Understanding the Human-Mangrove Relationship for Resilience in Samoa

Findings from the Moata'a Household Survey

Sascha Fuller, Masami Tsujita, Anita Latai-Niusulu, Faainuseimalie Latu, Phoebe Everingham, and Sarah Wright, with the Moata'a Aualuma

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EXECUTIVE SUMMARY

This report outlines key human-mangrove relationships in Moata'a, an urban village settlement in Apia, Samoa, with the aim to provide an understanding of the relationship between the Moata'a community and their mangrove environment that will inform future development, conservation, and climate adaptation activities in the area.

Healthy mangroves are integral to climate resilience in ways that see **social, cultural, environmental, and economic factors deeply entwined**. Results of the study indicate that climate adaptation and resilience activities in Moata'a need to be understood and responded to through a collaborative multi-sectoral approach which sees environmental, cultural, land/heritage, recreation, and economic (livelihoods) aspects as mutually reinforcing. The study also revealed gendered differences in the everyday lived experience of mangrove degradation and an important place for all members of the community, and notably women, in responding to change, and planning for future activities.

The study focussed on four main areas of results: positive aspects of the human-mangrove relationship; environmental impacts and climate change; adaptation, mitigation, management and care; and, future impacts and future plans.

1. *Positive aspects of the human-mangrove relationship*

The study found that the Moata'a community place **significant value** on their mangrove environment: mangroves were appreciated for their environmental values; their contribution to sense of place, belonging and identity; their practical use-value being integral to the provision of food and semi-subsistence; and as a site of recreation. Environmental factors were given the highest values followed by their importance to sense of place, identity and culture. While some respondents also valued them for development, this was the most contentious category and a significant proportion of respondents disagreed. Mangroves thus hold both significant environmental and cultural value for the Moata'a community.

The sense of belonging and identity that the Moata'a community take from their mangroves is directly tied to customary land (*fanua*) whereby caring for the mangroves is caring for Land, is caring for kin (*'āiga*). This key human-mangrove relationship – the appreciation of mangroves in the community for environmental considerations and the ways this is interlinked with mangroves' role in culture, identity and belonging – that is often not adequately recognised in mangrove conservation, biodiversity, and climate adaptation activities. Mangroves also provide for the environmental, spiritual/cultural, social, and economic **wellbeing** of the Moata'a community. The mangroves were ranked highest in their contributions to environmental well-being but economic, health, environmental *and* social factors were all highly rated illustrating the diverse and interconnected ways that mangroves contribute to well-being of the community.

2. Environmental impacts and Climate Change

Households report experiencing **significant change to their environment** and felt the burden of mangrove loss in multiple, interacting ways. Sea-level rise and flooding are identified as the greatest climate- and development-related impacts facing Moata'a. The community also

reported a loss of biodiversity, out-migration, increased waste and pollution. Households further noted the impact of these environmental and climate changes on their physical and mental health. This is unsurprising given the close relationships detailed between the environment and sense of identity and well-being.

Climate change and ill-planned development have thus had disastrous consequences with the community have experiencing not only a loss of plant and Land, but, with it, cultural practice, livelihoods, subsistence, recreational play, seasonal festivals and sociality, traditional knowledge, belonging, and identity.

3. Adaptation, Mitigation, Management and Care

A key human-mangrove relationship in Moata'a are activities and practices oriented towards **climate and environmental adaptation and mitigation**. There is a strong involvement from the community in mangrove management and care. The Moata'a community are taking action to adapt to and manage environmental and climate risks through: infrastructure development (building seawalls, houses and sandbanks, land reclamation), void filling erosion with soil, relocating inland or to the upper part of the village away from the mangroves, changing the direction of water flows, mangrove management and conservation (replanting and clean-ups), and by diversifying their income source. Households draw on traditional knowledge/ practice in the way they interact with, and value the mangrove environment. Many responses are led by women. Overall, there is emphasis placed on a reciprocal relationship – if we care for mangroves they will provide for and protect us.

Despite their losses the Moata'a community are resilient precisely because they have maintained as much as possible their connections with each other, the surrounding environment, and their cultural heritage, and continue to draw on these connections in existing governance, activities, and plans for the conservation and development of the mangroves. It will be crucial to build on these strengths and support local conceptions of resilience to reconnect the human-environment in mangrove conservation and restoration.

4. *Future impacts and future plans*

This report makes recommendations on key adaptation activities that will improve the health of the mangroves, regenerate human-environment connections and cultural practice, and thereby, strengthen the resilience of the Moata'a community. The Moata'a community was shown to overwhelmingly support eco-tourism development and to bring significant assets to the planning and implementation in their support of a regenerative, sustainable approach to tourism.

CONTENTS

INTRODUCTION

Anthropogenic global warming is predicted to reach 1.5°C between 2030 and 2052 if greenhouse gas emissions continue to increase at their current rate, with dire consequences for our planet (IPCC 2022). Anthropogenic global warming, hereafter referred to as climate change, exacerbates the intensity, frequency and impacts of climate variability and natural hazards. It is a global environmental, social, and economic emergency, 'a code red for humanity' (IPCC 2022) and requires urgent action (IPCC 2022).

At the Conference of the Parties (COP) 26 in Glasgow world leaders recognised, for the first time, the links between global biodiversity and climate change. Pledges and commitments were made towards nature-based solutions (NbS), or ecosystems-based adaptation (EbA) management and restoration for climate and ecosystem resilience that aim to deliver co-benefits for the environment as well as human health and well-being.

As 'biodiversity hotspots' Pacific Island large ocean states are disproportionately threatened by the impacts of climate change and biodiversity degradation. Climate change predictions for the Pacific islands' region include: an increase in extreme hot days and warm nights, extreme rainfall events, and an increase in tropical cyclones, sea level rise, and ocean acidification (SPC 2016). Climate change will increase and intensify the risks and impacts of the weather-related natural hazards the region is already exposed to, including, cyclones, volcanic eruptions, earthquakes, tsunamis, droughts, landslides, and floods (SPC 2016). These impacts cause progressive long-term degradation to critical ecosystems (for example, to coral reefs and mangroves), to critical infrastructure, and to key socioeconomic systems, resulting in loss and damage to the systems upon which Pacific Island communities depend for their subsistence and livelihoods, further undermining sustainable development efforts and mitigation capacities in the Pacific region (SPC 2016).

The latest IPCC report (2022) notes the observed impacts of climate change on tropical small islands to include:

- On natural systems:
    - Degradation of mangroves
    - Changes in ecosystem services
    - Changes in ecosystem structure
- On human systems
    - Settlements and infrastructure damage from erosion and seal level rise
    - Relocation and migration
    - Water stress from drought
    - Fisheries decline
    - Economic and livelihood loss

- Casualties, settlements and infrastructure loss and damage (general)
- Impacts on health and wellbeing

Pacific island leaders affirm that climate change represents the single greatest threat to the livelihoods, security, and wellbeing of Pacific communities. Of particular concern are the impacts of natural disasters (exacerbated by climate change) on Pacific peoples' social, economic, cultural, and environmental wellbeing, increasing the burden and risk of the regions security (Samoa Climate Change Policy 2020).

Despite these impacts, there has been a disappointing lack of ambition and level of action from the international community to curb carbon emissions. UN Secretary-General António Guterres contends the latest scientific evidence on the impacts of climate change is 'a damning indictment of failed global leadership' on climate (IPCC 2022). In the face of poor leadership, it is increasingly apparent that local communities will need to develop and implement their own climate adaptation and resilience strategies. This will be key for the survival of island societies in the face of climate risk and adversity (Fakhruddin et al. 2015).

Samoa is an independent Pacific Island state northeast of Fiji consisting of four inhabited and several smaller, uninhabited islands. The capital Apia is located on Upolu, the most populous and developed of the islands. Upolu and Savai'i, the other main island, account for 99 per cent of Samoa's 200,010 population (Samoa Bureau of Statistics 2022). Approximately 60 per cent of the population is employed informally and work in subsistence agriculture or local commercial ventures. Most of the formal employment is through the public sector and tourism.

As an archipelago of small islands in the Pacific Ocean, Samoa is at risk from climate change impacts including increases in water and air temperature, sea level rise, and coastal erosion, which are adversely affecting marine and terrestrial ecosystems, with many negative implications for biodiversity and human welfare (Fakhruddin, Babel & Kawasaki 2015).

Healthy mangroves are seen as one of the key drivers to climate resilience and biodiversity in Samoa, and thereby, to the resilience of human communities (Suluvale 2001), yet mangrove areas show signs of degradation from human activities. One such mangrove wetland is situated in Vaimauga West District on the central north coast on the island of Upolu, Samoa, incorporating the urban village settlement of Moata'a.

Against the threat of climate change and having lived through the environmental and socio-economic repercussions of ad-hoc and poorly designed infrastructural developments the community of Moata'a, wishes to conserve its remaining mangrove environment to ensure future livelihoods and well-being. The community has plans to develop the area into a key eco-tourism and educational site – a site of significant environmental and cultural value. Doing so is a key 'bottom up' climate adaptation activity. However, several social and environmental challenges that directly impact the health and appearance of the mangroves - sanitation and hygiene, hydrology, waste and pollution, for example - need to be addressed before eco-tourism can be promoted in Moata'a.

With support from the Irish Fund, this report provides an analysis of the findings of a household survey conducted in Moata'a in May 2022. Drawing on cultural ecology and

systems theory, decolonial perspectives, and bottom-up sustainable livelihoods approaches (SLA) to development, here we highlight the perception, values, practices, and adaptation strategies of Moata'a around key themes: climate change perceptions, ecosystem services, waste and pollution, mangrove conservation, adaptation, and management, traditional knowledge and practice, and opportunities for eco-tourism development, where gender, Indigenous, traditional, and local knowledge, and climate change are cross-cutting considerations.

The findings presented here provide rich data on the human-mangrove relationship in Moata'a and will inform the future direction of local, national, regional, and international planning for ecosystems-based adaptation, conservation, tourism development, and climate resilience by providing recommendations on the priorities, capacities, and solutions of mangrove communities in small island developing nations as posed by Moata'a residents within the broader economic, political, and sociocultural context of postcolonial Samoa.

MANGROVE CONSERVATION FOR CLIMATE RESILIENCE IN SAMOA

Marine ecosystems and their resources have always been an important part of life in Samoa. Today, most people continue to inhabit the coastal fringes, and remain dependant on marine resources and ecosystems to continue to support their everyday lives. Coastal waters support some of the most productive ecosystems such as mangrove forests – which provide coastline protection and sustain resources that are vital for the country's economy (Iakopo 2006).

Mangroves are a taxonomically diverse group of salt-tolerant, mainly arboreal, flowering plants (and ecosystems) that grow primarily in tropical and subtropical regions (Ellison and Stoddart 1991). They are among the worlds most threatened habitats yet form one of the most biodiverse and productive wetlands (Latai 2009). While mangroves make up a small geographical component of Samoa (less than 1% of the land) they are extremely significant biota. Several bird species, fish, mammals, and invertebrates live in the mangroves of Samoa (Suluvale 2001). Mangroves are the starting point for many food chain resources, and are valuable, constant food sources for several species of small fish, eels, crabs, prawns, and other small invertebrate (Iakop 2006).

They are vital to ecosystem health and climate resilience for the following key reasons (Suluvale 2001):

1) the complex root system of the mangrove trees trap sediments and act as an agent of land reclamation, forming natural breakwaters, which protect the land from wave action and coastal erosion. In this way, mangroves are naturally resilient to climate change and can facilitate resilience through filtering and trapping pollutants and stabilising coastal land by trapping sediment and protecting against storm damage (McLeod and Salm 2006).

2) nutrients in land-based runoff may be retained within the mangrove ecosystem before they reach the reefs and cause damage.

3) many fish species inhabit the mangrove areas at some stage during their life cycle, especially prior to spawning.

4) they provide multiple resources to the local village economies. For example, they are the source of mangrove crabs, mangrove wood for fuel and outriggers of small canoes, and bark which is used to make a dye for tapa cloth. The crab fishery contributes significantly to the subsistence and income of families living adjacent to mangrove areas.

Mangroves in Samoa, therefore, are one of the most valuable coastal habitats providing immeasurable benefits (both tangible and intangible) to the local communities as well as the ecology and environment surrounding them (Suluvale 2001). Degradation of mangroves is, therefore, of huge concern due to their importance ecologically, physically, and economically (Iakopo 2006). For mangrove dependent human communities, overharvesting of mangroves poses a threat to their conservation as well as to the sustainability of livelihoods.

In recent years, more efforts have been made to conserve and manage mangroves in Samoa. As a result of these efforts, there has been notable increases in mangrove coverage on the leeward side of the Mulinuu Peninsula and the landward side of the mangrove fringe along the Fugalei Stream, for example (Suluvale 2001). However, despite this, and the invaluable contributions to daily subsistence, some mangrove areas have been threatened by processes of coastal reclamation and development, including infrastructure (Iakopo 2006). This is the case in Moata'a where only five of nine hectares of mangroves remain. The path of the tidal channel has been significantly altered to make way for major developments which has resulted in subsequent mangrove degradation and fish decline (Suluvale 2001). Pressure from growing populations and urbanisation have also led to the destruction of mangroves. As more people move into urban areas for employment and education the need for land increases, as does pollution. As capitalist practices demand more intensive needs for cash economies, this also damages (traditional) fishing practices also affecting mangrove areas (Iakopo 2006). There are several interventions from various government and non-government actors aimed at conserving the remaining mangroves and restoring ecosystem health in Moata'a. However, if these are to be effective and sustainable, a greater understanding of the relationship between the Moata'a community and their mangrove environment is needed.

