureau of Meteorology Server. The Meteorology Division are still on the learning board and the problem of forecasting tropical cyclone intensity change continues to be a challenge for all tropical meteorologists despite the recent advances in numerical weather prediction. Tropical cyclone intensity change remains as one of the atmospheric science's greatest mysteries. Measuring of tropical cyclone intensity is still a challenge in small tropical cyclone warning centres and it involves a challenging blend of experience, intuition and creativity and improved understanding.

Tropical cyclone track forecast

The software called SATAID, developed by the Japanese Meteorological Agency has been used for fixing the current cyclone position and intensity, as this is the first step in making a track and intensity forecast. Since the forecast quality is dependent on the accuracy of this data, considerable care is needed in the analysis stage. During the 2004-2005 season the SATAID have improved the accuracy of finding the centre of tropical cyclones. The staffs require lots of in-depth knowledge and experience before fully eliminating major forecasting errors in critical conditions. The Meteorology Division tropical cyclone warning office has to

justify/verify its findings (tropical cyclone centre position, intensity, direction of movement, movement speed, radius of winds) by comparing with values provided by JTWC, RSMC Nadi and NOAA NWS Honolulu if available before next Special Weather Bulletin for Samoa is issued.

The lack of surface observation on the vast ocean, this problem is still a major challenge for a frontline forecaster; satellites, and land-based automatic weather stations are the most common methods used to locate the centre and determine the intensity. If initial positions of tropical cyclones were poorly defined, a major forecast error would contribute in the forecast tracking and could be from 30 km to 180 km in the case of a satellite fix of a poorly defined centre. The initial intensity estimates may be in error by as much as 30 knots, particularly when using satellite imagery.

The simplest method used to forecast the track of a tropical cyclone is to extrapolate the motion of the tropical cyclone during some past period, say 12 to 24 hours, for the next 12 to 24 hours. Another method uses historical data to determine the average direction and speed of motion of similar tropical cyclones passing close to the given location. Another technique employs current and forecast atmospheric variables in a set of statistical equations to predict the motion. The final set of track forecast techniques makes use of computer models of the atmosphere to predict the motion of the cyclone from an observed initial state of the atmosphere.

The Meteorology Division just recently employed a new tool call tropical cyclones Module from the Bureau of Meteorology Australia, which can both produce a consensus track and threat area map. This special package was developed and is widely used by the Australia Bureau of Meteorology and was given to the countries small with some capability in Tropical cyclone Forecasting and has Meteorologist working on site.

According to the following Author, Elsberry (1987), Velden and Leslie (1991), Shapiro, 1992, Jones (1995), DeMaria (1996) the motion of TC is the result of the deep layer flow in which resides, usually 850 to 200 mb; also moderate changes in the magnitude or vertical shear of the mean winds can alter the storm in ways that could potentially affect the structure and intensity of the cyclone, as well as its path. Moreover, a few stated that existent of a mid troposphere Tropospheric Upper Tropical Trough (TUTT) can often influence the current and future motion of a nearby Tropical cyclone

Case study – Tropical cyclone Olaf

On the 9th of February 2005, a series of satellite images had shown an area of Mesoscale Convective System (MCS) within 8.0 souths 179.0 west and 10.0 south 175.0 west. The satellite images of the 11th and 12th February indicated the developments of Extreme Convection (EC) within the MCS.

The Fiji Meteorological Services' evening surface chart of the 12th February indicated a closed isobar within the area MCS is located. The satellite images showed that the area of convection have moved northeast by 15 to 25 nautical miles with increasing organization and persistent convection around a developing low level circulation. The EC band was estimated to be located at about 460 nautical miles northwest of Apia and satellite images after midnight indicated a sign of banding eye. The CIMMS upper analysis showed favourable conditions for development of the system.

Tropical cyclone OLAF forecast track

The Tropical Disturbance reached Gale Force on 131500Z and named by the RSMC Nadi a double of hours later. The RSMC at Nadi initially forecasted Olaf's centre to go past the southwest of Savaii. The JTWC predicted Olaf to cross over Upolu. The Samoa Meteorology Division projected TC Olaf centre to cross about 60 nautical miles north of Apia and expecting to travel between Upolu and Tutuila. This was a result of comparison of NOGAPS, AVN, GFS and BOM GASP models, average centre position but there with inclusion of human bias based on surface chart analysis. The original track was altered by minus 0.5 degree latitude to take into account the increase pressure advection from southwest. This was purely based on experiences and knowledge learned from tropical cyclone Ron (1997) and Heta (2004).

The availability of a new tropical cyclone forecasting models like the tropical cyclones Module has made it possible the compare the average centre position to produce a projection track. The same method used to compare the three tracks produced by the RSMC, Nadi, JTWC and the Meteorology Division. The three projection tracks were used to construct a consensus track. The first consensus track put the centre of Olaf at about 20 nautical miles direct north of Apia by Tuesday Morning. The position of the consensus track produced by the tropical cyclones Module was more biased towards the Division's projection track and that showed how divert the tracks were in their first run. The difference of tracks produced by each centre depends on output of the models employed and office perception.

The Meteorology Division ran a number of projection tracks for every twelve hours and consensus tracks for every six hours. The Division projection tracks was purely based on observations and the output of the latest run models available and surface analysis with consideration of surface high pressure system that located east of New Zealand and the developing midlevel ridge over Fiji to become active and move northeast ward within matters of time 12 to 24 hours. Most of the models accessed to at the time have had their projection tracks over and close to north of Samoa. The first two consensus track put the centre of Olaf about 20 and 10 nautical miles direct north of Apia on Tuesday morning.

4.3 What causes tropical cyclones Olaf to divert eastward?

From Monday night to early Tuesday morning Olaf had slowed down to 3 to 5 knots due to its interaction with tropical cyclone Nancy. At 141500Z, Olaf was located at about 9.6 south 176.8 west or 350 nautical miles northwest of Asau with estimated intensity of 80 knots close to centre, with the models expecting an increase to 110 knots within three to six hours. At 142100Z or 10am Monday morning, a mid-level steering ridge had driven Olaf and the satellite images exhibited a good outflow to the northeast (Figure1).

Samoa was ready for Olaf's destructive winds that could hit most of the islands within 12 to 24 hour period as shown in Figure 2. Is it a miracle or just the caused of nature? At 150900Z, TC Olaf was located at 12.3 South and 173.6 west and was moving southeast at about 10 knots. TC Olaf was expected to strike northwest of Savaii around 4 to 5 am Tuesday morning.

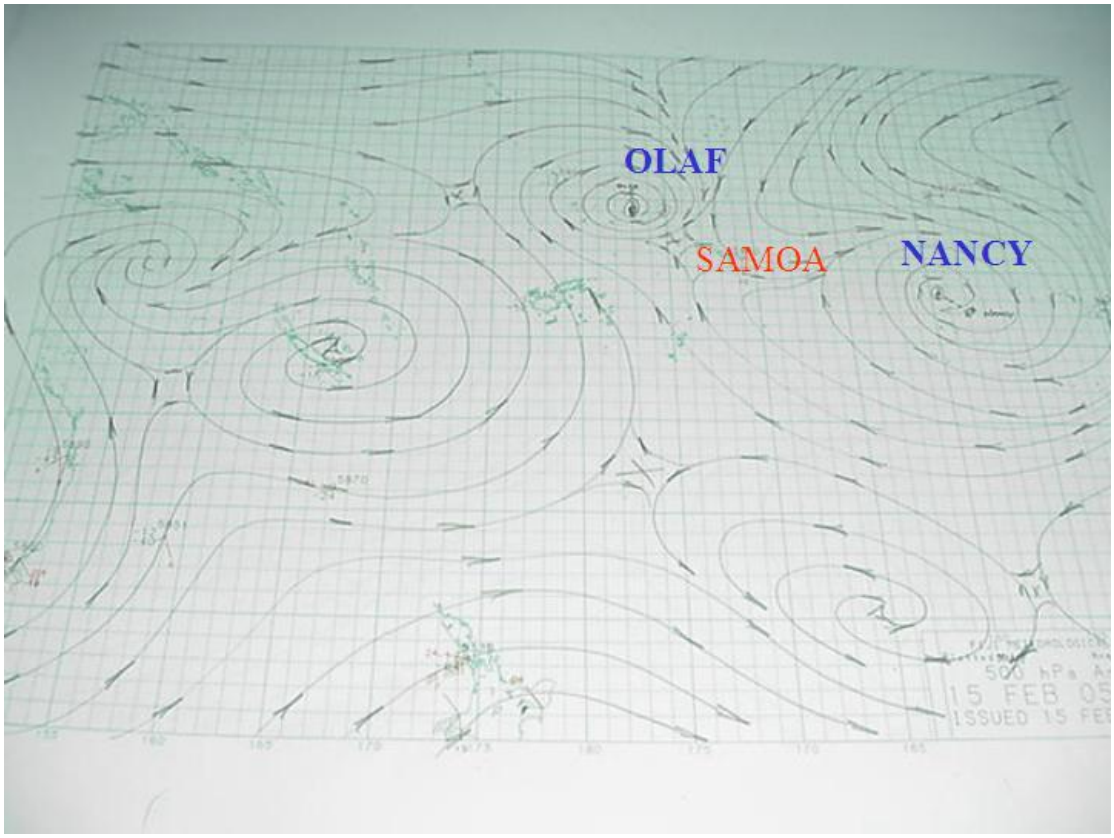

Figure 1: Tropical cyclone Olaf is steering southeast by a midlevel ridge to its northeast (Chart courtesy of RSMC Nadi)