AIMS AND RESEARCH QUESTIONS

This research aims to understand the characteristics of social-ecological systems in Moata'a to support future climate adaptation interventions, including eco-tourism development. We are particularly concerned with understanding the intricate links between the human population living in the village of Moata'a and the surrounding mangrove ecosystem for facilitating resilient, more-than-human connections for sustainable livelihoods.

To gain insight into the human-mangrove relationship in Moata'a we implemented a household survey that addressed the following key questions:

1. What value/significance (spiritual, environment, economic, social/cultural) do households place on the mangrove environment of Moata'a?

2. How do households interact (degrade/ and or manage/conserve) with the mangroves in their everyday life (livelihoods, habits, routines, cultural practice, food production, waste management, traditional knowledge)?

3. How has the mangrove environment changed over time? How do the community attribute these changes?

4. What are the barriers and enablers of mangrove conservation?

It is hoped the findings of this study, including recommendations, will be made available to all partners to assist project partners to make informed decisions regarding the climate adaptation needs of the community and the priorities and plans for the development of Moata'a village into a key site for eco-tourism and environmental education in Samoa. The ultimate outcome of this project is aimed at building healthier ecosystems and thus, a more resilient community.

METHODOLOGY AND METHODS

METHODOLOGY: DECOLONISING RESILIENCE THROUGH A 'BOTTOM-UP' SUSTAINABLE LIVELIHOODS APPROACH

Resilience has been defined as the capacity to self-organise, learn, and adapt in the face of adversity (Carpenter and Brock 2008), which also 'requires institutional capacity to respond to environmental feedback, to learn and store information, and to be prepared to adapt to change' (McMillen et al., 2014, 4). However, Latai-Niusulu et al., (2020) and Binns & Nel (2019) point out that resilience is often linked to Western scientific neo-classical economic frameworks, underlined by assumptions of returning to a state of equilibrium using a non-equilibrium cultural ecological lens. Taking a non-equilibrium view, Latai-Niusulu et al., (2020) link resilience to highly dynamic social systems of island nations that undergo persistent adaptation in the context of ever-changing environmental factors. From this cultural ecology perspective humans are repositioned in less dualistic ways through more holistic understandings of environmental changes.

Understanding the characteristics of social-ecological systems that confer resilience to climate and environmental change has been identified as one of the world's most pressing problems (Gunderson and Holling 2002; Adger et al. 2005). It requires knowledge from local to global scales (Chaudhary & Bawa 2011, Lauer et al. 2012) and the integration of natural and social sciences (Liu et al. 2007b, Barnes et al. 2013). This study takes the work of Latai-Niusulu et al., (2019) as a starting point for understanding resilience in relation to climate change adaptation strategies in Samoa. Applying cultural ecology to resilience moves the analysis away from macroeconomic indicators as the determiner of what constitutes resilience, towards 'human perceptions and local understanding of past, present, and future environmental change at the community level, as well as key human survival strategies' (Latai-Niusulu et al., 2020, 43). The cultural ecology perspective opens analysis towards decolonial understandings of knowledge (re)production and subverts the dominant western-centric perception of islands and their populations as small and vulnerable (see also McMillen et al., 2014).

Incorporating local Indigenous Pacific islander perspectives into the field of environmental management theory and practice is beginning to take place, although challenges remain in the areas of biodiversity conservation and the creation of sustainable livelihoods. The concept

of Integrated Environmental Management (IEM) is a contemporary example that aims to address the importance of knowledge exchange between Western and Indigenous knowledge systems (Latai 2009). However, designing effective systems of environmental governance through the integration of these vastly different knowledge systems is hindered due to the dominance of 'centralised approaches based on Western conventional science' (Latai 2009, 1). Latai (2009, 1) argues:

> The Western-Indigenous theoretical divide remains evident in how Western approaches subordinate the holistic governance systems of indigenous/ traditional societies, thereby alienating local peoples from management.

Indigenous perspectives and concerns have typically not been accommodated in much of the climate change adaptation research, however, a new research agenda around climate change adaptation in line with Indigenous peoples' lived experiences is emerging, that takes seriously, Indigenous peoples' relational ontologies, and promotes, 'adaptation that draws on Indigenous capacities and aspirations for self-determination and cultural continuity' (Johnson et al., 2021, 1). Decolonising and intersectional studies are needed to map Indigenous adaptation practices that already exist and reposition Indigenous people as active agents of resilience rather than passive victims (Johnson et al., 2021; Wright et al., 2020). 'Indigenous victimhood narratives' overlook the ways in which Indigenous peoples understand their relationships to climate change in the ways they can and already do adapt. In the Samoan context, traditional ecological knowledge of weather and climate for example, give local communities key indicators for forecasting changes in weather and climate, helping Samoans 'anticipate, plan, and adapt to extreme weather and climate events' (Lefale 2010, 317).

Prioritising Indigenous experiences, worldviews and knowledge systems into environmental management approaches is key for facilitating innovative local responses to global crises. Climate change action should not only inform adaptation processes for community survival, but also empower communities to develop their economic, social, and cultural capacities in ways that centre their well-being (Johnson, Parsons & Fisher, 2021). Human and natural systems are interlinked in complex ways (Liu et al. 2007). Taking a perspective to foreground the connections of humans and natural systems allows for an understanding of 'the characteristics of social-ecological systems that confer resilience to climate and environmental change' (Latai 2009, 2).

This can only be done by taking a 'bottom-up' sustainable livelihoods approach to community resilience. A Sustainable Livelihoods Approach (SLA) is a framework with the potential to guide holistic and integrated assessments of vulnerability to multiple stressors (Kelly and Adger 2000; Knutsson, & Ostwald 2006; the Task Force on Climate Change, Vulnerable Communities and Adaptation 2003; African Development Bank et al. 2004; Scoones 2004). A sustainable livelihoods approach improves understanding of the livelihoods of poorer communities and the factors that constrain as well as enhance livelihood opportunities. It can inform development planning processes by assessing the contributions that existing activities make to sustaining livelihoods (Serrat 2017). This approach is 'rooted in 'bottom-up' perspectives that start from understanding how resources are mobilized on the local level, rather than predicting impacts of specific changes at regional, national, or even global level' (Knutsson and Ostwald 2006, 2). These cultural ecology and Indigenising approaches underpin the importance of co-developing this research with the Moata'a community to ensure the

local community benefits from climate adaptation activities, through practices that conserve the mangroves for resilient and sustainable livelihoods.

METHOD

A literature review and household survey questionnaire were the key methods used to understand the human-mangrove relationship in Moata'a. Household surveys are questionnaires given to a sample of households in any given population/region (Wolff 2015). This method has been chosen as it is more suited to the baseline scope of the project, that is, it will allow for a large sample size that will be representative of the community. A literature review, the lived experience of researchers, and the aspirations of the Moata'a community informed the household survey design. The household survey contains questions that will produce both quantitative and qualitative data. Open-ended questions have been utilised to overcome the quantitative limits in understanding the human-mangrove relationship in Moata'a.

RESEARCH COLLABORATION AND INTENT

Key to our method of decolonising resilience is our collaboration and co-development of the research aims and methods. Academics from the University of Newcastle, Australia, and the University of Samoa have partnered on this project to form a multidisciplinary Indigene-colonizer (Jones and Jenkins 2008) research team.

Dr Sascha Fuller is an environmental anthropologist and development practitioner with extensive experience conducting human-environment relations research. Sascha is currently the University of Newcastle's Pacific Node Coordinator and in this role was based in Samoa at the Secretariat of the Pacific Regional Environment Programme (SPREP). It is through this role that Sascha approached Dr Masami Tsujita, Senior Lecturer in Development Studies at the Centre for Samoan Studies, National University of Samoa to collaborate on this project. Masami invited her colleagues Dr Anita Latai-Niusulu and Galumalemana Faainuseimalie Latu to form the NUS team for this study.

Dr Anita Latai-Niusulu is the Head of the Department of Social Sciences and Lecturer in Geography at the National University of Samoa. Anita's research focuses on community resilience to climate change and other environmental challenges, coastal and environmental governance/ management, urban and children's geographies. Anita's earlier (2009) study on the Moata'a mangroves is a key orienting piece to this study.

Faainuseimalie Latu is a conservation ecologist and environmental engineer and Head of the Department of Science at the National University of Samoa. Faainu has extensive research experience on water, soil, and marine projects and has been part of previous mangrove restoration projects in Samatau, Southwest coast of Upolu, Samoa.

Professor Sarah Wright is a Future Fellow in geography and development studies at the University of Newcastle. Sarah works in critical development studies, particularly on geographies of weather, and Indigenous and post-colonial geographies, working with Yolngu and Gumbaynggirr co-researchers to attend Indigenous ontologies of connection.

Dr Phoebe Everingham is an interdisciplinary researcher in the field of tourism geography and management. She has worked with NGOs and NFPs in South America and Australia, with a keen interest in intercultural knowledge transfer and sustainability. She has a strong publication record in the field of sustainable tourism.

Through our collaboration we aim to avoid academic inequality in knowledge production that has been noted as occurring in previous NUS collaborations between the 'Global North' and the 'Global South' (Tsujita and Boodoosingh 2019). We have done this through our 'shared talk' (Jones and Jenkins 2008) and by centring the ontologies and epistemologies of peoples of the Pacific region, Samoa, and the Moata'a community in the framing of the problem and the development of solutions. This is demonstrated throughout this report, where we have drawn on key literature from Samoa and the Pacific in our theoretical framing of resilience and decolonisation.

PARTICIPANT RECRUITMENT AND ACTIVITIES

This project was undertaken following human research ethics approval from the University of Newcastle, Australia, and the National University of Samoa. A formal presentation of the project, its aims, activities, and participant selection process were provided to the Moata'a Village Council (as per Samoan community protocol) by the Newcastle research team at an inception meeting. Here, formal permission was requested by the research team to enter the community and conduct research. Following this approval, a community meeting was held with representatives from potential households and the National University of Samoa research team. In line with Government of Samoa research protocols this was organised by the community Elders and Pulenu'u. Here, potential participants were informed of the research by community elders and the *aualuma* (women's committee of 'daughters' of the village) as outlined in the Participant Information Statement. Special attention was given to the selection and recruitment processes. The date and methods of household survey implementation were agreed upon the discussion with the members of Moataa Village Council and with the assistance of the *aualuma.*

Twenty research assistants, including NUS students majoring geography and environmental science, were recruited to conduct the household survey. All student research assistants participated in a half-day online training prior to survey implementation which was conducted by the Chief Investigators. Here the focus was on brokering knowledge around the purpose of the project, survey implementation and data collection methods, and the importance of confidentially.

The household survey was conducted on the morning of Saturday 21st May by teams of NUS staff and students. Ten survey teams were formed with two assistants per team—one was assigned to ask participants survey questions while the other was to take note and insert responses into a Samsung tablet on site.

Households were selected by dividing households in the Moata'a community (approx. 300-400) by the proposed sample size (100). This determined the sampling interval (4). Based on this, we aimed to survey every 4th household in Moata'a. In the Samoan village context, a household refers to an immediate extended family that shares customary land, and so one household may comprise more than one residence within a village. On the day of the survey,

the selection of potential participants was ultimately decided upon by the Moata'a Village Council and representatives from the *Aualuma,* and as such, the original survey sample was modified to include those participants who were willing and available on the day. As a result, there may be some impact on the balance of the survey sample across gender and age. However, research teams were guided by members of the Moata'a *Aualuma*, to ensure only one representative from each household was surveyed.

Each research team interviewed 10 separate households. The potential participant from each household was introduced to the research and asked to complete a consent form before beginning the survey. All households gave their consent to participate. A household representative then responded to the survey questions related to their daily practices, routines, and livelihoods as well as mangrove management/ conservation practices, their observations of change, community decision making and future eco-tourism capacity. All surveys were collected in Samoan language and research teams entered survey responses directly into the online survey tool Question Pro in English using tablets with internet access. Surveys were collected on 21 May 2022. There were 101 total survey respondents, and 84 completed surveys. There average time taken to complete each survey was 25 minutes.

ANALYSIS

The household survey was developed using the online survey tool, Question Pro. Researchers also used Question Pro to analyse quantitative data, cross tabulating and filtering the findings by gender, age, disability, and community group to analyse similarities and differences between groups. Quantitative data was thus analysed by key themes derived by demographic variables. Qualitative data was transcribed and coded according to themes and sub-themes derived from the literature and researchers' lived experience of the human-mangrove relationship in Samoa. A thematic analysis allows for flexibility in the theoretical foundations of the research (Terry, Hayfield, Clarke, and Braun 2017). The thematic analysis provided an understanding of the community's everyday interactions (daily practices) with their mangrove environment, the value they place on the mangroves and their attitudes and practices towards mangrove management/ conservation. This was underpinned by postcolonial and decolonial theories related to political ecology and more-than- human relationships. Insights generated relate to the more-than human relationships with the mangroves, and future conservation and development concerns and recommendations.

REPORTING AND DISSEMINATION OF FINDINGS

This report containing key findings and recommendations has been produced for the Secretariat of the Pacific Regional Environment Programme (SPREP). It will be made publicly available on the SPREP website and disseminated to research participants in the Moata'a community, as well as to key stakeholders in non-government and government organisations in Samoa. A summary of key research findings will also be presented to the Moata'a community orally at a community meeting. Dissemination of findings in this way aims to promote social, cultural, and economic self-sufficiency for the Moata'a community in their plans for mangrove conservation, climate resilience, and eco-tourism development.

Peer reviewed publications will also be generated from the outcomes of the collaborative research. Here, we aim to promote a broader understanding of the connection between Pacific peoples and their environment, resilience, and adaptation practices in relation to climate change, and the role of ecotourism in building resilient and sustainable futures for the Pacific region more generally.

FINDINGS AND DISCUSSION: THE HUMAN-MANGROVE RELATIONSHIP IN MOATA'A

SURVEY REPRESENTATION AND DEMOGRAPHICS

The total population of Moata'a recorded in Samoa's 2021 census is 1420 (715 men, 705 women), down slightly (3%) from 1467 in 2016. (Samoa Bureau of Statistics 2022, p. 6). Moata'a is therefore the largest village in the urban district of Vaimauga 2, representing 25% of the population (Samoa Bureau of Statistics 2022, p. 6).

In this study, seventy-seven per cent of survey respondents were female. This may be because women were more likely to be available when the survey was conducted mid-morning on a Saturday. The statistical representation of women participating in the survey is reflected also in the qualitative data included in this report. Here, we highlight open-ended responses from 55 women and 14 men. There was no participation from gender non-binary in this study.

Most survey participants (60%) were aged 45 years and older. For men 86% of respondents were over 45 years old. Indeed 45% of male respondents were in the age range, 45-54. The ages of women were more evenly spread.

In general, the survey is representative, although the youth voice is largely absent. Only 3% of respondents were aged 18-24, and these respondents were women. There were no male respondents in the 18–34-year-old category.

Very few participants (4%) identified as having an impairment. Three women had an impairment - 2 had sight impairments, and one woman had a hearing impairment. One man also identified as having an undisclosed impairment.

Most survey responses are from members of the community who spend their days in and around the village, who have, perhaps, closer daily interactions with the mangrove environment (compared to those who leave the village for daily work commitments). Most survey participants (39% of women, 23% of men) cite home duties as their main occupation. When combined with 'unemployed' (22%) this makes up more than half of all respondents and, in the case of women, 61% of respondents. Twenty-four per cent (24%) of respondents are employed outside the village. Fifteen per cent (15%) work in government/ public service and 8% in education. This again points to the educated nature of village and access to 'development' through government sectors.

EDUCATIONAL BACKGROUND

Twenty-six per cent of participants have a Bachelor degree or higher suggesting Moata'a is a well-educated community (in terms of formal education). In Samoa, only 14% of the population has a higher level of education (post-secondary school) (Samoa Gender

Monograph 2020), demonstrating the level of education in Moata'a is not typical. The level of education may have implications for community perceptions of environment and climate change and the value placed on 'environment'.

VILLAGE STRUCTURE AND OUT-MIGRATION

The majority of households (60%) in Moata'a contain more than six people. Eighty per cent of households in Moata'a have a family member living outside the village. Of these, most have more than 5 family members living outside the village, although it is unclear from this survey whether those living 'outside' remain in another village in Samoa or have moved overseas. Of those stated as living outside the village, 84% are female and 68% male, meaning considerably more women than men live outside the village. This may be explained by exogamous marriage tradition in which Samoan women move to their husband's village upon marriage; however, no explanation for this was sought or given during the survey period.

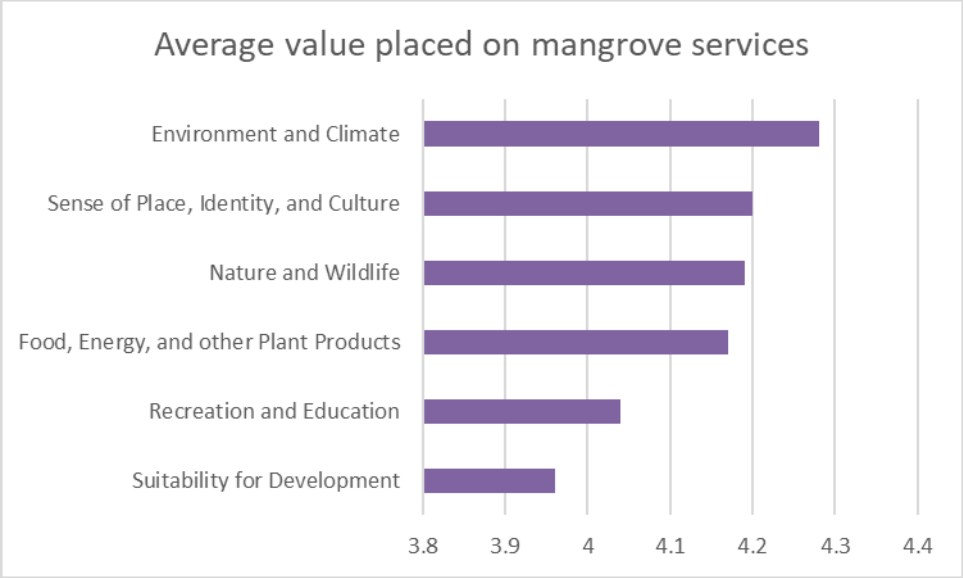
POSITIVE ASPECTS OF THE HUMAN-MANGROVE RELATIONSHIP

The Moata'a community interacts with mangroves in complex and multi-faceted ways. We begin by looking at values associated with mangroves and detail some positive interactions and relationships that emerged through the household survey. In particular, we explore how mangroves are valued and used, and the ways that mangroves support a sense of place and identity to people living in Moata'a.

VALUING MANGROVES

The Moata'a community places significant value on their mangrove environment and this is extended to all ecosystem services (recreation and education; environment and climate; food, energy, and other plant products; nature and wildlife; suitability for development; sense of place, identity, and culture), although there are slight variations to the importance of these for all community. The respondents were asked to rank the value placed on mangroves for various reasons on a scale of 1 to 5, from no value (1) to extreme value (5). Figure 1 shows the significant values placed across a range of social, economic, and environmental foci.

Figure 1: Average value placed on mangrove ecosystem services (the higher the number, the greater the value place on that service)



ENVIRONMENT AND CLIMATE

Households place significant value on environment and climate (rated 4.27 of a total of a possible 5). This is more than any other ecosystem service and is prioritised for both men and women in Moata'a. The overwhelming response (for almost 90% of households) are that mangroves are valued as extremely important to individuals' environmental well-being. The environmental value placed on mangroves exceeded the value allocated for education, recreation, development, and food provision.

For Moata'a households, the mangroves are a site of protection and safety from the impacts of environmental and climate changes. In narratives of the positive impacts of mangroves, mangroves are valued as providing protection from natural hazards and disasters. In open-ended responses, participants elaborated:

> 'A positive impact of mangroves on environment is that, during tsunami or flooding mangroves can help protect households from big waves.' (Woman 1, 25-34 years)
>
> 'The mangrove protected our house from floods.' (Woman 1, 65+)
>
> 'It's very important as we used it for food and most importantly is how it protects the area from storm surges especially as sea level is rising.' (Man 1, 65+)

Moata'a residents feel the mangroves provide protection to them so there is no need to move away from place.

> 'It supports my family, helps protect my family from previous floods because they hold back the flood water'. (Man 2, 65+ years old)

Nature and wildlife were also prioritised. Here 83% of women and 76% men placed extreme or much value on nature and wildlife.

SENSE OF PLACE, SENSE OF IDENTITY, AND CULTURE

Mangroves are valued as very important to a sense of place and sense of identity in Moata'a. Seventy-two per cent (72%) of Moata'a households agree mangroves are 'extremely important' (50%) or 'very important' to their sense of identity. Less than 4% of respondents place no value on mangroves for their sense of identity. Valuing a sense of identity was slightly more important for women (75%) than men (65%). This resonates with findings from literature that looks to First Nations understandings of mangroves. In the context of Australia swamps were places 'of plenitude, kin making and place guardianship' (Motta 2022).

In Moata'a, seventy-nine per cent of respondents value mangroves as 'extremely important' (52%) or 'very important' (27%) to their sense of place. Men place more value on sense of place than women (85% for men, 77% women). This was reiterated in responses when asked 'If you were given the opportunity to move away from the mangroves, would you?'. Here, 63% of villagers responded 'no', with just over one-third (37%), responding 'yes' (Figure 2).

While the majority of respondents would not move from Moata'a even if given the choice, some younger people, particularly young women were more inclined to be willing to take this step. This indicates the importance of age and gender in this factor, and potentially the kinds of opportunities within the village and outside it, for those with different life circumstances. Within the 25-34 age range category indicating young people, 63% suggested they would move. Young women are more like to say they would move (42% compared to 23% of men), but this may be swayed by the fact that there were more responses from younger women and none from younger men in this age category. This may indicate many young men have already moved away.

The importance of place and belonging was underscored in the qualitative responses. When asked, 'If you were given the opportunity to move away from the mangroves, would you?', a 'Sense of belonging' (to cultural heritage) (*Fa'asinomaga*) was overwhelming given as a reason for why people would stay (Figure 2.). This sense of belonging encapsulates 'home' - belonging to place, belonging to culture (cultural heritage) and belonging to Land/ territory. Responses included:

> 'Sense of belonging, I have no interest in moving away.' (Woman 3, 55-64 years old)
>
> 'Because this is where I have lived since I was young. It's my place of identity.' (Woman 4, 25-34 years old)
>
> 'Because this is where we grew up and these lands are important to our family.' (Woman 5, 45-54 years old)
>
> 'We would leave but we will not leave our land … we will resist again and again.' (Woman 6, 45-54 years old)
>
> 'There is no need to move away from where we live now. It is our home.' (Woman 7, 25-34 years old)
>
> 'It gives me strength to live because this is where I am from.' (Woman 8, 65+)

‘It's where I belong, it’s my heritage.’ (Woman 9, 45-54 years old)

Figure 2. Word cloud responses to the question, 'If you were given the opportunity to move away from the mangroves, would you?'

Related to sense of belonging is a strong sense of identity. Moata’a villagers will not leave Moata’a because their identity/ lineage is tied to place.

> ‘Because the village is known for the mangroves and it's provided for our families and where my identity is found.’ (Woman 10, 18-24 years old)

> ‘It gives me a sense of identity because staying near the mangroves is important due to its freshness and that it defines who we are’. (Woman 11, 45-54 years)

The sense of belonging and identity people have, is in this way, directly tied to mangroves as Land.[1] Land in the way Moata’a villagers refer to it here is customary/ traditional land (*Fanua*

[1] Land is capitalised throughout this report as decolonising practice (Styres, 2019; Murphy, 2020, p. 379). As an Indigenous philosophical construct, following Styres' definition we recognise Land as:

> both space (abstract) and place/land (concrete); it is also conceptual, experiential, relational, and embodied…Land is more than the diaphanousness of inhabited memories; Land is

tau Samoa/Fanua fa'a le aganu'u) that belongs to the household as it is defined as incoroporating extended family. Land in this way tied to lineage, family identity, and kin relations. The customary relationship to land is given as a major reason for why people will not move away from Moata'a.

> 'We have developed our family in this Land, and this is our Land.' (Man 3, 35-44 years old)
>
> 'Because this is a customary Land and it is where we were born and raised.' (Man 4, 35-44 years old)
>
> 'As Samoans, we have our customary lands, and that's important because it is our sense of identity.' (Woman 12, 45-54 years old)
>
> 'We must hold on to our family inheritance (customary land).' (Woman 13, 65+)
>
> 'It's my heritage, my Land.' (Woman 14, 55-64 years)
>
> 'I'm too old learn to adapt. It's my identity my place. The whole area where I lived was once a mangrove.' (Woman 15, 35-44 years)

The sense of responsibility to caring for customary land for future generations is another reason given for why people will not leave Moata'a. This is particularly important to the population remaining in the village in the face of out-migration.

> '(I wouldn't leave) because I'm the one who work for the cleaning our mangroves.' (Woman 16, 18-24 years old)
>
> 'My family relies on me to take care of this household as there is no longer anyone to take care of my family (as a result of out-migration)'. (Man 5, 45-54 years old)
>
> 'I cannot go because I have to take care of my grandmother as we are the only members of this household.' (Man 6, 45-54 years old)
>
> 'This Land has supported my family through many generations.' (Man 7, 65+ years old)

The Moata'a community exhibits a sense of loyalty to their Land as a form of kinship relationship. Many respondents indicated that they would not leave because the Land has 'supported' family life. These accounts show that caring for kin is caring for land and caring for Land is to care for kin; just as people care for Land in Moata'a there is some acknowledgement that the Land (mangroves), in turn, supports households in two main ways: as a source of protection from flooding, and as a source of food and income.

> spiritual, emotional, and relational; Land is experiential, (re)membered, and storied; Land is consciousness—Land is sentient…Land refers to the ways we honor and respect her as a sentient and conscious being. (Styres, 2019, p. 27)

FOOD, ENERGY AND OTHER PLANT PRODUCTS

The mangroves of Moata'a are valued by households as very important to the provision of food particularly for respondents who undertake home duties or are unemployed. Seventy-six per cent (76%) of respondents placed high or extreme value on the food and plant products gleaned from mangroves.

Households use mangroves for food provision/ semi-subsistence, as an additional source of income selling fish and crabs in market stalls (where crabs are sold in ST$30-$50 bundles), and a small number of households use the mangroves for firewood and building materials. Of the households that rely on the mangroves to sell produce at market stalls, the following products are sold:

- Crabs (45%) – 25 respondents
- Fish (36%) – 20 respondents
- Firewood (7%) – 4 respondents
- Watercress (5%) – 3 respondents
- Bok choy (2%) – 1 respondent
- Handicrafts (2%) – 1 respondent
- Eel (2%) – 1 respondent

The majority of households who sell produce (19) earn less than ST$100 tala a week selling produce through market stalls. Very few households (4) earn more than 200 tala a week. This demonstrates that human links to mangroves in terms of their contributions to household economy may be understated if not specifically asked as, while the monetary contribution is small, the subsistence contribution is highly valued. Indeed, this accords with other research, working with oral testimonies, that finds the mangrove area has always been and continues to be an important resource for catching fish, mud crabs, shellfish, peanut worms, freshwater eels, beach crabs and for obtaining firewood (Suluvale, 2001).