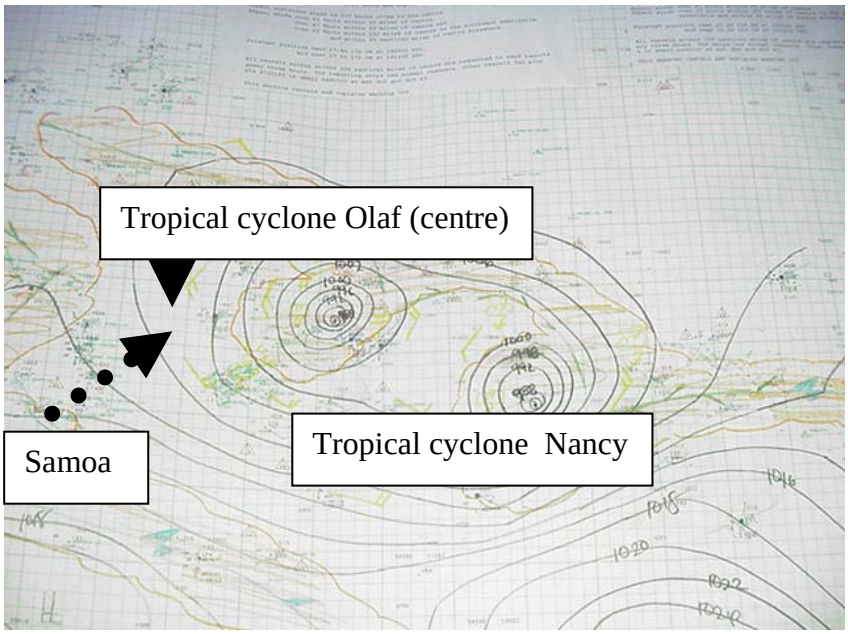

Figure 2: Location of Olaf centre from Samoa (Courtesy of RSMC NADI)

The system was almost stalling and undecided on which way to go between 151100Z and 15121300Z. The first suspect was an interaction between Olaf and Nancy (Figure 3). According to Chan, Gray and Kidder, the most popular kind of interaction of any dual system in the northern hemisphere has to be within 5 to 10 degrees. No studies have been done on this area of the South Hemisphere with regards to interaction of dual system, and having TC Olaf and TC Nancy more than 10 degrees apart, the only possible interaction was a repulsion between the two and this was one possible reason it held Olaf further north Samoa than previously predicted.

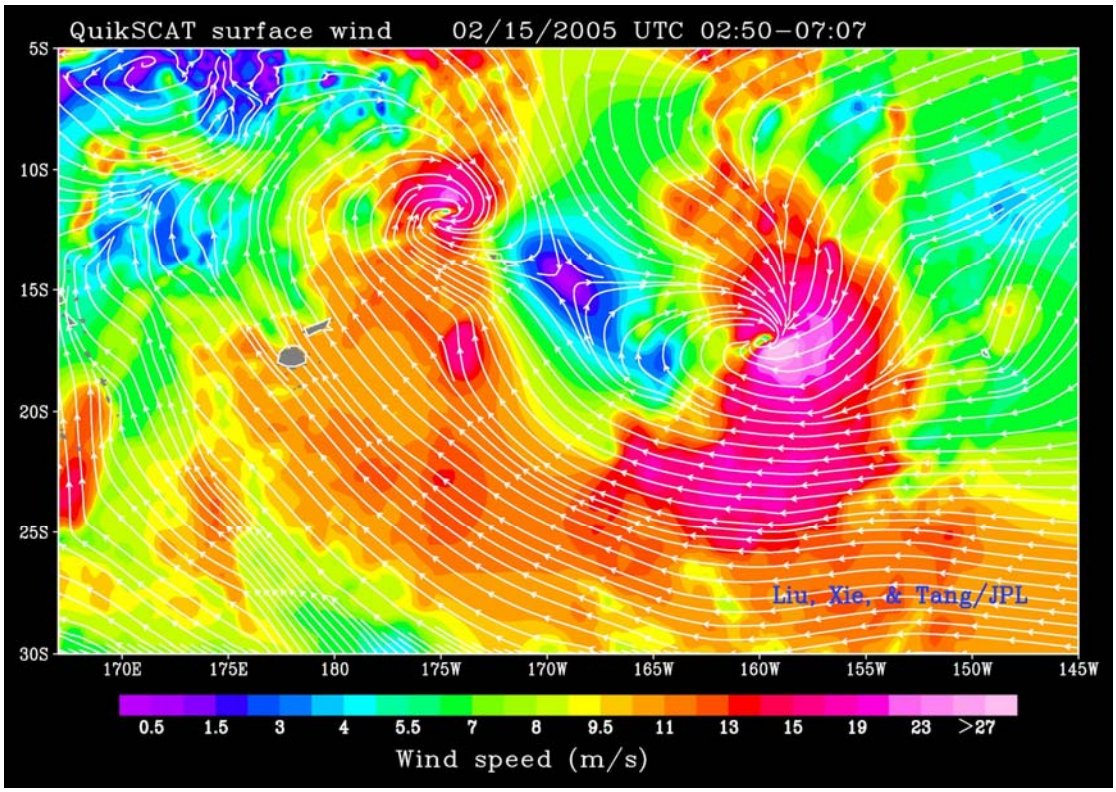

Figure 3: Tropical cyclones Olaf and Nancy interaction (Courtesy of NASA)

Chan and Gray reported that according to Lander and Holland (1993) – "storms that were unable to approach each other at distances smaller than a certain minimum distance (of about 450-500 km) without being mutually stretched out. The initial attraction of the storms in this regime was replaced by repulsion, in agreement with observations. One of the possible causes hindering further storm attraction is the displacement of the maximum latent heat release to the opposite sides of the interacting storms. The storms can be pushed away from each other due to the tendency of tropical cyclones to displace toward the areas of maximum heating."

Many authors had discussed that the result of any dual tropical cyclones depend on certain elements such as comparably small changes in structure and strength of interacting storms, Coriolis force, Sea Surface Temperature and vertical and horizontal shears of the background flow can also lead to different scenarios of their interaction. Predicting results of any dual system interaction is rather difficult and requires a lot of room for research.

With Olaf and Nancy competing over available energy, the satellite images showed that most of the convective clouds were located east of Olaf and that was where most of the latent heat required for feeding Olaf was brewing (Figure 4).

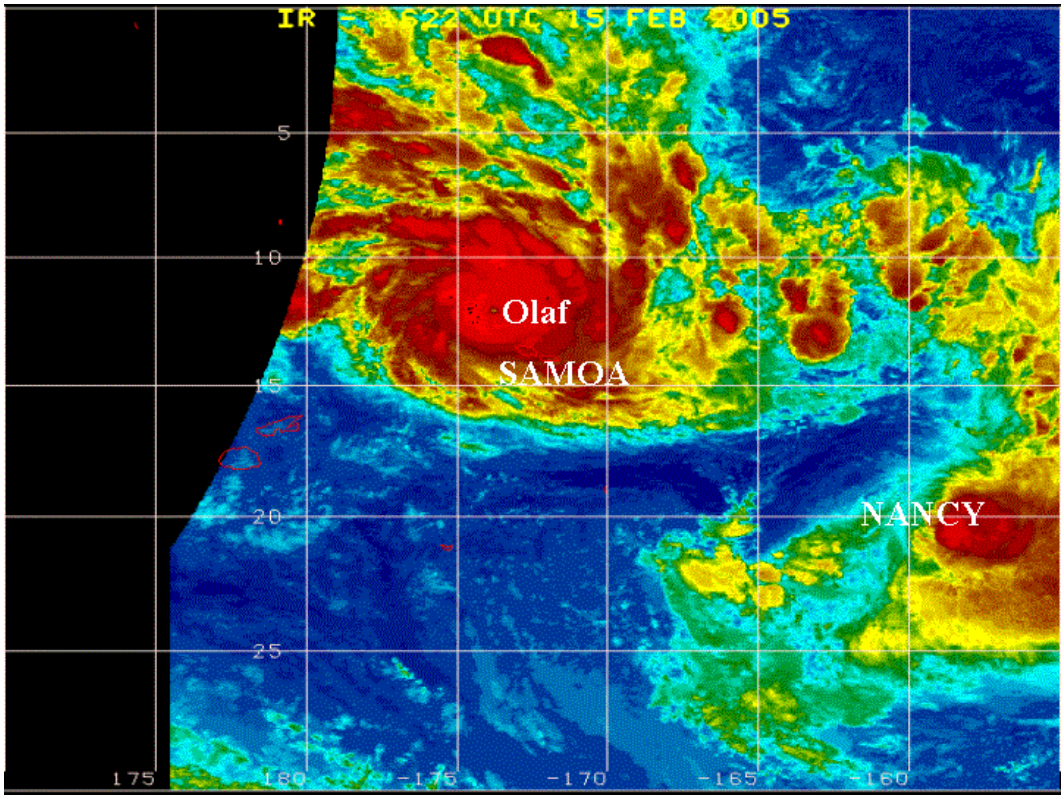

Figure 4: Satellite image of tropical cyclones Olaf and Nancy

The surface pressure was falling at this area of active convective clouds so Olaf was moving towards this area of falling pressure. At the same time a midlevel ridge to the northeast steering Olaf southeast although the wake of a ridge of high pressure to the west of Fiji extended to the northeast of the Fiji group holding Olaf just less than 100 miles north of Samoa. This means that a tropical cyclone goes through the low pressure area and avoid high-pressure area. This southeast ridge was also vertically extend to the 700 mba contributes to shrinking of Olaf gale and storm force winds radius on its southern quarters. There was a possible repulsion between Olaf and Nancy) slowing Olaf's movement from 190900z to 192000z. At the time, this wave interaction was occurring, an upper trough approaching in from the southwest (Figure 5), accelerating Olaf eastward after 200000z with it centre pass north of Apia at about 70 nautical miles and its closest point to Samoa land. Samoa would still have received destructive forces of Olaf gale and storm winds if two of the mention synoptic features not arrived on time.