For some residents of Moata'a the mangroves as a source of food and income is given as a reason for why people would not move away from the mangroves if given the chance.

> 'This is our iconic place. Mangroves are the source of income for families.' (Woman 17, 35-44 years old)

> 'Because mangroves are so important, and it helps some families of our village for food.' (Woman 19, 25-34 years old)

Households are least concerned with mangroves as a provision of clothing (slightly important), and provision of building materials. The provision of firewood, household water supply and drinking water were all considered only moderately important, although it is worth noting 30% of households in Moata'a deem mangroves important for their household water supply.

While cutting down mangrove trees may also be contributing to the destruction of the mangrove area, oral testimonies that tree cutting has always been an integral part of the mangrove ecosystem, and that it has always been done on a sustainable basis (Suluvale, 2011).

For Moata'a villagers, the mangroves are less a concern of primary income and more about livelihood and other forms of connection. Men place more value on food, energy, and other plant products than women (82% men, 74% women placed extreme or much value). The Moata'a mangroves are an important livelihood sources and as well an important source of protein for households within and beyond the village bounds.

RECREATION AND EDUCATION

The mangroves are important for both recreation and education in Moata'a with 75% of respondents placing extreme or high value on these factors. Women tend to place more value than men on recreation and education with 81% of women and 58% of men placed extreme or much value. Nowadays, largely due to pollution and village restrictions, very few people use the mangrove wetlands for recreational activities such as swimming.

Mangroves are valued as very important to education, as indicated in the qualitative responses. As one respondent indicated:

> 'People have now realised the importance of mangroves and one change is of not being able to swim in it again.' (Woman 20, 55-64 years old)

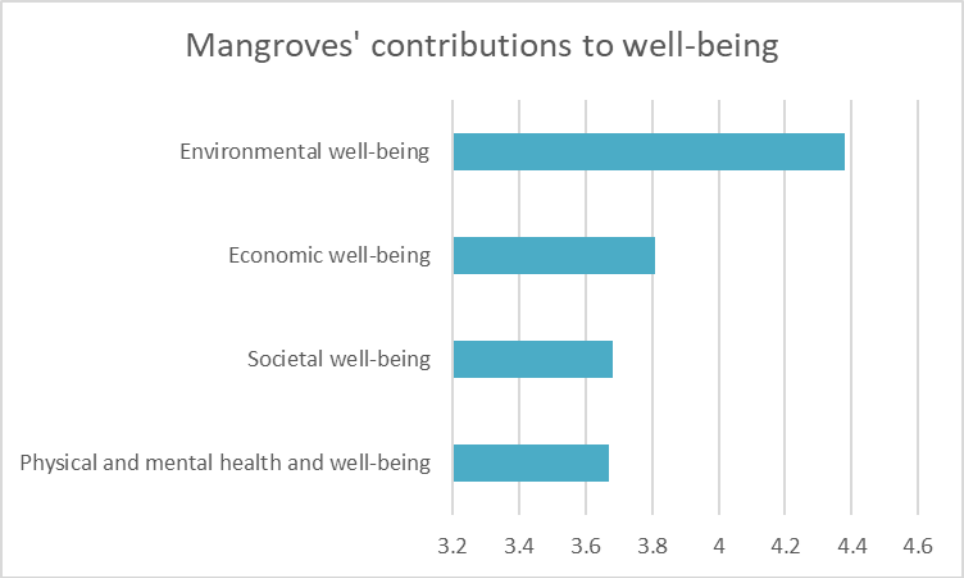
This refers to restrictions placed on swimming/ recreation in the mangroves by the village council.

SUITABILITY FOR DEVELOPMENT

Suitability for development ranked the lowest in terms of value of ecosystem services but not significantly. Seventy-five per cent (75%) of households still place extreme value or much value on the mangroves' suitability for development; however, 19% place limited or no value on the mangroves as a suitable site for development, making development of the mangrove area the most contested issue. Here, women place a higher value on suitability for development than men with 80% of women but only 60% of men placed extreme or much value on this aspect. Moata'a households place considerably more value on environment than they do development.

WELL-BEING

The survey also explored mangroves as a source of well-being. It was found that mangroves were important to respondents' well-being in multi-faceted ways. Well-being was strongly linked to economic, health, environmental, and social factors. Underscoring the value placed on environmental relationships that emerged above, the mangroves were ranked highest in their contributions to environmental well-being. All ratings scored above 3.6 out of a possible 5 illustrating the diverse ways that mangroves contribute to well-being.



ENVIRONMENTAL WELL-BEING

The contribution of mangroves to environmental well-being was highlighted in the survey with 87% of all respondents pointing to mangroves as either extremely important or very important to environmental well-being. This is the most important aspect of well-being highlighted by respondents. Its high ranking reveals that notions of place and environment are indeed central to well-being, and that mangroves have a central place in nourishing a sense of well-being in Moata'a.

ECONOMIC WELL-BEING

The household economy in Moata'a is mixed. The majority of household economies in Moata'a rely (63 %) rely on paid work as their primary source of income. Remittances are the primary source of income for 23% of households. This is in line with national figures. In 2020, 25% of Samoa's GDP came from remittances (World Bank 2022). Only 4% of households rely on market garden profits in Moata'a and only 3% of households rely on subsistence. From these results, it would be easy to assume that in terms of the household economy there is very little human-mangrove interaction for most households in Moata'a, that is, that most people are disconnected from mangroves in a livelihood sense. However, this is not the case. Thirty-five per cent (35%) of households use mangroves to support their household economy (Figure 3) and most respondents value mangroves to their economic well-being.

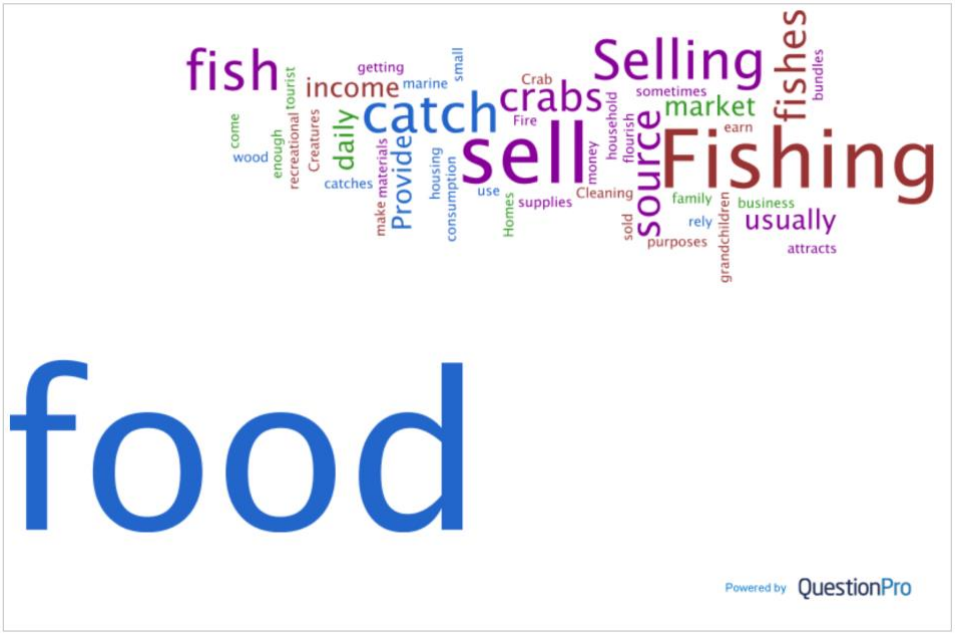
Mangroves are valued as extremely important (33%) to economic well-being in the Moata'a community. When combined with very important (30%) this increases to 63%. Only 6% of households see mangroves as 'not at all important' to their economic well-being. Only slightly more value was place on economic well-being by men (66%) compared to (61%) women.

The mangroves can particularly be relied upon in times of hardship. As one participant explained:

> 'The mangrove has provided us with a source of sustenance and income in times of need.' (Man 8, 45-54 years old)

Figure 3. shows the diverse ways that mangroves are used to support the household economy. Food is a dominant concept as the people of Moata'a discuss their mangrove use in economic terms.

Figure 3.Word cloud responses to the question, 'How do you use the mangroves to support your household economy?



In addition to being utilised for food, marine resources collected from the mangroves have commercial value (as shown above) usually collected and sold at local fish markets or alongside the roads. Earlier studies discuss the wood of mangrove species being used by locals to be burned in furnaces to make charcoal for export (Iakopo, 2006). We did not find this in our own study.

HEALTH AND WELL-BEING

Mangroves are valued as very important to physical and mental health and well-being. This is notably stronger for men 75% of whom rated mangroves as very important to their health wellbeing, than women of whom 55% gave this response.

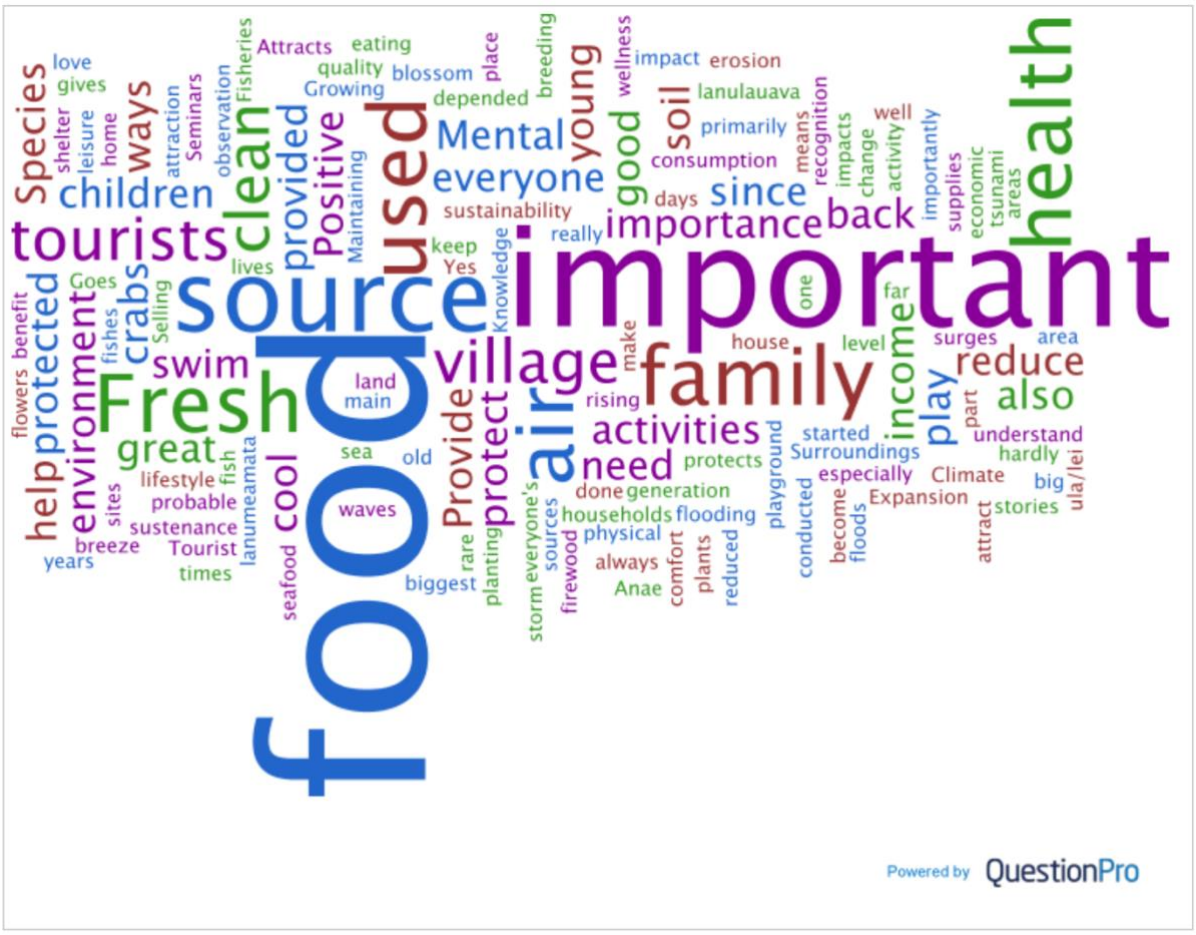
Mangroves are also valued as very important social and community bonds. Here, women tended to rate this as higher at a rate of 64% in comparison for 50% for men. They were also valued for their contribution to spiritual and cultural fulfilment. Here, men tended to place a higher value with 63% of men and 49% women rating the value of spiritual and cultural fulfilment. 62% of respondents also valued the mangroves highly or very highly for their contribution to societal well-being.

Around 30% of households shared narratives of how mangroves have positively impacted them (Figure 4.) Here mangroves are valued for the many ecosystem services they provide, where food sources, family (wellbeing) and health are prioritised. Beyond this, mangroves are

valued for their biodiversity, sustenance, income, fresh air, source of fun and play, and therefore, as a positive site for physical and mental health and wellbeing in Moata'a.