According to Chan, Gray and Kidder "Most of numerical models fail to predict cyclone with turning motion beyond 24 hours. In addition, same authors found that the largest tropical cyclone track forecast errors usually associated with them undergoing a turning motion" like Olaf. This is one of the reasons why forecasting of Olaf's track was far out from its actual track in the first 48 hours of its lifetime.

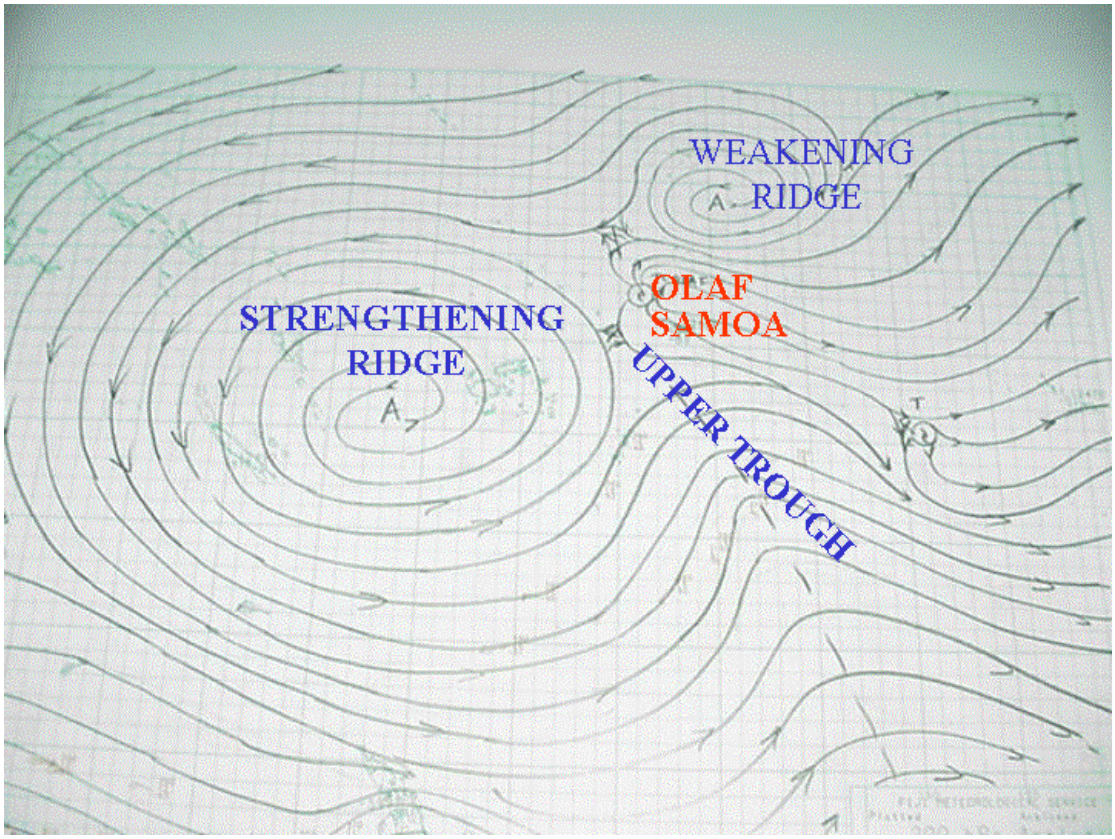

Figure 5.0 Courtesy of RSMC Nadi

Tropical cyclone Olaf was a most CHAOS system that most professional meteorologists would agree with. Olaf's destructive and damaging storm to hurricane winds never reached the Samoa islands. Despite winds of 115 to 125 knots close to centre, the southern quadrant gale and storm force winds radius were greatly reduced as Olaf got closer to Samoa (Figure 6). The southeast of Upolu and northeast of Savaii had experienced gale winds within a very short period, approximately from 2 to 3 hours with only minor damages reported. Sustained southeast winds of 35 to 40 knots with gusts of 47 knots were recorded at Tafitoala (southeast east of Upolu island) automatic weather station on Tuesday night while Olaf was moving closer to Tutuila and over Manua Island (American Samoa) early next day.

Tropical cyclone Olaf was also accompanied by heavy rainfall from Monday afternoon to Thursday morning with a total of 171.8, 170.0, and 82.3 mm for Apia, Faleolo and Maota respectively. Lowest pressure recorded in Samoa was at Avao (northwest of Savaii) with 990 hpa while Apia and Faleolo recorded pressures of 991.3 and 991.2 hpa respectively.

Challenges and recommendation

Tropical cyclone forecasting has a lots of challenges and does requires a lots of commitment and determination. The Meteorology Division needs more tropical cyclone meteorologist to consults our forecasters in critical situation where deeper understanding of the dynamics, hydrostatics and kinematics of the atmosphere require.

The professional meteorologist would dedicate their time to researches on weather systems and climate pattern in our region and they could collaborate with Samoa National University staffs of the Mathematics, Science and Computer Departments in developing systems that

could promote both disciplines within the region and globally. Strongly recommended the integration of knowledge from related science field for various researches.

There is also a great need to bridge the gaps in our knowledge and observations of the early tropical cyclone rapid development processes. This is a real problem globally and the tropics here in the pacific is the most difficult to deal with due to the lack of research in such area. Also need to observe and investigate the scale interactions that lead to controlling the motion of tropical cyclones. There is a great need to improve our understanding of the complex interactions leading to changing tracking and motion of tropical cyclones.

The RSMC and JTWC are the other two meteorological agents that also issue tropical cyclone information for area from equator to 25 degree south. The Meteorology Division is the official tropical cyclone warning office for Samoa. Many users of weather information have access to other tropical cyclone warning centres websites, comparing forecast options and question the differences, especially when divergence of the forecast is significant. These results may degrade credibility and create pressure to mimic the other agency's forecast. The convergence of forecasts is in the best interest of overlapping agencies and is based on fact and not political considerations. This should encourage close collaboration and coordination among meteorological agencies.

When the tropical hurricane warning was issued for all of Samoa on Monday morning 15th February, all private businesses and government ministries closed down to allow people to prepare for the worse. Should Olaf have hit Samoa without any warnings, the public would not be able to mitigate any impact of hurricane winds and could result in a bigger economic loss.

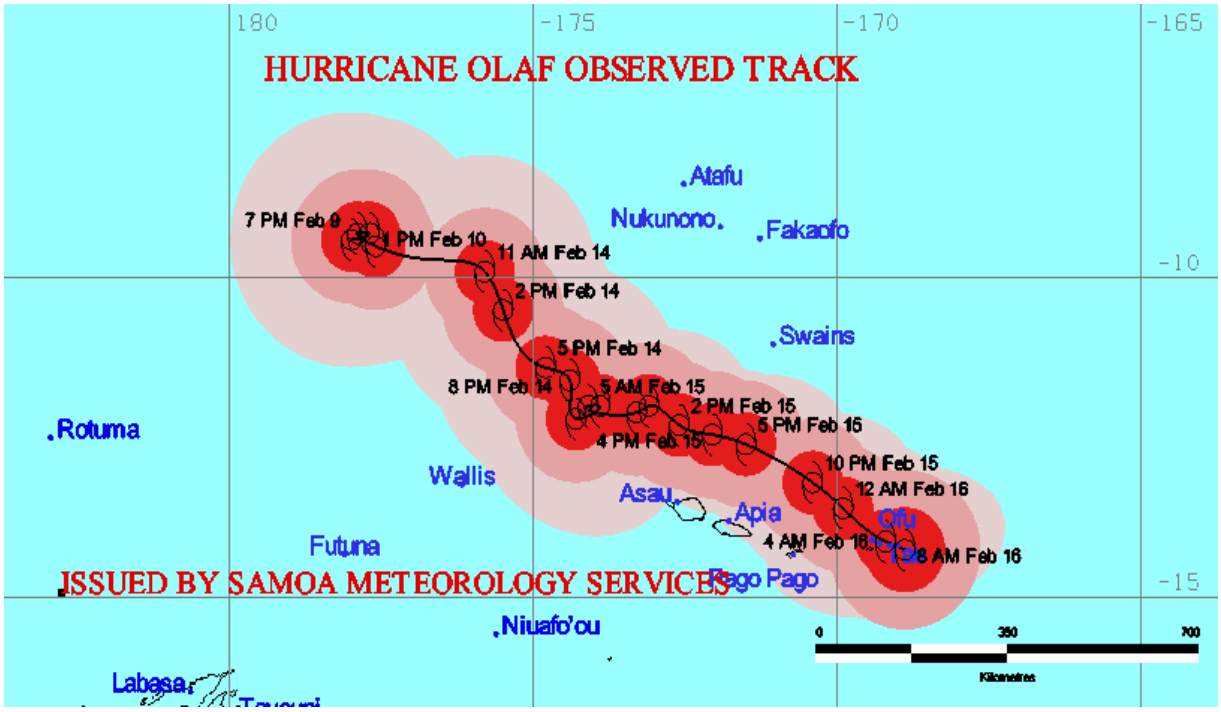

Figure 6: Tropical Cyclone Olaf Track and estimated wind radius (hurricane, storm, gale force) (courtesy of MNRE Weather Services)

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Samoa and the World Heritage Convention - is Samoa ready for World Heritage listing?

Tuiolo Schuster*

To date Samoa is a state party to over twenty Multilateral Environmental Agreements including the World Heritage Convention (or Convention) of 1972. It is noted in the Operational Guidelines for the Implementation of the World Heritage Convention World Heritage (or Guidelines) (UNESCO 2005), that when a country ratifies the convention, it automatically and immediately becomes law in that country. So what does this mean for Samoa? Do we fully understand all possible implications, benefits, costs and consequences of Convention to our heritage and resources?

What is the World Heritage Convention?

The Convention concerning the Protection of the World Cultural and Natural Heritage developed from the merging of 2 separate movements in the 1960s - the first focusing on dangers to cultural sites, and the other dealing with conservation of nature. However, it was only when the Egyptians took the decision to build the Aswan High dam on the Nile River that the international community came together to address global heritage issues that the movement really came into effect in the 1960s. This project was going to flood the valley containing the Abu Simbel temples under water which are a treasure of ancient Egyptian civilization.

There was an international reaction to save the temple and fortunately, the temples were dismantled, moved to dry ground and reassembled. It costs around USD80 million and half of the money was donated by some 50 countries, showing the importance nations' shared responsibility in conserving outstanding cultural sites. The international campaign led to the protection of other cultural sites around the world and finally lead to a draft convention on the protection of cultural heritage. In 1972 the Convention concerning the Protection of World Cultural and Natural Heritage was adopted by the General Conference of UNESCO; named simply the World Heritage Convention (UNESCO 1972).

When countries sign the Convention, each country pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage. Thus, one of the first steps a country must make after signing the Convention is to prepare a Tentative List of the sites it intends to preserve and to be considered under the World Heritage List (or List). To date there are 788 sites from 134 countries of the world – 611 Cultural sites, 154 Natural sites and 23 Mixed sites – 23, In the Pacific region 11 countries have ratified the Convention namely Fiji in 1990; Kiribati in 2000; Marshall Islands in 2002; Federated States of Micronesia in 2002; Niue in 2001; Palau in 2002; Papua New Guinea in 1997; Samoa in 2001; Solomon Islands in 1992; Tonga in 2004; and Vanuatu in 2002. Only the Solomon Islands' has completed its nomination for the Renell Island for the List (UNESCO 2004a).

It was noted that when the Convention took form at the beginning, countries wanted to inscribe the 'Cadillac sites' - the best of the best and the World Heritage List was almost seen

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as a beauty contest. However, noting from the countries enlisted, it has evolved to represent all cultures of all periods not only the major cultures (UNITAR 2005)

What is heritage?

There are numerous definitions noted from reports such as:

- Places and objects we wish to keep safe and these are natural or cultural places/objects that people value because they came from ancestors.
- Places/objects that are beautiful, scientifically important and irreplaceable.
- They are a source of inspiration.
- Heritage is shaped by nature and history and it becomes an inheritance passed from one generation to the next.
- Heritage helps people to understand and tell stories about their land and people; and
- Legacy from the past to the future.

Under the Convention heritage is regarded as both cultural and natural and the Convention is a reminder of the ways in which people interact with nature, and the fundamental need to preserve the balance between the two. Nature and culture are complementary and cultural identity is strongly related to the natural environment in which it develops (UNESCO 1972).

According to the Guidelines, heritage is defined under natural and cultural heritage.

Article 1 - Cultural heritage refers to:

1. Monuments: Architectural works, works of monumental structures and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science;
2. Groups of buildings – groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, which are of outstanding universal value from the point of view of history, art or science;
3. Sites – works of man or the combined works of man and nature, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, anthological or anthropological point of view.

Article 2 - Natural heritage refers to:

1. Natural features consisting of physical and biological formations or groups of such formations which are of outstanding universal value from the aesthetic or scientific point of view.
2. Geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation.
3. Natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

How do we understand heritage?

The concept heritage is used in many different ways in contemporary society to designate a broad spectrum of subjects (viewed from cultural, philosophical and religious aspects). However, as stewards of heritage sites, it is important that everyone develops his or her own personal definition of what the concept heritage encompasses and be able to share it with a broad spectrum of people. So in simple terms it can be defined as: 'whatever each of us individually or collectively wishes to preserve and pass on to the next generation'.

If we want to preserve something (whether it is natural, built, living or intangible) then it is our heritage. This of course varies quite a bit, depending on the person or the group of people expressing their interests and also in relation to its ownership and its type. It is important to note the intricate relation between different values given to the same asset by different parties. This can be demonstrated by exploring a three-dimensional analysis - the dimension of the subject, the characteristics of heritage and its values – where the dimension of the subject includes the people, family, region, community and country; characteristics of heritage includes natural, cultural - living or tangible; and its values are the ways in which a place is important.

This dimensional analysis of heritage can help us better understand the differing values of heritage and why we need to identify and protect a heritage place. Thus the higher the value each of the subjects (e.g. individual, family, country) place on the property whether it be natural, cultural or intangible, the higher the need to preserve it as heritage. (UNITAR 2005). Places that are important for telling natural, historic and traditional stories are considered as having 'heritage values'. In reality they often have a combination of different natural, historic and traditional heritage values. Understanding this complex heritage place means recognising all these different elements and acknowledging the importance of all its values

What is value?

Heritage value is generally defined as 'The positive characteristics attributed to heritage places and objects by legislations, governing authorities and other stakeholders' (UNESCO 2005). These characteristics are what make a site significant and they are often the reason why society and authorities are interested in a specific cultural site or object. In general, people expect benefits from the value they attribute to the resources (UNESCO 2004b).

Types of values include: social and cultural; commemorative – what it is we intend to commemorate, treasure of the Pacific, natural resources; environmental – river, fauna and flora, unique land form; historical – events and people; symbolic or religious; aesthetic – site and setting – scenery, natural beauty, clean air, silence and solitude; economic – new job opportunities; and scientific and educational – information about our people and visitors

Why the heritage place is important

It is essential to understand the important elements of a place – its heritage values. People need to be clear about what the values of a place are and how important or significant they are so that what makes a place important can be protected (UNESCO 2004c). This is the purpose of the Convention for Samoa, the reason for the Ministry of Natural Resources and Environment (or Ministry) to be actively involved and the aim of our conservation efforts.

Significant role of heritage in sustainable development

The physical, human-made components of the heritage are not only inextricably linked to but also arise from the natural geography and environmental setting of their respective cultures and serve as the setting for more intangible expressions of cultural traditions. Some experts in the area of heritage emphasized the inter-relatedness of practices for the conservation of the physical heritage sites, the intangible heritage and cultural landscapes. It is important to preserve heritage values represented in heritage sites as fundamental to the preservation of cultural identities. And the importance of local cultural resources as basic to sustained and equitable social and economic development (Australian Heritage Commission 2004).

Ideally with heritage conservation the National Heritage Coordinating Committee and the Ministry try to manage three things: 1) Assets (can be forests, traditions, buildings, ruins, wetlands, etc.); 2) People (who work for us or those who visit the sites); and 3) Values (what differentiates us from managers of airports or public transports). Values are at the core of our conservation strategies. That is why we do what we do.