> 'It has provided us with food and can be a wellness and playground place for us.' (Woman 21, 18-24 years old)
>
> 'Selling crabs and fish has been a source of income for our family. The children also love to swim and play in the mangroves. It is has become a home for our family.' (Man 9, 35-44 years old)
>
> 'The mangroves are home to '*anae* (mullet), they are breeding sites.' (Woman 22, 55-64 years)
>
> 'The mangroves provide positive mental and physical health impacts to everyone. The surrounding gives us comfort and health with the supplies of food and leisure activities. The plants and fresh air provide good quality lifestyle. Mangroves are very important for our mental health and physical health.' (Man 10, 55-64 years)
>
> 'Mangroves are important for food, environment, and greenery (Man 11, 45-54 years old)
>
> 'I'm 75 years old me and my family have depended on these areas since we were young.' (Man 2, 65+ years old)

Figure 4. Word cloud responses to the question, 'Do you have any positive stories of how the mangroves have benefited or helped your household or your environment that you would like to share?'



ENVIRONMENTAL AND CLIMATE CHANGE IMPACTS

Samoa is only low exposed to disasters (11.46; rank 122) on the World Risk Index (although the Pacific region is ranked highest as a region). Nevertheless, natural disasters have had a major impact on Samoa's economy and society in recent decades (Leach et al., 2022). Samoa shares with other SIDS (Small Island Developing state) the characteristics of being economically vulnerable and ecologically fragile because of its geographical location, isolation, limited resources, and exposure to global economic crisis. Climate change impacts are an added imposition on the inherent challenges Samoa already faces.

Findings from the *Pacific Attitude Survey* (2022) show contemporary community-level attitudes of Samoans to climate change and its impacts, with 60% of Samoan's thinking climate change is significantly impacting life in Samoa, 41% thinking it significantly impacts their own life, 38% thinking it has significantly impacted personal income and livelihoods over the last ten years, and 60% of people thinking they can do 'a lot' about climate change (Leach et al., 2022). The attitudes of the Moata'a community support these findings.

Our findings demonstrate mangroves are valued as a positive force in the protection against climate change (above). In this section we show the ways the Moata'a community are living

with and threatened by the impacts of climate change in their everyday lives, and their attitudes towards climate change and adaptation efforts as a result.

Over the last ten years households have experienced significant change to their environment. In this section we explore the negative impacts experienced by the community from a loss of mangroves, as well as the ways the community itself has had problematic interactions with the mangrove environment.

The study shows the community has witnessed considerable change in the environment and felt the burden of mangrove loss in multiple, interacting ways.

DIVERSE IMPACTS FROM CLIMATE CHANGE AND MANGROVE HABITAT LOSS

In the last five years, Moata'a households have experienced the impacts of climate change across a range of factors: 94% of households have experienced sea level rise, 93% of households experienced an increase in air temperature, 91% of households have experienced extreme rainfall and 82% of households have experienced rainfall variability. In the last five years 75% of households have experienced flood risk, 74% an increase in storm surges, 74 % have experienced heatwave/ heat stress, 65% have experienced more intense/ severe cyclones, and 53% have experienced increased pests and disease. Drought (48%), water scarcity (47%), and food scarcity (44%) are less commonly experienced in Moata'a and may be attributed to the water and food source of the mangroves. In this way, as much as living with mangroves means risks due to sea-level rise, they also drive resilience.

The majority of participants felt the chances that are taking place are primarily an environmental concern (56%), followed by a social/cultural concern (25%), an economic concern (18%). However, when broken down by gender, for women the changes taking place in Moata'a are primarily an environmental concern (61% to men's 38%), whereas for men it is also notably an economic concern (33% compared to 14% for women). Women were more likely to offer stories of environmental change and development than men. No one answered that the changes taking place are primarily a religious/ spiritual concern. They were equal on social/cultural concern (25% women, 24% men), suggesting the environment is more closely linked to culture and society than religion in Moata'a.

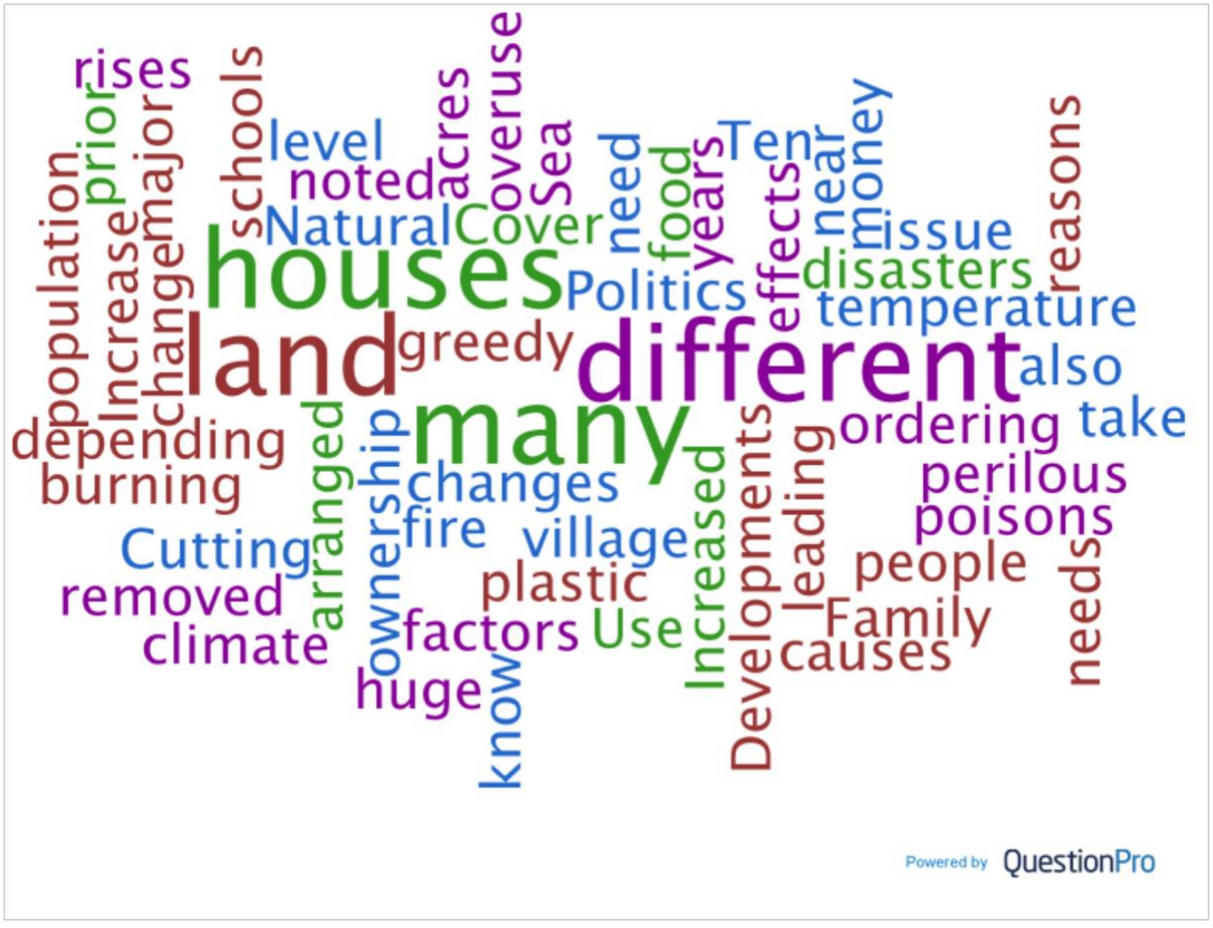
While much of the change taking place in Moata'a is attributed to climate change, it is also, quite significantly attributed to an increased population and development. In order of impact (where the lower the number, the greater the impact), Moata'a households attribute the climate and environmental changes occurring in their community in the following order:

1. Climate-related changes (flooding, drought, sea level rise, increased air, and water temperature) (2.19)
2. Waste and Pollution (3.05)
3. Development (infrastructure, agriculture, fisheries, deforestation) (3.15)
4. Ecological changes (Invasive species/ pests and disease) (4.44)
5. Increased human population (4.59)
6. Tourism (4.97)
7. Increased cost of living (5.36)

Our findings point to the importance of external factors such as development activity in causing deforestation and compounding the impacts of climate change. The consequences of these impacts are felt keenly by communities. However, these findings also indicate that while the Moata'a community are aware of the importance of the mangroves, through their own actions, for example through pollution and deforestation and/or overfishing, they may still have been active agents in their degradation.

Speaking about the reasons for changes, participants themselves point to a diverse range of sources including social, economic, environmental, and political reasons for the negative changes they have experienced in their mangrove environment. The word cloud of responses (Figure 5.) highlights this. Here you can see the words 'many' and 'different' along with 'houses' and 'land'. This focuses attention on the complex understandings of the respondents, the diverse sources of change and, once again, the centrality, of Land in their experiences of, and responses to, environmental change.

Figure 5. Word cloud responses to the question, 'Are there any other reasons for this change?'



FLOODING AND SEA LEVEL RISE

Over 90% of households have experienced a rise in water level while 75% of respondents reported experiencing increased flooding, a change in water flow, and erosion.

Around half (47%) of all households have been directly impacted by the environmental changes that have taken place in the Moata'a community. As a result of flooding and sea level rise households have lost fertile agricultural land and the land that houses their home. Some have had to move to occupy land they own further inland (*uta*) in Moata'a Uta.

Their recreation has been impacted as households no longer swim in the mangroves and swimming area as it is considered dirty and unsafe, and it was noted that there are an increased number of mosquitoes that has impacted households through sickness. Mangrove degradation, including urbanisation, ineffective drainage, and loss of fish species, is associated with increased mosquito activity (Claflin and Webb 2017).

As described in the open-ended questions:

> 'Sea level is rising posing risk to our land it floods the area.' (Man 12, 45-54 years old)
>
> 'Flooding causes us to move to Moata'a Uta because we do have to plant and make food through agricultures, because mainly we are rarely able to make plantations on the previous land because the land is unsuitable (now) for such agricultural developments.' (Woman 23, 45-54 years old)
>
> 'Flooding was caused by the Apia Park (development) which affect our houses and properties.' (Woman 6, 45-54 years old)
>
> 'Flooding of lands and loss of habitat.' (Woman 24, 35-44 years old)
>
> 'Disease from flooding such as mosquitoes affecting us through diseases associated with it.' (Woman 25, 65+ years old)
>
> 'Flooding swept away some of our property and the bad smell it has caused along with wastes.' (Woman 26, 45-54 years old)
>
> 'Before we used the mangroves as a recreation area and I used to take my kids to swim but now with sea level rise, it's not safe anymore for the kids.' (Woman 27, 45-54 years old)
>
> 'The floods brought in a mass of mud and dirt in and around homes next to the banks.' (Woman 28, 45-54 years old)

The risk of flooding and sea-level rise are the main reasons for why people would leave Moata'a if given the chance. Households located nearby mangroves made it clear that when they begin to be directly impacted by storm surges, flooding, and sea level rise, they will leave Moata'a for 'safer' grounds. That is, to stay in Moata'a, living by the mangroves, to face of risk and impacts of flooding and sea-level rise would be unsafe. Yet, this should be considered within the context of the above results that indicate an unwillingness to move unless it is a matter of immediate urgency. Some households do directly attribute sea level rise to climate change and global warming.

‘Due to the sea level rising, I would move away from the area because the water will affect the house, and it will be very unsafe for the family.’ (Woman 1, 25-34 years)

‘We will move away when we are directly affected by the mangroves (water rising)’. (Woman 29, 25-34 years old)

‘[We will move] to stay safe.’ (Woman 30, 25-34 years old)

‘It is not safe for families during flooding and with the cause of sea level rise’. (Man 14, 65+ years old)

‘With global warming, we believe we would have to move away due to sea level rising.’ (Woman 27, 45-54 years old)

People from households that are not located close to the mangroves also note sea-level rise as a major issue related to moving/ displacement but explain they would not need to move (be displaced) as they are not under direct threat from flooding and sea-level rise.

‘Because we're further away from the area and we are not affected.’ (Woman 33, 35-44 years old)

‘We feel that the mangroves do not affect us living here so I don't see why we would have to move. I guess because we don't live right next to it (the mangroves).’ (Woman 34, 25-34 years old)

SEASONAL CHANGE, RAINFALL VARIABILITY, EROSION, AND INCREASED TEMPERATURES

Some households noted seasonal change, rainfall variability, and increased temperature as climate and environmental changes in addition to sea level rise. In the last ten years 78% have experienced shifting seasons.

‘Seasons have offset the growth of flowering plants.’ (Woman 12, 45-54 years old)

‘Changes of weather patterns... Hot and dry to wet seasons.’ (Woman 35, 25-34 years old)

‘(There has been) major rainfall variability.’ (Man 13, 45-54 years old)

Some Moata’a residents noted increased air and water temperature and heat stress as a change that has occurred over the last ten years.

‘Hot temperatures in and around the mangrove make swimming in it less ideal.’ (Woman 65+)

‘It has become very hot.’ (Woman 36, 25-34 years old)

‘The increase of water temperature has probably led to the diminished number of fish species.’ (Woman 37, 65+ years old)

‘Erosion of soil around the place of living.’ (Woman 3, 55-64 years old)

LOSS OF BIODIVERSITY (FISHERIES AND DEFORESTATION)

A loss of biodiversity was also reported by many respondents. For example, one participant noted:

> ‘The destruction of the biodiversity through deforestation, along with the economic developments through infrastructure.’ (Woman 12, 45-54 years old)

Over the last ten years, 65% of household have experienced decreased fisheries. 64% of households note a change in type of fish species available, including a loss of endemic species.