How do we know what sites have heritage value, what is historical truthful, what is significant, and what is worth preserving? That is the question for each and everyone of us to think about**.**

Samoa can benefit from the Convention through:

- Use of world heritage to help counter problems associated with the exploitation of forest resources by serving as refuge for plants and animals, and source of inspiration of people
- Use of world heritage to demonstrate how we can manage areas to preserve universal biological value of Protected Areas while still meeting the livelihood needs of people
- Recognising that world heritage aims to protect cultural and natural heritage of outstanding universal value but underscore that the whole range of values (whether local values, intangible spiritual values and traditional management systems) should be understood, respected and taken into account in identification and management of heritage properties.
- Universal and local values are part of a continuum and should not be separated. It is not viable to identify universal values without acknowledging and maintaining the values of a place to the local people.
- Heritage properties are dynamic entities where cultural and social values evolve. They should not be frozen in time for purposes of conservation. Indeed, the continuity between the past and future should be integrated in management systems accommodating possibility for sustainable change and ensuring evolution of the local values of the place is not impaired.
- All stakeholders should be made aware of, consulted and involved in the interpretation and assessment of its heritage sites and values in the tentative list/nomination process and fully understand all possible implications benefits costs and consequences of world heritage to their heritage and resources.
- Efforts be made to maintain social structures and traditional skills that are vital for safeguarding social and economic developments; and
- Preservation of our national heritage need for effective governance, application of principles within appropriate and sustainable capacity and good understanding of heritage values (UNITAR 2005, IUCN 2003).

What are some of the challenges to our heritage conservations efforts?

Our heritage sites are threatened from a variety of forces linked to population growth, environmental degradation, urban redevelopment, industrialization and the globalization of traditional socio-cultural fabric. It can also be recognized that tourism and the process of presentation for tourism purposes can introduce subtle threats. Absence of clear definitions of what constitutes heritage, lack of regulatory controls, inadequate financing and incentives can compromise heritage conservation efforts in Samoa. These issues can be of the greatest danger to longer-term safeguarding of heritage sites in the Samoa, which is inadequate public understanding of the need to conserve the heritage and inadequate localization of stewardship responsibility over heritage resources.

These and others can threaten the survival of heritage and endanger its truthful transmission to future generations. There is a need to establish guidelines to assist our leaders and planners in the protection and management of the heritage and to establish conservation practices to guide the conservation, restoration and adaptive reuse of heritage properties. Conservation of the heritage should and always will be a negotiated solution reconciling the differing values of the various stakeholders, and underscored that this 'negotiated state of mind' is a value inherent in our cultural processes (UNESCO 2004b).

Is Samoa ready for the World Heritage List?

There is a general notion everybody wants to have a world heritage site and at some point around the world there was a mad rush to inscribe. The inscription would mean it will immediately elevate a local or national site to international status and recognition. Thus it brands the site as one of the selected few that compromise exhibit universal value.

Naturally, every country wants to inscribe sites on the List. It is a matter of national pride and international recognition but it should not be seen as a beauty contest there is substance in the purpose of the Convention. Of course the Convention brings benefits in terms of additional funding and tourism but it should also generate reflection and discussions on universal values and on the fundamental reasons for protecting and safeguarding precious heritage for future generations.

Samoa needs to understand those values in order to afford appropriate protection and management carefully. Although inscription increases tourism and improves opportunities for income generation, it also opens the site to exploitation and misuse. Therefore safeguarding the property or sites must be recognized as the underlying purpose of inscription. Despite the attractive benefits and prestige that inscription brings, heritage sites must be carefully protected to ensure that its heritage values will not disappear (UNESCO 2004c).

Preparing for the tentative list should ideally combine efforts among local and national authorities, as well as the communities. It is essential that all stakeholders etc agree upon the same set of heritage values to provide the framework for a unified site management plan that they implement in partnership.

Although it may appear that the Ministry and the communities carry out the major part of conservation efforts and heritage sites, strong national implications exits. The Convention is an international instrument ratified by state parties. Commitment is on a national level. The Convention requires each state party to provide full socio-economic and technical support to heritage sites within its borders. The process begins with an agreement on heritage values followed by site identification commitment to abide by world heritage inscription responsibilities and the assurance of a management plan.

While heritage awareness has improved in recent years most people are unaware of heritage site maybe some do not care Thus the world heritage mechanism works to the advantage of conserving our natural resources when all national, local, and community stakeholders fully understand the responsibility for site preservation in principally in their hands. Whether or not to inscribe a site on the List is indeed a national choice for all of us. Work is currently in process for the preparation of Samoa's tentative list and in order to be inscribed on the List, Samoa must at least satisfy one of the 10 criteria of outstanding universal value (UNESCO 2005):

1. Represent masterpiece of human genius

2. Exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on development in architecture or technology, monumental arts, town planning or landscape design.
3. Bear unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared
4. Be an outstanding example of a type of building or architectural or technological ensemble or landscape which illustrates significant stages in human history
5. Be an outstanding example of a traditional human settlement or land-use which is representative of a culture, especially when it has become vulnerable under the impact of irreversible change
6. Be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance
7. Be outstanding examples representing major stages of earth history, including the record of life, significant on-going geological processes in the development of land forms, or significant geomorphic or physiographic features or
8. Be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial , fresh water, coastal and marine ecosystems and communities of plants and animals or
9. Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
10. Contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation

So how do we know what sites have heritage value, what is historical truthful, what is significant, and what is worth preserving?

Heritage is about People as well as Place

Heritage is Values of people, by the people and for the people

Heritage is about what we wish to preserve and pass on to the next generation

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Exploring the status of tsunami early warning systems in Samoa

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Abstract
Historical records indicate that a total of sixty tsunami events have impacted the Samoa Islands between the period 1837 to 1980. The majority of these tsunami events were teletsunamis which originated from seismic activity associated with the Pacific Ring of Fire, although local volcanism have also played a role in generating local tsunami events. Relative to the impacts of other natural hazards such as tropical cyclones and flooding, there has been the perception that the magnitude of tsunami impacts in Samoa have been rather moderate. This holds true at least up until the December 26th 2004 Indian Ocean tsunami, which served as a wake up call to Government's around the world to reassess the nature and impacts of tsunamis likely to affect their countries, as well as their respective levels of resilience to such hazards. Samoa has since upgraded the risk of tsunami hazards to extreme based on the unpredictable nature of these events, as well as Samoa's proximity to the Tonga trench region. This change however, has prompted the need to re-evaluate Samoa's existing warning system, as well as identify the loop-holes that need to be strengthened so as to meet public demand for greater service efficiency in the provision of timely public tsunami warnings. This paper takes a generic look at the status of Samoa's tsunami warning system, by exploring the nature of tsunamis that have affected the country, as well as the relative measures Samoa has undertaken in response to tsunami mitigation.

Introduction
Earthquakes, tsunamis, and volcanoes are naturally occurring phenomena which exist within an interlinked geophysical system driven by the earth's internal and crustal processes. Each phenomenon is associated with the other either directly or indirectly, and for the case of tsunamis, the nature of different tsunamis is determined by the magnitude and extent of their source of origin; most commonly shallow submarine earthquakes and volcanoes.

This is not to say that tsunamis are only formed from earthquakes and tsunamis. Tsunamis can also be formed from meteorite impacts, as well as submarine landslides formed from sediment overloading; different from volcanic wall collapses as a result of an erupting submarine volcano. Based on the limitation of detailed information in this area, it is not known whether such sources have ever generated damaging tsunami events in the Samoa Islands, at least with reference to historical evidence.

While the nature of tsunamis in Samoa is relatively known, the levels of national and community preparedness to these hazards are still a working progress. At the national level, two documents which would serve as the framework and mandate for development activities associated with disaster preparedness, response, recovery, and mitigation against all hazards in the country have been tabled to cabinet and parliament for their endorsement; the National Disaster Management Plan (or Plan) and the National Disaster Bill. Stemming from the Plan is the National Tsunami Plan, which lists the risk of tsunamis in Samoa as extreme. This is based primarily on two factors; the non-seasonal nature of tsunamis making them difficult to

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forecast and predict, and, the fact that there exists documented evidence of tsunami impacts in Samoa.

In light of this, the Government of Samoa (GOS) has made and is undertaking current developments to strengthen the existing system, which depends mainly on the continuity of seismic and oceanic data flow from respective seismic and sea level monitoring stations within the region to the Pacific Tsunami Warning Center (PTWC) in Ewa Beach, Hawaii. Although noting the sufficiency of the system in responding to regional or distant tsunamis (teletsunamis), it has become apparent that the system is inefficient in providing timely tsunami advisories or warnings for locally generated tsunamis. Such cases present scenarios where the travel time before impact of a locally generated tsunami (such as along the northern tear-fault region of the Tongan trench) traveling at a speed of more than 700 kilometres per hour could be less than 15 minutes. It is situations such as these that have prompted the GOS to place heavy emphasis on tsunami public education and awareness activities. These activities center on the concept of self-initiative and community collaboration in responding to tsunamis, based on empirical observations of natural fluctuations that are associated with them.

The following Sections of this paper serve to outline the risk and vulnerability that Samoa faces from tsunamis, as well as the national systems in place to monitor them and provide early warning services to the public at large.

Nature and impacts of tsunamis in Samoa

Understanding the nature of tsunamis in Samoa as well as their consequent impacts provides the fundamental basis for understanding the importance of having a tsunami monitoring and warning system in the country. Subsequently, the risk tsunamis impose on the local environment and socioeconomy must also be understood in order to fully realize the need for an efficient early warning system. It is should be noted that approximately 80% of Samoa's population live in coastal areas (that are less than 10 metres in elevation). The central business district of the country is located along the Apia harbour. With the known fact that the majority of population as well as critical infrastructure in Samoa is located in coastal areas, as well as the highly possible rising developments in these areas that are associated with population as well as socioeconomic growth, the risk to tsunamis as well as potential costs to impacts will also increase.