> ‘Some fish are not found anymore, most mangroves are now gone.’ (Woman 38, 35-44 years old)

> ‘Back then there were prawns that the villagers collect when the mangroves produce flowers (winter). Nowadays, it cannot be found anymore.’ (Woman 27, 45-54 years old)

> ‘(There has been) major decrease in wildlife within the mangroves and also the increase of temperature.’ (Woman 35, 35-44 years old)

The decreased fish stocks have led to a ‘decrease in food sources’ for Moata’a households. Moata’a households refer to a decline in fisheries both in terms of sources of food and lost income, highlighting the significance of the mangroves to food provision and livelihoods in the village.

> ‘The availability of primary sources of food such as crabs have decreased.’ (Woman 17, 35-44 years old)

> ‘There is a less bountiful harvest of crabs and fish.’ (Woman 40, 65+ years old)

> ‘There has been a decrease in some marine shellfish that we used to depend on for daily consumption.’ (Man 7, 65+ years old)

> ‘Some fish and shellfish that we depend on are no longer found that our family had depended on for so long.’ (Man 2, 65+)

Households earn extra money from selling crabs and fish but this has ‘decreased due to the decreasing number of crabs and fishes in the mangrove.’ (Man 9, 35-44 years old)

Households also noted the decreased expanse of mangrove cover which allows the ‘sea to wash up against the shore where the mangroves (used to) grow (Woman 41, 65+ years old). The decrease in mangrove cover is given as a reason for wildlife and biodiversity loss.

> ‘The mangrove system is not as vast, there has been a decrease in wildlife.’ (Woman 52, 25-34 years old)

While a decrease in wildlife in general is noted, 55% of households have also experienced increased in pest and disease. Pests and disease are recognised as a growing threat throughout the Pacific region because of increasing trade in agricultural commodities, increasing tourism and international travel and the impacts of climate change that enable new pests and diseases to spread across agricultural systems (ACIAR 2021).

OUT-MIGRATION

Global labour mobility sees many Samoans travel abroad for work, particularly to Australia and New Zealand to help meet the seasonal harvest needs in the rural and regional areas of these countries. While there is evidence this labour mobility may undermine the local business economy in Pacific communities (Lilomaiava-Doktor 2009), the payments for this work are also used to support families and communities in Pacific Island nations through remittances. As of 27 April 2022 there were 4,136 Samoan workers in Australia under the Pacific Australia Labour Mobility scheme. Despite living abroad, many Samoan's continue to make decisions in their villages back home (Fataupaito et al. 2021). Indeed, labour mobility schemes are temporary and most workers return to Samoa when they have completed their contract.

Our findings show out-migration is considered a major environmental change that has taken place over the last ten years in the Moata'a community. While 79% of households agree that population is increasing in the village, 58% of households have also experienced decrease in population which can be attributed to out-migration. When people move away permanently this may result in a change in land ownership. A change in land ownership has been experienced as an environmental change by some households.

INCREASED WASTE AND POLLUTION

The human-mangrove relationship in Moata'a includes activities undertaken by the community and others that may pollute the mangrove environment. Rubbish among the mangroves has been a major issue since the 1970s. The closure of Vaitoloa dump in the mangrove area west of Apia marked a big step forward in the conservation of mangrove swamps and wetlands in the area (Suluvale, 2001). However, illegal waste and chemical dumping from nearby households and businesses continues to pollute the mangrove environment.

Around 65% of households have experienced increased waste and pollution in Moata'a. Respondents spoke of this change in their comments:

> 'The mangroves are now dirtier compared to the olden days.' (Woman 31, 25-34 years old)

> 'The mangrove is not what is used to be. It was clean and people loved to swim in it. Now, it is dirty.' (Woman 31, 25-34 years old)

The top three components of household waste are plastic bottles and containers (33%), followed by food packaging (31%), followed by food scraps/organic materials (29%).

Most households (87%) dispose of rubbish in regulated garbage cages for door-to-door collection twice weekly by private contractors on behalf of government. However, almost 10% of households still dispose of their rubbish in an informal and unregulated community dump site, with two households using their own land. Here households, 'dig a hole in the property to dump rubbish and bury it when it is full' (Man 8, 45-54 years old). It is unclear how much rubbish is generated externally (from outside the village) and internally (from within the village) that ends up in the Moata'a mangrove environment.

When asked who is primarily responsible for mangrove degradation in Moata'a, households place most of the blame on individual households (74%), followed by businesses (10%), and government departments (8%). There was a notable difference in responses between men and women for this question as 78% of women and only 61% of men nominated households as primarily responsible. Men were comparatively more likely to nominate businesses and government departments. This may be because most women who were interviewed for this study spend more time at the household level than their male contemporaries who spend their days outside the village. Responses, then, reflect gendered difference in the everyday lived experience of mangrove degradation. Very few households wash dishes or laundry in the mangroves. Those households who do, do so because it is easier/ more convenient, and there was no alternative.

Residents of Moata'a note the environmental and human health impacts, including decreased water quality and lessened recreation activities, as a direct result of the increased waste and pollution in and around the mangrove environment.

> 'The water is not nice to swim anymore, which was a fun part of living near the mangroves.' (Woman 31, 25-34 years old)
>
> 'The fish supply has decreased, due to pollution.' (Woman 44, 25-34 years old)
>
> 'Pollution creates (human) health problems as well as (problems for) marine life and animals.' (Woman 45, 25-34 years old)
>
> 'When the water is dirty, it is not safe for drinking or for recreational purposes.' (Woman 10, 18-24 years old)

Incinerating household rubbish, including plastics, is a concern for Moata'a residents who describe the effects of this as 'air pollution creating health issues'. For example, respondents noted:

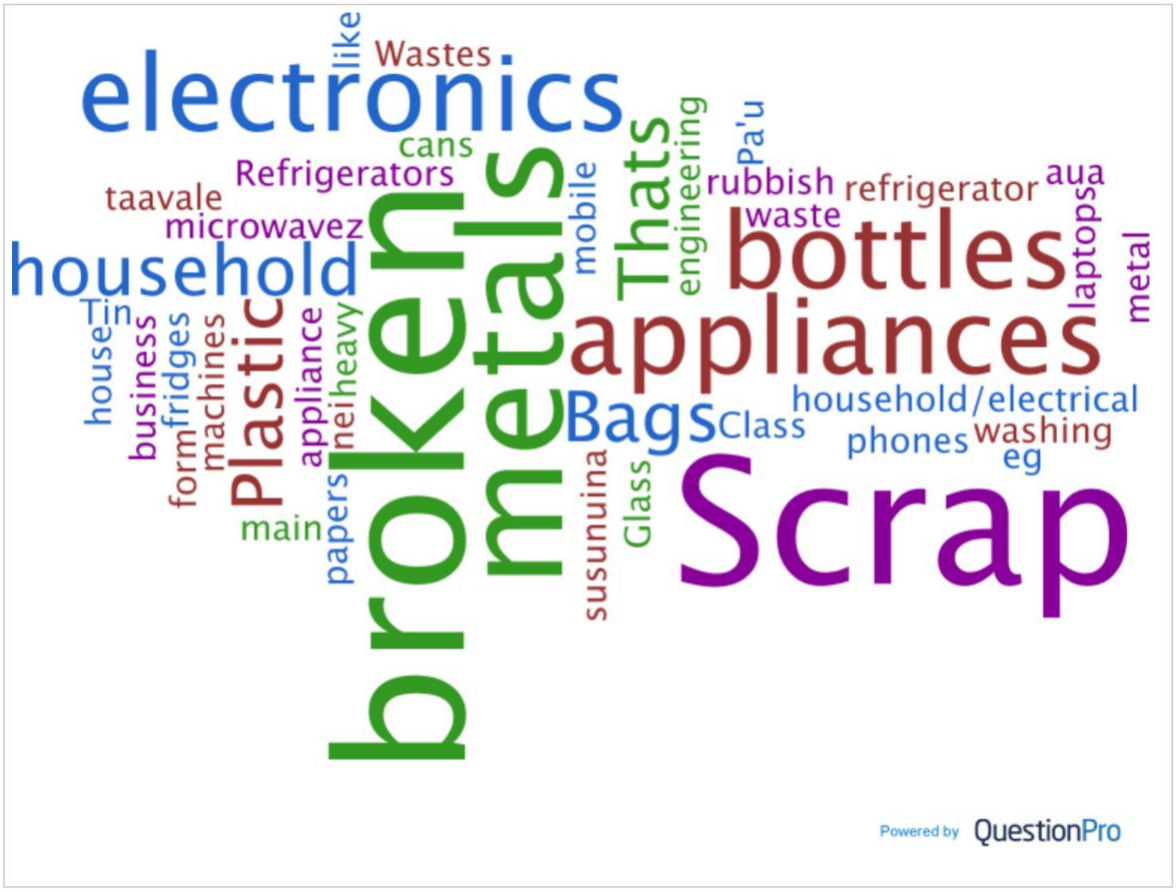
> 'We have been exposed to the burning of rubbish such as car tyres, plastic and such, in which the poisonous fumes infiltrate our family.' (Woman 35, 35-44 years old)
>
> 'The burning of plastic which has been a huge issue, leading on from climate change and more perilous effects.' (Woman 35, 35-44 years old)

Community members from Moata'a commonly attribute an increase in waste and pollution directly to an increase in population and development. One respondent, for example, said the change has come about as:

‘Pollution through infrastructure and developments which changes our atmosphere and our sense of inhaling the air.’ (Woman 12, 45-54 years old)

Emerging and problematic household waste includes e-waste (computers, laptops, mobile phones, and other electronics), household appliances (refrigerators, microwaves, and washing machines), scrap metals, plastic bags and bottles, and glass bottles (Figure 5).

Figure 6. Word cloud responses to the question, 'Other household waste’



DEVELOPMENT

Moata’a has long been perceived as a site of development in the broader context of Samoa due to their proximity to Apia city. It is this development which has posed the greatest risk to the mangrove environment due to land reclamation, pollution and over exploitation of the mangrove resources for cash (Suluvale 2001).

The health of the Moata'a mangroves has been in significant decline since the mid 1970s when the extent and distribution of the mangroves was dramatically altered for land reclamation by an American billionaire who had dreams of creating his own private island. Ultimately, the development failed and the reclaimed land remained unused for 20 years. In August 1994, the village council negotiated with the government for the use of the land on a lease basis, whereupon plans were activated to convert the area to a sports complex to

complement the facilities at Apia Park (Suluvale 2001). The mangrove forest in the north of the village was further destroyed in favour of the construction of the foreign-owned Taumesina Island Resort and a sports field (Suluvale 2001). The width of the mangrove fringe at the southern end of the estuary has narrowed significantly. (Suluvale 2001).

The negative impacts from the damage to the mangrove area has had significant follow-on effects for community livelihoods – for example, on the long tradition of catching fish and other marine organisms from the Moata'a stream estuary, where the richness of that resource has been severely depleted (Suluvale 2001). Other effects are the rapid decline of *anae* [mullet finfish] catches, which local people rely on for food and the loss of the mangroves as a barrier against cyclones and destructive storm surges (Latai 2009, 14).

Latai's earlier study (2009) showed uncontrolled infrastructural development (ironically often due to seawalls being constructed to protect these 'valued assets') as well as roads have also damaged the mangrove areas, casing further decline in fisheries and water quality, all negatively affecting village life (Latai 2009). The construction of Taumesina Island Resort has blocked off breeding grounds for the mullet and reclaimed land is interfering with the trial flows that are also affecting the mangroves. Conflicting interests around environmental management and uncontrolled infrastructure development has resulted in residents losing faith in the government as they look towards the land for food and income rather than support government attempts at improving the quality of the mangrove area (Latai 2009).

In this study, the community cited development as a significant environmental change taking place in Moata'a over the last five to ten years. For households in Moata'a 'development' can mean different things: infrastructure development for increasing populations, development interventions (such as development aid and environmental conservation projects), and economic development. In terms of change, the majority of households refer to the changes that have taken place as a direct result of infrastructure development and development interventions. Over the last five to ten years, as a result of the increasing population, there has been 'major overuse' of the mangroves. They have been cut down to make way for more houses, and mangrove resources have been exploited for a growing population.

> 'Many businesses are being set up here in our village in the area that were once flourishing mangroves. The development of our new primary school required the removal of about 10-20 acres of mangrove cover.' (Man 2, 65+)

Development interventions noted as impacting the mangrove environment include the reconstruction of a school building funded by Japanese aid, which 'has removed many acres of mangrove cover' and agricultural interventions which promote pesticide/ chemical use, 'the use of poisons' which was noted as a reason for loss of biodiversity.

These findings reinforce the point that much of the environmental change experienced in Moata'a is not necessarily climate change but may instead be a result of poorly designed development/ development interventions. For example, 69% of households have experienced increased buildings and development, 60% of households have experienced a decrease in the size of mangroves.

Yet development was also seen as something needed to support the economy and to provide opportunities for young people. It is the lack of development (of economic opportunity) that would see some households move away from the mangroves if given the chance. The younger generation who said they would choose to move away would do so for greater employment opportunities – 'for a new source of income', for a 'better future' tied to an ideology of 'development'.

> 'I need to develop my family and children to have a successful life.' (Woman 20, 55-64 years old)

Development in the form of eco-tourism was seen as a very positive option by the community (see section on 'Future Resilience' below).