Pararas-Carayannis and Dong in June 1980 compiled a catalogue of tsunamis in the Samoa Islands, and noted that a total of 60 events impacted the Islands' from between November 7th 1837 to June 1980; a period of 143 years. Most of these events were located or identified using qualitative methods, which involved a detailed review of historic periodicals and journals, as well as personal interviews.

One might immediately argue that the findings could equate to a consistent rate of tsunami occurrence in Samoa as 1 event every 2½ years. This assumption however does not hold true, as tsunami occurrence rates must be calculated according to their respective regions of origin. For example, the rate of tsunami occurrences generated from convergence along the Peru-Chile subduction zone are calculated independently of the rate of tsunami occurrences generated from plate convergence in the Japan region. This however, is beyond the scope of this paper, and will not be touched on further. Rather, a generic look at the data will be conveyed in order to establish the importance of having a tsunami monitoring and warning system in the country.

Based on the data, the majority of tsunamis which have impacted Samoa were generated as a result of large earthquakes (magnitudes ≥ 6.5) which occurred, respectively and in different years, along the Pacific Rim of Fire. The most notable of these occurrences in terms of their impacts were in the years 1883, 1906 / 1907, 1917, 1952, 1957 and 1960.

The 1883 event on March 24th was interesting in that the source is unknown. Pararas-Carayannis and Dong argued that it may have been a locally generated tsunami, which caused all houses within a quarter of a mile of the beach on the east end of Savaii to be swept away for a distance of 15 miles along the shore. A likely local source for an event of this magnitude could have been a subsurface eruption of the Mt. Vailuluu submarine volcano, which lies approximately 60 miles east of the island of Tau in the Manua group. An eruption within the hydro-explosive zone may have caused a volcanic wall collapse resulting in the formation of a local tsunami, although it is premature at this stage to make any conclusive assumptions.

The eruption of Mt. Matavanu in Savaii from between 1905 to 1911 was also interesting in that it presented another source for local tsunami generation in the country. A total of 7 local tsunamis were generated as a result of lava coming into contact with the ocean along the coastal area. One of these events occurred on November 28th in 1906, and the latter 6 occurred between the months of June to October, 1907. The impacts were felt along the northwest coast of Savaii, although fortunately they were minimal.

The June 25th 1917 event was significant in terms of the spatial distribution of impacts. A magnitude 8.3 earthquake on the Richter scale which occurred in the Tonga trench region triggered a tsunami which impacted Samoa 10 minutes after the earthquake's origin time. Reports indicated that destructive waves 3 metres in height were experienced at Aleipata, and for the case of Lotofaga, half of the village was submerged and houses destroyed. A bridge was washed away at Palauli and a number of native houses destroyed. In Satupaitea, a copra house was carried down the coast by the wave for about a quarter of a mile, and all native houses were demolished. In Pago Pago, a recession of ocean water was observed a few minutes after the earthquake was felt. Many native houses were destroyed, including partial destruction of a Catholic church in Leone, and a Mormon church in Pago Pago, American Samoa.

Similarly, the 1952, 1957 and 1960 events were significant in terms of their respective spatial distribution of impacts. The actual source for the tsunami on November 4th 1952 is not known, although the major impacts noted was the destruction of a school and some Samoan houses in Fagaloa, particularly Maasina, Sanamea and Taelefaga. The 1957 event originated from a magnitude 8.5 earthquake in the Aleutian Islands, and had a travel time of approximately 9 hours. The impacts of the event were relatively distributed along the north coast of Upolu, Savaii and Tutuila islands, although the most notable were experienced at Fagaloa. Inundation over the lower part of Fagaloa village was approximately 23 metres, causing sea flooding in most of the houses in the area.

In 1960, a magnitude 8.5 earthquake in South Chile generated a Pacific-wide tsunami, which caused devastating impacts in Japan; all the way in the northwest Pacific. This tsunami was undoubtedly one of the largest that has been recorded in the Samoan group. At Lalomanu village (east coast of Upolu Island), two fisherman in canoes near the reef had been picked up by the wave and washed onto the beach by the road. At Fagaloa, the first motion was a recession of the sea beyond the reef. A few minutes later, a crest advanced 82 metres through the village, where the peak water level reached the roof of one of the local Samoan houses.

Fortunately, there were no losses of lives recorded. In Pago Pago, damages amounted to approximately USD$50,000. One house was lifted and moved 3 metres inland, and another was washed into the bay by the outgoing wave.

On a probable though inconclusive note, it is important to bear in mind the possibility of a local tsunami being generated as a result of submarine volcanic activity associated with Mt. Vailuluu; the active hotspot location in the Samoa Islands chain. Volcanic-wall collapse as a result of explosive eruptive activity in the relative future may generate a local tsunami that could propagate west. Theoretically, the islands in the Manu'a group would be most affected, although destructive impacts might still be felt on the islands of Upolu and Savaii (Hart et. al, 2000; Konter et. al, 2004; Staudigel et.al, 2004).

It is clear from the evidence provided above that Samoa is no stranger to tsunamis and their consequent impacts. As a result of this, disaster management authorities have listed tsunamis as one of the highest risk natural hazards in the country (GOS, 2006b). This is based primarily on the fact that more than 80% of our local population reside in coastal areas that are less than 10 metres in elevation, as well as the non-seasonal nature of tsunamis, making them more complicated to predict than geohazards of atmospheric nature. These combined factors indicate that the risk of tsunamis is high, and that communities residing in exposed coastal areas that are less than 10 metres in elevation are vulnerable to the impacts of such hazards.

Existing monitoring and warning system

Samoa, like most island-countries in the Pacific, relies on the PTWC for the issuance of tsunami warnings. The only real-time auxiliary seismic station (AFI AS095) in the country, which is located at Afiamalu (13.9 S, 171.8 W), transmits seismic data to PTWC among other organizations such as the Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO), and the Albuquerque Seismological Laboratory (ASL).

Prior to February 2006, the primary method for the receival of data from the station at PTWC was through the internet. Data was transmitted via VSAT to Vienna (the headquarters of CTBTO), and then onto ASL in Albuquerque also via VSAT. It was ASL that was then responsible for transmitting the data to other relevant organizations including PTWC via the internet. This method, while effective, possessed an element of vulnerability in terms of data transmission in that the system was reliant on local telecommunications organizations in Hawaii. If problems arose within the local telecommunications system, the possibility of disruption to data transmission was very high.

The recent installation of the new VSAT at the station site in February 2006 established the enabling mechanism for the direct transmission of data to PTWC. Now, the primary method for transmitting the data to PTWC is through the new VSAT, with the former method serving as the backup. This new shift has served to boost the reliability of data transmission, while also serving to increase the efficiency and effectiveness of data analytical time with respect to tsunami response.

Samoa also has one tide gauge installed at the Apia wharf, which was installed under the South Pacific Sea Level and Climate Monitoring Project. The data, which is also used to verify tsunami events, is transmitted to the National Tidal Center of the Bureau of Meteorology, Australia.

The system, which is comprised of a network of seismic, sea level, and ocean buoy monitoring stations around the region, is based on the acquisition of this integrated data for analysis and interpretation at PTWC. The seismic data is used to verify the details of an earthquake with potential tsunamigenic properties; the PTWC earthquake magnitude threshold for the formation of a tsunami is greater than or equal to 6.5 on the Richter scale. Ocean and sea level monitoring stations are important for verifying the generation of a tsunami, although they are used in slightly different ways. The ocean buoys have the ability to detect a tsunami while it is still offshore (before impacting land), while the sea level stations can verify the height of a tsunami wave upon impact.

All of these parameters are factored into the PTWS, which currently occupies the role of issuing tsunami information bulletins to PTWS member states, which includes Samoa. After an earthquake has been located and magnitude determined, a decision is made concerning further action. If the earthquake is within or near the Pacific Ocean basin and its magnitude is 6.5 or greater, but less than or equal to 7.5 (less than or equal to 7.0 in the Aleutian Islands), then a Tsunami Information Bulletin is issued to the Warning System member states. Tsunami Warning/Watch Bulletins are issued to the dissemination agencies (Meteorology Division in Samoa) for earthquakes of magnitude greater than 7.5 (greater than 7.0 in the Aleutian Island region), alerting them to the possibility that a tsunami has been generated and providing data that can be relayed to the public so that necessary preliminary precautions can be taken. It should be noted that any decision to issue national public-wide tsunami warning or watch bulletins is made by respective member states' authorities. For Samoa's case, the overall decision comes from the Prime Minister, in his or her role as the Chair of the National Disaster Committee.

It is the Meteorology Division of the Ministry of Natural resources & Environment that holds the responsibility of monitoring and issuing warnings against most, if not all, natural hazards in the country, including tsunamis. More specifically, it is the Geophysics Section of the Division that monitors earthquakes, tsunamis and volcanoes, as well as issues national warnings against these hazards when relevant. The overall decision to issue a national tsunami warning or watch is made by the Prime Minister, based on information received from PTWC. The primary means by which the information is disseminated to the public is through radio and television media outlets, as well as informing the Fire Department who have the responsibility for coordinating urban evacuations. Plans are in place to utilize cellular phones and landlines as another possible means of receiving pre-recorded tsunami early warnings, via audio and text means (GOS, 2006a; GOS, 2006b).