SOCIAL AND EMOTIONAL IMPACTS OF ENVIRONMENTAL CHANGE

In addition to the impacts mentioned above – rising sea-level, flooding, loss of biodiversity, out-migration, increased waste and pollution – households also note the impact of these environmental and climate changes on their physical and mental health. This is unsurprising given the close relationships detailed between the environment and sense of identity and well-being. Speaking of environmental changes, respondents articulated significant social and emotional aspects:

> 'Emotional state develops.' (Man 10, 55-64 years old)

> 'It has impacted the safety of my family.' (Woman 43, 55-64 years old)

Where households do not depend on the mangroves for day-to-day semi-subsistence or live further away, respondents acknowledge that they are less (or not at all) impacted by change compared to households that do rely on the mangroves. Here, the human-mangrove relationship appears to be influenced by proximity and day-to-day experience:

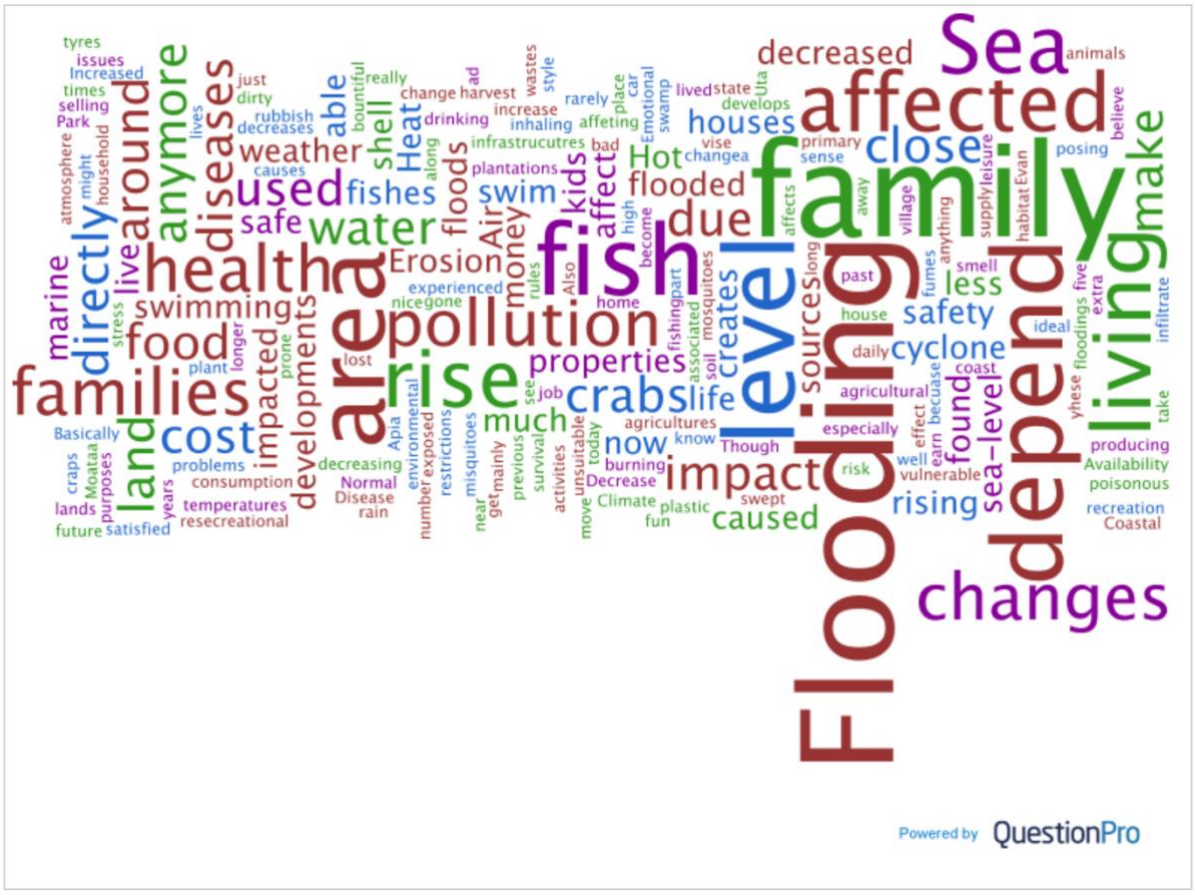
> 'No impact because we don't depend on the mangroves for anything.' (Woman 33, 35-44 years old)

> 'My family does not depend on the mangroves for or survival, although the changes in the weather might affect our houses and health in the future.' (Woman 7, 25-34 years old)

> 'We are not affected directly. I have a job, and this is where I get the money from.' (Man 9, 35-44 years old)

> 'It hasn't affected our family directly because we do not live close the mangrove area but I know it has affected families who lived around the area.' (Woman 37, 65+ years old)

Figure 7. World cloud responses to the questions, 'How have these changes impacted you?'



ADAPTATION, MITIGATION, MANAGEMENT AND CARE

The third major section of this report deals with adaptation and mitigation, management, and care. Here, we look to the active ways the community responds to environment and climate change challenges around climate change and highlight community visions around management and plans for the future.

The Pacific Attitude Survey sought to assess the degree to which Samoans feel a sense of agency regarding climate change action (Leach et al., 2022). Findings show that when Samoans were asked what they can do about climate change, they had a "strong sense of agency, with a majority of Samoans believing that there is 'a lot' (67%) they can do about climate change". In Moata'a we see this thinking in the action taken by residents.

ADAPTATION AND MITIGATION

A key human-mangrove relationship in Moata'a are activities and practices oriented towards climate and environmental adaption and mitigation. As a result of climate impacts facing households, the Moata'a community are taking action to adapt to and manage environmental and climate risks through: infrastructure development (i.e., building seawalls, houses and sandbanks, land reclamation), void filling erosion with soil, relocating inland or to the upper

part of the village away from the mangroves, changing the direction of water flows, mangrove management and conservation (replanting and clean-ups), and by diversifying their sources of income. (Figure 7).

Households are 'preparing' for future disasters by taking 'precautions and necessary action around their households and community.' Respondents shared a range of strategies:

> 'During rainy season, we reclaim our land with more soil and stones to help resist the impacts.' (Woman 11, 45-54 years)

> 'We started building sea walls and extending land cover by bringing more soils to bury the ocean.' (Man 12, 45-54 years old)

> 'We rebuilt our house. However, this does not really help which up until now, we are still trying to overcome this change.' (Woman 6, 45-54 years old)

> 'We are dumping soil and sand around the banks to combat soil erosion.' (Woman 3, 55-64 years old)

Households are also changing the flow of water courses in Moata'a.

> 'Clearing waterways in the mangroves'. (Man 8, 45-54 years old)

> Making canals (*alavai)* by digging lanes to which the water will run into the sea.' (Woman 26, 45-54 years old)

Figure 8. Word cloud responses to the question, 'How have you adapted to or managed the changes taking place in your community?'

Another major adaptation activity is relocation. In the face of flooding and sea level rise, and with now less arable land, some Moata'a residents have been forced to relocate and move to higher ground as they are displaced from their homes near the mangroves:

> 'We move inland. further away from the sea because of sea rise.' (Woman 38, 35-44 years old)
>
> 'We resettled in Moata'a Uta (upper Moata'a), a place away from Moata'a Tai (lower Moata'a), due to the need to develop agriculture.' (Woman 23, 45-54 years old)
>
> 'We adapted to the changes by moving to Vaivase for safety.' (Woman 22, 55-64 years)
>
> 'We moved inland to my other land at Moata'a Uta.' (Woman 39, 45-54 years old)
>
> 'We did have families living in the area where the Apia Park is now located. They have shifted in Moata'a Uta, a newly reclaimed area of the village.' (Woman 25, 65+ years old)

MANGROVE CONSERVATION AND MANAGEMENT ACTIVITIES AS ADAPTATION

Participating in mangrove conservation and management activities such as planting and waste management ('supporting community initiatives') and regulating mangrove interactions as per government advice and community restrictions/ by-laws are noted as a major climate adaption action for Moata'a households.

> 'We plant more trees to reduce the carbon emissions from human sources. We plant mangroves to counter the increased flood risk.' (Man 2, 65+ years old)
>
> 'We clean our land three times a week.' (Woman 25, 65+ years old)
>
> 'By replanting trees and clearing the rubbish that people who live near the mangroves throw into the mangroves.' (Woman 40, 65+ years old)
>
> 'Letting the trees grow near our house helps counter the heat.' (Woman 7, 25-34 years old)
>
> 'We replant more trees in our gardens to hold the soil.' (Woman 20, 55-64 years old)
>
> 'By doing what the government have advised to improve awareness.' (Woman 5, 45-54 years old)
>
> '(I have adapted to environmental and climate change) by following village rules and regulations, government policies on the mangroves and associated environmental areas, however, it needs more improvement.' (Woman 12, 45-54 years old)

In response to the environmental changes they have experienced in their village, households are now undertaking 'Proper disposal of rubbish' (4543180), they have 'stopped burning rubbish' and are 'keeping the environment clean to protect ourselves from diseases.' (Woman 46, 25-34 years old)

DIVERSIFYING INCOME THROUGH OUTSIDE EMPLOYMENT

Another major adaptation activity for Moata'a households is diversifying the household income to become less dependent on mangroves for survival.

> 'For the issue of food insecurity, we do not depend heavily on the mangroves, therefore we work hard to earn to provide food for our families.' (Woman 21, 18-24 years old)
>
> 'I have learned to adapt to the changes by looking for other sources of income instead of depending on the mangroves.' (Woman 31, 25-34 years old)
>
> 'We've not really depended as much aside from selling crabs as I have a steady job.' (Man 5, 45-54 years old)

> ‘We seldom go fishing now, instead we depend on food bought from shops.’ (Man 7, 65+ years old)

SENSE OF HOPELESSNESS

Despite community action oriented towards climate adaptation, there is a sense of hopelessness in a few households regarding the impacts of climate change and of development - that, ‘there is nothing we can do about’ (Woman 32, 55-64 years old). The community must simply, ‘get used to it’ (Woman 30, 25-34 years old); they must ‘understand and accept the changes’ (Woman 10, 18-24 years old) and ‘try to live with the changes regardless’ (Woman 33, 35-44 years old). As one participant explained:

> ‘Due to the ever-growing society, we have had no choice but to adapt to these changes.’ (Woman 35, 35-44 years old)

MANGROVE MANAGEMENT AND CARE

There is a strong involvement from the community in mangrove management and care. Eighty-eight per cent (88%) of households take action to care for/ protect the Moata’a mangrove environment in Moata’a. The majority do so through waste clean ups (31%), supporting the government in their work on the ground (21%), replanting mangroves as part of conservation development programmes (21 %), and though awareness raising activities (inform other members of the community about the importance of mangroves) (17%).

The Moata’a community have a village council and women’s committee that are dedicated to organising clean-ups in the community. They are motivated to seek out funding for conservation, clean-up, and tourism activities. They are also involved with the planting of other species to support a healthy mangrove-based ecosystem including pandanus trees. This was an activity particularly supported by women, as indicated through informal conversation, due to its entwined cultural and livelihood significance.

Awareness raising of the benefits of the mangrove environment and the causes of degradation to the mangrove environment is a key mangrove conservation activity in Moata’a carried out by the Village Council and by members of the community to instigate behaviour change. The Village Council have enacted regulations/ restrictions on human-mangrove activity ‘to prevent people from damaging the mangroves’ (4543206). The village by-laws/ regulations/ rules place restrictions on deforestation (cutting mangroves for firewood), littering and waste dumping, overfishing, and recreational (swimming) activities.

There are penalties in place for harming the mangrove environment although it is unclear whether members of the community are penalised in practice. When asked about the mangrove degradation penalties/ consequences in Moata’a, 45% of households note the fine or other penalty for going against by-laws that protect the mangroves and restrict use/ overuse. Twenty-three per cent (23%) state the consequence is a degraded environment, while another 23% note community backlash is a consequence. Nine per cent (9%) of households state there is no consequence.

The by-laws encourage households to enforce laws 'for the protection of the mangroves.' When asked, 'how do you care for mangroves?', many households noted their compliance to village rules and regulations as the main form of care:

> 'I promote village restrictions on deforestation and waste and pollution by sharing with my family (awareness raising) to protect the mangroves.' (Woman 23, 45-54 years old)
>
> 'We share information about the importance of mangroves.' (Woman 36, 35-44 years old)
>
> 'I advocate to stop improper usage of the mangroves.' (Man 13, 45-54 years old)
>
> 'I encourage the village to stop cutting mangroves for firewood.' (Woman 27, 45-54 years old)
>
> 'Encourage villagers to not dump rubbish near the mangrove swamp area.' (Woman 46, 25-34 years old)

Sixty-six per cent (66%) of households are either 'very satisfied (45%) or satisfied (21%) with the way mangroves are being managed in Moata'a. Seventeen per cent of households are 'very dissatisfied (15%) or 'not satisfied' (2%). Women tend to me more satisfied (73%) compared to 41% of men who say they are very satisfied or satisfied with mangrove management in Moata'a. Of those households who are unsatisfied, the main reason is precisely because their personal use of the mangroves has been restricted.

> 'We are not really able to depend as much on the mangroves due to the village rules.' (Man 5, 45-54 years old)
>
> 'Personal use of the mangroves has been restricted by the village council.' (Woman 45, 25-34 years old)
>
> 'I'm not satisfied with the mangroves I see today because of restrictions on fishing and swimming and leisure activities.' (Woman 47, 55-64 years old)

WASTE MANAGEMENT AND POLLUTION CONTROL

Waste management is integral to the human-mangrove relationship, and an important consideration in mangrove conservation and management. Less than half of all households (43%) perceive waste management in Moata'a as excellent and 20% perceive it as good. However, around 36% of households perceive waste management as average, below average or poor. Women were much more likely to think it 'good' or 'excellent' (72%) compared to just 33% of men. Most men thought it was average (57%). This may be because women are often responsible for informal waste management in their households and organised clean-ups in the community.