With respect to local tsunamigenic earthquakes, the primary method in place is public education and awareness on the nature of tsunami hazards in the country. The Disaster Management Office as well as the Red Cross Society of Samoa implement public and community awareness programs, which include a wide range of different hazards and disasters, both natural and human-induced. Included within these programs are public information kits on the nature of tsunamis, as well as the means to recognize the signs in nature of an approaching local tsunami.

Although this has all been expressed in corporate and management plans of the Ministry and Meteorology Division respectively, there are still a lot of loop-holes which exist within the operational framework of the system. On the technical front, local geophysical hazard monitoring is limited due to the absence of a national geophysical hazard monitoring network; a challenge that will be discussed further in the following Section of this paper.

Seismic monitoring in the country relies heavily on external sources of information; primarily information issued by the National Earthquake Information Center in Denver, Colorado. With reference to Samoa however, this mechanism is useful only for recording earthquakes with magnitudes larger than 5.0 on the Richter scale. As a result, detailed seismic and integrated geophysical hazard monitoring at the national level is limited.

On the anthropological front capability within the Geophysics Section is limited due to ongoing challenges associated with local budgetary restrictions, as well as bilateral collaborative partners. It cannot be overstated that development in any form depends heavily on the availability of resources, and of high importance within this category is the availability of financial resources. With adequate financial resources in hand, the implementation of technical developments that parallel institutional and human resource strengthening can be undertaken.

In the meantime however, the Geophysics Section is comprised of 7 personnel positions. Institutionally it falls under the Geoscience Section of the Meteorology Division, forming one of two units within this Section. It is headed by a Senior Officer position supervising the duties of 6 subordinate staff positions. Of this 6, 3 positions are delegated to the geophysical hazards program, and 3 to the geomagnetic program.

General technical capability within the Section needs to be strengthened through bilateral assistance, while continuing to support regional and international efforts. This would involve the utilization of financial aid to implement technological developments at the national level, as well as institutional strengthening and public capacity building programs. This would serve to emphasize the importance of the role geophysical monitoring has in the provision of early warnings to geophysical hazards. It would also have a pronounced influence on strengthening emergency response to geophysical hazards at the national level within Samoa.

Conclusion

It is clear from the evidence provided that Samoa is no stranger to tsunamis, both distant and local. The tsunami impacts discussed as a result of the respective tsunami events which occurred over the last 169 years clearly demonstrate that the Samoa islands are not immune to the impacts of tsunamis. While acknowledging the relative difference in scale between the known impacts of tsunamis compared to tropical cyclones, the inevitable fact is that there still exists a wide information-gap on the nature of tsunamis in Samoa, making it difficult to plan effectively. Subsequently, the timeframe in which these events occur or are generated limits prediction and forecast capability considerably. Tropical cyclones, droughts, and flooding, which are seasonal nature, can be forecasted with ample time left to undertake emergency response measures, at least in most cases. Tsunamis on the other hand, follow the non-seasonal nature of earthquakes; which are still complicated to forecast and let alone predict. These combined parameters mean that one living in coastal areas will need to be prepared at all times for the possibility of a tsunami.

With respect to PTWC, the system is very useful in the provision of information which local authorities may utilize to make emergency response decisions against distant tsunamis; tsunamis with an estimated time of impact of more than 2 ½ hours. This window of 2 ½ hours provides sufficient time for emergency officials to implement necessary emergency measures, which may include evacuation to higher ground or vertical evacuation (moving to the top floor of multi-storey buildings). For local tsunamis however, PTWC's response time may not prove sufficient, as the travel time for tsunamis before impacting land could be as

little as 5 to 10 minutes. Inevitably, this would mean that the only early warning would be the occurrence of the earthquake itself. Once a strong earthquake is felt, one should assume that it occurred within close proximity to the Samoa islands. For residents inhabiting coastal areas or areas less than 10 metres above sea level, all precaution should be taken. If a rapid ocean recession occurs within the adjacent lagoon, this would mean that a tsunami is approaching.

While public and community education seems a simplistic attempt to determine an approaching tsunami, it is concluded as being the most effective given the existing local and regional capability to respond to local tsunamis. While it is relatively conclusive that the development of a national seismic monitoring network will contribute to strengthening Meteorology Division's ability to monitor and provide local tsunami early warnings, the fact remains that the timeframe for issuing this information as well as the means by which the public receive it may prove insufficient. At present, the primary method for disseminating information to the public is via radio and television media outlets. This in itself presents limitations, as not all media and radio networks operate on a 24/7 basis. Moreso, the majority of people living in Samoa are usually asleep during the early hours of the morning, should an event occur during this time. These factors lead to the conclusion that the existing mechanisms in place to inform or warn people of an approaching tsunami are limited in their effectiveness. Further concluding that public education and local community response systems need to remain a priority, especially in the case of responding to locally generated tsunamis.

It thus becomes articulately clear that tsunami early warning and mitigation systems in Samoa, while existent, need to be strengthened in a manner that complements inter-related development programs. This would involve the incorporation of new systems with existing ones in an all-natural hazards context, whereby technology may be used in an integrated manner to monitor multiple natural hazard events as opposed to a single event. Existing weather, climate, hydrological, earthquake and volcano monitoring technology could be integrated with new technology to form a multi-natural hazards monitoring network at the national level within Samoa. Institutionally, this could be enabled as all of these services fall under the mandate of Meteorology Division. Regardless of which, the primary facts remain that collaboration at all levels, nationally, regionally and internationally is essential to any form of achievement in Samoa's quest to strengthen its tsunami warning systems capability to both local and distant generated tsunamis.

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Determination of a mean daily discharge values for Faleaseela River – implications for population water demand.

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Abstract

Faleaseela is a 10.1 km^2 catchment basin (Figure 1) to the southwest of Upolu Island. The stream's tributaries converge into a very stable artificial control weir on the edge of a moderately steep water fall. Data is collected by a mechanically operated Leupold & Stevens Type A stream flow recorder and converted to mean daily discharges using an empirical rating curve equation, $Q = ah^c$ where Q is the Mean Daily Discharge; h is the stage height; and c the exponential constant, and multiply a another constant value accounting for channel and flow characteristics. Mean daily discharges are applied to the determination of the total runoff volume for a period of 5–10 years. Comparative analysis of reticulation to the end users (population) against supply is an indicator for providing an effective strategy for the management of the resource at abstraction point. Some assumptions had to be made for the validity of the study: 1) the slightly falling trend in the average mean daily discharge through out the research period is a result of land clearance in critical parts of the catchment area, and 2) the point of abstraction is in close proximity with the measurement point, assumption of identical mean daily discharge values.

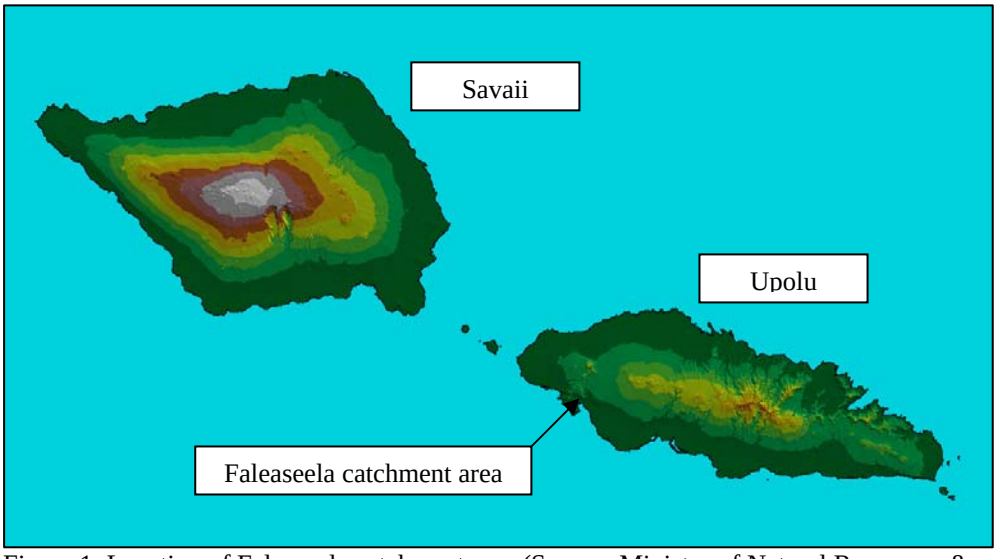

Figure 1: Location of Faleaseela catchment area (Source: Ministry of Natural Resources & Environment)

Introduction

During the dry season or close to its onset, perennial problems of water shortage are experienced in certain parts of Samoa. A generalized statement, observed only without clear scientific justifications. It is also extremely difficult to make a genuine assessment and

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planning if the resource cannot be quantified by our water users, mainly Samoa Water Authority (SWA), Electric Power Corporation and Ministry of Health.

Hydrological analyses should provide the answer. It is based on well-established principles of hydrodynamics, thermodynamics, and statistics. The central set-back is that these principles must be applied in a homogeneous, well sampled and fully understood natural environment.

The reason we have opted to use this 'simple' parametric approach, analysis that is performed by inter-comparison of hydrological data recorded at different locations and time. As opposed to the more complex deterministic, probabilistic and stochastic hydrological analyses. Note also that very little is provided on the temporal, spatial and regionalization of variables, but most the relationship and for planning purposes consumption rate – more of social variable in this respect.

Data collection

A flat-shaped artificial weir was constructed at Faleaseela River for flow control and a L/Stevens Type F to gauge the water level was also installed in 1975 (Methorology Division 1975-1979). A 5 year period was selected because of quality control. Runoff volume (m^3) was calculated using mean monthly discharge for the month (Table 1). Census data on population for Faleaseela and Lefaga district (Ministry of Finance 1981-2001) were used for demand versus supply projection and for future trend analysis (Table 2).

Years	Runoff volume (m^3 x 10^6)	Average per month	Average per day	Average for 5 years
1975	17.220	1.435	0.0472	14.5012
1976	11.700	0.975	0.0321	14.5012
1977	11.727	0.977	0.0321	14.5012
1978	17.099	1.425	0.0499	14.5012
1979	14.760	1.230	0.0404	14.5012

Table 1: Hydrological data (Source: Ministry of Natural Resources & Environment)

Census year	1981	1986	1991	2001
Lefaga & Faleaseela	3,776	3,747	4,044	4,508

Table 2: Total population of Lefaga & Faleaseela district (Source: Ministry of Finance)

Methodology and analysis

Calculation of runoff volume

The methodology is a parametric approach – estimating the average annual volume of runoff (m^3), from average mean daily discharge rates (m^3/s) From Table 1, the monthly and annual volume is computed as Average monthly runoff volume (m^3) = Mean daily discharge (m^3/s) times seconds/day times number of days in the month.

For example in January 1975, MDD is 1.373 m^3/s x 86,400 s/day x 31 days = 3.678 million m^3. Adding the 12 months in a year gives us 17.220 million m^3 annually. After the analysis the average annual runoff volume for the 5 year period is estimated at 14.5 million m^3 of water is available

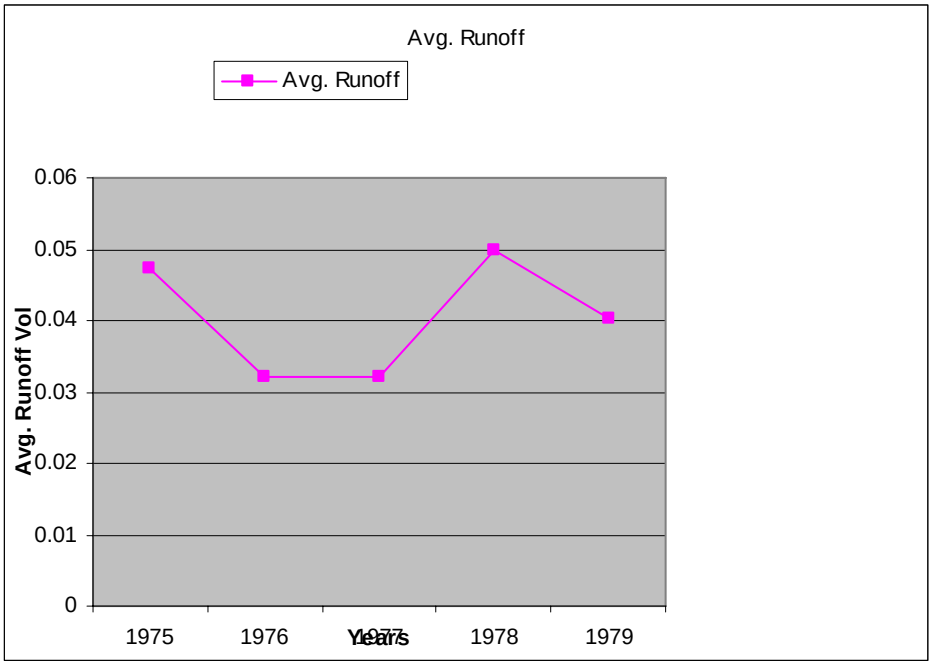

Figure 2: Average/day/month/ Runoff x 10^6 vs Years

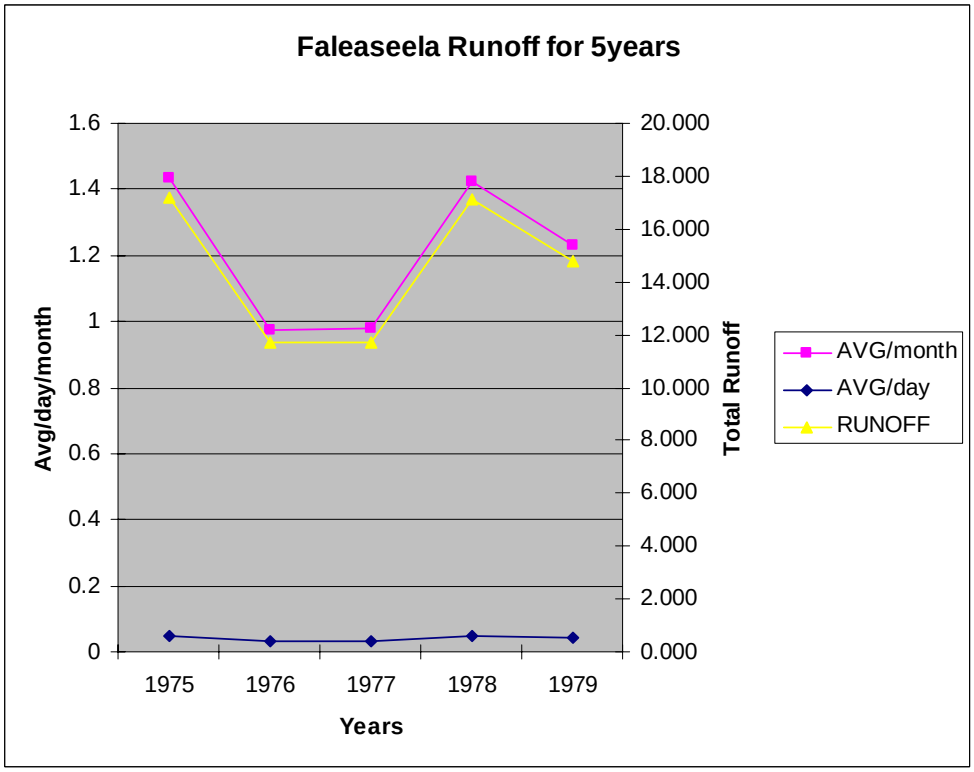

Figure 3: Graphical presentation of hydrological data

Graphical presentation of hydrological data

Figure 2 shows the average Runoff-Volume in cubic meters (m^3) computed per day for each year from 1975 to 1979 which gives a comparative value to plan abstraction on a daily basis and similarly for Figure 3 which shows the overlay of the 3 parameters - (1) 'pink' – average run-off volume in m^3 per month *point values on the left Y-axis*; (2) 'black' – average run-off

volume per day in m^3 *point values on the left Y-axis* and the 'yellow' is the total run-off in m^3x10^6 *point values with the scale on the right. Y-axis* (Note: the different scales of the axes maybe similar but are not identical)

After the analysis the average annual runoff volume for the 5 year period is estimated at 14.5 million cubic meters of water is available

Population growth and trend

From Table 2, there has been very little population growth in the1980s however an 8% increase in 1991 then an 11% increase in 2001. The last two censuses depicted some significant increase in the population in the Lefaga & Faleaseela district

Consumption rate

For the purpose of the study some assumption had to be made on the abstraction rate: (1) there is no leakage within the reticulation system; and (2) the consumption rate (usage – shower, washing etc.) is equal to that of the abstraction rate.

Though, very little data exist on the SWA database on abstraction rate, so we have to undertake a special field exercise at the intake site. The value obtained is 18 liters per second or 0.5 million cubic meters is abstracted annually.

The consumption rate is 243 liters per day (pers. comm SWA) and is quite high in Samoa; about 40% of this amount is wastage, the rest is utilized for drinking, washing, shower etc. usage.

So in the final analysis an estimate is made on the quantity of the water resource (surface water) or run-off *less* the estimate of the water abstracted from the intake (consumption) leaving the incremental portion of surface water available.

Conclusion

1. The estimated average annual run-off volume for Faleaseela Catchment Area of $10km^2$ is 14.5 million cubic meters;
2. SWA abstract 0.5 million cubic meters annually or 18 liters per second;
3. The 2001 census with a population of 4,508 persons requires 0.4 million cubic metres per year or 80% of Saw's drawing rate;
4. If the trend of a 3% increase of population continue linearly every 5 years it shall project the district population in 2006 to be at 4,743 persons requires a .42 million cubic meters per year;
5. About 77% of the surface water still remain to be developed from Faleaseela;
6. The major problem is the demand is at the ceiling of the abstraction rate so SWA needs to develop a large intake and an increase abstraction rate to cope with the demand

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