Themes associated with a positive perception of community waste management include: the reliability and thoroughness of the governments twice-weekly regular rubbish collection service – it is 'always on time', and the strength of village council by-laws/ regulations and effectiveness of community clean-ups. Households note the behaviour change of Moata'a

residents because of the 'commitment' of the community, the introduction of littering by-laws and community awareness raising through waste clean-ups organised by the women's committee. Many households value the actions taken by the village council and the women's committee who are 'working together' to solve the waste problem in and around the Moata'a mangroves.

For most households this, combined with the regular rubbish collection services, has seen an improvement in the negative impacts of waste and pollution.

> 'The village council and the women are all working together to protect the mangrove.' (Woman 5, 45-54 years old)
>
> 'People who throw wastes in the mangroves are punished by the village council.' (Woman 48, 65+ years old)
>
> 'Everyone is contributing to conserving it and cleaning up.' (Woman 49, 65+ years old)
>
> 'Well managed by women's committee.' (Woman 50, 65+ years old)
>
> 'Because of good leadership of village council of Moata'a.' (Woman 17, 35-44 years old)
>
> 'The multiple new sanctions have provided an opportunity to forbid negative forms of waste management and proper disposal.' (Woman 36, 25-34 years old)
>
> 'Everyone contributes to clean-ups – from village youths to village council and government programs.' (Woman 51, 45-54 years old)

Today there is greater emphasis on 'preservation' of the mangroves through waste management.

Negative perceptions of mangrove management remain in Moata'a. Some of these perceptions are to do with waste management. Households attribute individual blame for illegally dumping, or not managing rubbish effectively at the household level.

> 'Not many people are doing the right thing, still some villagers still dumb rubbish in the area.' (Man 12, 45-54 years old)
>
> 'I still see some families are throwing rubbish in the mangroves.' (Woman 38, 35-44 years old)
>
> 'Some people in the village are not doing their part as well, some of the villagers are still dumping rubbish near the mangrove areas.' (Woman 4, 25-34 years old)
>
> 'People still dump rubbish at the mangrove area so it does improve its state.' (Woman 21, 18-24 years old)
>
> 'The main problem falls on the family themselves for not fully taking care of the rubbish.' (Woman 52, 25-34 years old)
>
> 'Although the village decided to implement practices to improve the mangrove area, some villagers do not abide by the rules and practices.' (Man 14, 65+ years old)
>
> 'People are not working together for mangrove protection.' (Woman 53, 45-54 years old)

> ‘Not everyone in the village is concerned with the welfare of the mangrove environment.’ (Woman 40, 65+ years old)
>
> ‘Most people use it as a dump site.’ (Woman 41, 65+ years old)
>
> ‘Not everyone is doing their job right.’ (Woman 14, 55-64 years)

The community perceives the need for more waste infrastructure to manage growing volumes of waste. Current waste infrastructure is ‘insufficient’, thus waste ‘continues to cause land pollution and air pollution for the village’. Here, there is a problematic emphasis on waste management rather than waste prevention; that is, there is little emphasis on preventing and reducing the influx of pollution into Moata’a in the first place (through single-use plastic bans for example).

There was some acknowledgement by households that externally generated waste (through marine litter flows and roadside littering) impacts their community. As respondents noted:

> ‘When the tide comes in it brings rubbish from out at sea, the community conducts mass clean-ups to clear and properly dispose of this rubbish.’ (Man 8, 45-54 years old)
>
> ‘People still litter beside the road.’ (Woman 13, 65+)

INDIGENOUS AND TRADITIONAL KNOWLEDGES AND PRACTICES IN MOATA’A

Lefale’s (2010) research examines the ways in which Samoans view the environment as an integrated system, relationally connected to ancestral beings and cosmology and shared through stories, ritual and other cultural and spiritual practices. Lefale (2010) demonstrates traditional practices of environmental management in Samoa are not separated from social and cultural protocols and relationships. For example, the meaning of *talafatai* [coast] and *pulega* [management], signifies that caution and respect are vital to ensure benefits to all members of society as well as to the ecosystem. These aspects underlie all resource use, evident also in the caretaker role that the *matai* [chief] adopts over coastal zones within their jurisdiction. Those who hold a chiefly title are seen as trustee/ caretakers, rather than ‘owners’ (Latai 2009, 66-67).

To understand the role of the *matai*, the village council, and other villagers play as caretakers and decision-makers demonstrated in current management practices and in considerations for future planning, a discussion of Samoan custom regarding these, roles, responsibilities and decision-making is required.

SAMOAN CUSTOM IN ENVIRONMENTAL RESPONSIBILITY, AND DECISION-MAKING

The term *Fa’aSamoa* (Samoan culture/custom) encapsulates the relationalities between ‘’*aiga* (kinship group), *mata*i, and *fa’amatai* (chiefly system), land, *fa’alavelave* (ceremonies) and the values of *alofa* (love and compassion), *tautua* (service) and *va fealoa’i* (social respect)’ (Cahn 2008, 4*). Fa’aSamoa* as lived experience is part of everyday Samoan life, defining

'identity, values, and behaviours' and is an integral part of Samoan rural livelihoods (Cahn 2008, 4).

Since gaining independence in 1962, Samoa has been proactive in returning control of government, land and resources to traditional owners and efforts have been made to empower local communities and maximise their participation in natural resource management laws and policy including incorporating Customary law and practices (Techera, 2006). Although Samoa maintains a system of English common law and the Constitution is drafted in Western style, 81% of Samoan land falls under the traditional *matai* titles system, giving a central role to the customary Land and Titles Court (LTC) (Land, 2020). Samoa has 11 traditional administrative districts, divided into over 300 villages, each governed by a *fono* (village council). '*Agia* (extended family groups) play a significant role within the villages, with each *'āiga* headed by one or more matai who represent the village having authority to administer customary land for common benefit. The use of customary land is contingent upon continued residence in the village service to the matai, who in return have responsibility to oversee the welfare of each villager. Succession of matai titles occurs through nomination by the matai or the aiga more broadly (Land 2020). Pule, (power and authority) within the '*āiga* rests with matai (Macpherson and Macpherson 2000) and includes the authority to determine the use of the '*āiga's* labour and resources (including land) (Cahn 2008). Access to natural and financial resources for business comes through kinship systems and *fa'aSāmoa* with access to land available through customary land systems.

In Samoa egalitarianism is balanced with hierarchy, and prestige has traditionally come through generous distribution, not the accumulation of wealth. Traditional protocols also underpin information flow, for example, 'Outsiders' such as wives and husbands of village men and women who normally marry outside the village are not included in this deliberation process. This does not mean that they are totally excluded for their opinions are voiced through their spouses. Outside authorities can 'mediate but never arbitrate in village matters, no matter how good their decision as without the sanction of the village council, rights to land, boundaries and fishing rights could not be made effective' (Latai 2009, 65). Behavioural codes give rise to the principle of '*vā-fealoai* [mutual respect] that permeates human interaction with the environment as a whole and not to just one element of it. This force also exists between the living and the dead (ancestors), and between such human and physical aspects of the environment as land, sea, sky, plants, and animals" (Latai 2009, 65). The concept of the *vā-tapuia* governs all Samoan interactions, particularly the way decisions are made in the '*āiga*, as well as in the *fono*.

'TOP-DOWN' WESTERN CONCEPTIONS IN ENVIRONMENTAL MANAGEMENT AND CONSERVATION (THE HUMAN/MANGROVE DIVIDE)

Environmental management has tried to accommodate Indigenous perspectives in Samoa in the past, however engagement processes with village councils has in practice been limited by funding and top-down processes of management (Latai-Niusulu et al., 2019). The concept of Integrated Environmental Management (IEM), for example, is a contemporary environmental management concept that has tried to address the importance of knowledge exchange between Western and Indigenous knowledge systems (Latai, 2009). The theory of IEM which emerged in the 1980s, was viewed as revolutionary on the global stage as it combined

Western conventional science and Indigenous Knowledges to produce a multi-disciplinary approach to management. It proposes a combination of natural science and social sciences and advocates a paradigm shift towards organic models that are integrative and interdisciplinary (Latai 2009). The 1990s saw a wide adoption of IEM by most Pacific islands. However, these frameworks still tended to privilege Western knowledge systems, whereby colonial legacies perpetuate dualistic distinctions between traditional systems of authority and communication and a Western centralised system of management that takes a sectoral top-down approach (Latai 2009). As Johnson et al., (2021, 10), point out, IK has too often been 'extracted by non-Indigenous researchers and reformulated to fit the parameters and serve western science or academia, resulting in inaccurate 'snapshots' of Indigenous realities'.

Western conceptions of ownership that privilege individualism have been detrimental to environmental management practices in Samoa. Traditional values conflict with Western individualism including land ownership and attitudes towards wealth. For Latai (2009) the importance of reciprocity in Samoan society is in direct conflict with economic individualism.

Colonial legacies that underpin environmental management in Samoa more broadly have affected mangrove management practices in Moata'a. Western concepts such as individual ownership for example, has led to ambiguity around who owns the mangroves, hindering their sustainable management in more holistic ways aligned to traditional worldviews (Latai 2009, 22). Divisions between land and sea management jurisdictions and practices have created conceptual divides that do not align with the Samoan worldview. For example, a review of Samoan environmental legislation in the early 1990's questioned the local relevance of borrowed terms relating to coastal waters and foreshore, none of which addressed distinctive features of Samoa's coastal environment, such as reefs, coastal mangroves, and wetlands (Peteru 1993). As Watts (2013) points out, the processes of colonization have corrupted categories of Indigenous conceptions of the world leading to a disconnect between how this agency and understanding of the world is manifested in Indigenous societies. This relates to the epistemological-ontological divide of Western conceptions of land which contrasts to Indigenous conception of Place-Thought. Removing non-human agency from what constitutes a society separates humans from the animal world, the sky world and the spirit world, in stark contrast to Indigenous worldviews. Similarly, Yacaaa'al & Weibe (2020) interrogate the settler-colonial governmentality of natural resource extraction, which is incompatible with Indigenous cultures and worldview. Centering Oceanic Indigenous cultural worldviews, Yacaaa'al & Weibe (2020, p. 500) describe these seascape epistemologies as life affirming through more-than-human existence that 'centers relational experiences grounded in reciprocity and responsibility'. As Bawaka Country et al (2020, 295) point out, responding to climate change from Indigenous perspectives is 'relational and patterned, embodied and affective, and co-constituted through more-than human placed and multi-temporal relationships'. Attending to diverse and culturally diverse ways in which humans relate their worlds is key for bringing to the foreground the resistance and agency of Indigenous communities in the face of climate change.

The strength and continuity of the *fa'amatai* has survived through the ages of colonialism, neo-colonialism and globalisation and has evolved/ hybridised to consider new social trends (for example allowing children to take part in family discussions). However, while *fa'amatai* remains strong at the family and village level, its role at the national level has virtually

disappeared and is vastly more influenced by Western principles and institutions (Huffer & So'o 2003). Tensions and contradictions of national/ local/ tradition/ modern governance present challenges for environmental management in Samoa.

NATIONAL, REGIONAL, AND INTERNATIONAL FRAMEWORKS

There are numerous plans, policies and resources directed towards addressing climate change, ecosystems, development, and pollution concerns from the international to the national level, that have consequences for the way mangroves are managed at the community level in Moata'a. (Table 1). While aimed at protecting the natural environment, these policies and plans have the potential also to disrupt local knowledge and practice at the community level (i.e., they represent top-down decision-making of needs, priorities, responsibilities and actions).

Table 1: Relevant International, regional and national policy frameworks for mangrove conservation.

International Level	United Nations Framework Convention on Climate Change (UNFCCC)
	United Nations Convention on Biological Diversity (UNCBD)
	The United Nations 2030 Agenda for Sustainable Development
Regional Level	Framework for Resilient Development in the Pacific (FRDP)
	Pacific Islands Framework for Nature Conservation
	Clean Pacific 2025
National Level	Samoa Climate Change Policy 20220
	CBD Strategy and Action Plan
	Samoa Tourism Sector Plan (STSP), 2020/21 – 2024/25.
	Pathway for the Development of Samoa 2021-2016
	Samoa Water Authority Act 2003 - Samoa Water Authority (Sewerage and Wastewater) Regulations 2009
	National Waste Management Strategy 2019-2023
	Waste (Plastic Bag) Management Regulations 2018

District and Community Level	Vaimauga 2 District Development Plan
	Community Integrated Management (CIM) Plan Vaimauga West 2018
	Mangrove Management Plan for the Village Community of Moata'a

While specific provisions are made for Samoan custom and practice, giving agency to local villages to manage their own affairs, the *Fono* jurisdiction does not extend to land outside the village, preventing district or regional environmental land management issues being considered. This silo approach is a major stumbling block in relation to biodiversity protection (Techera, 2006). These challenges relate more broadly to socio-legal debates concerning how best to recognise customary legal systems in postcolonial states (Techera 2006).

Furthermore, the use and management of mangrove ecosystems in the context of sustainable development has been insufficiently addressed in Samoa's environmental legislation. Multiple government agencies have jurisdiction over mangroves (as either aquatic ecosystems or forests) and mandates are unclear resulting in overlapping and uncoordinated responsibilities over mangrove management (Siamomua-Momoemausu, 2013). It is widely recognised that adjustments need to be made to existing legislation to achieve sustainable development and environmental protection aims for mangrove ecosystems. However, by doing so it is necessary to have "the full awareness and recognition of the value of mangroves as both a natural 'mitigating' and 'adaption' measure for climate change and improved livelihood" and recognition for the "opportunities they provide for education, scientific research and eco-tourism" (Siamomua-Momoemausu, 2013, 2).

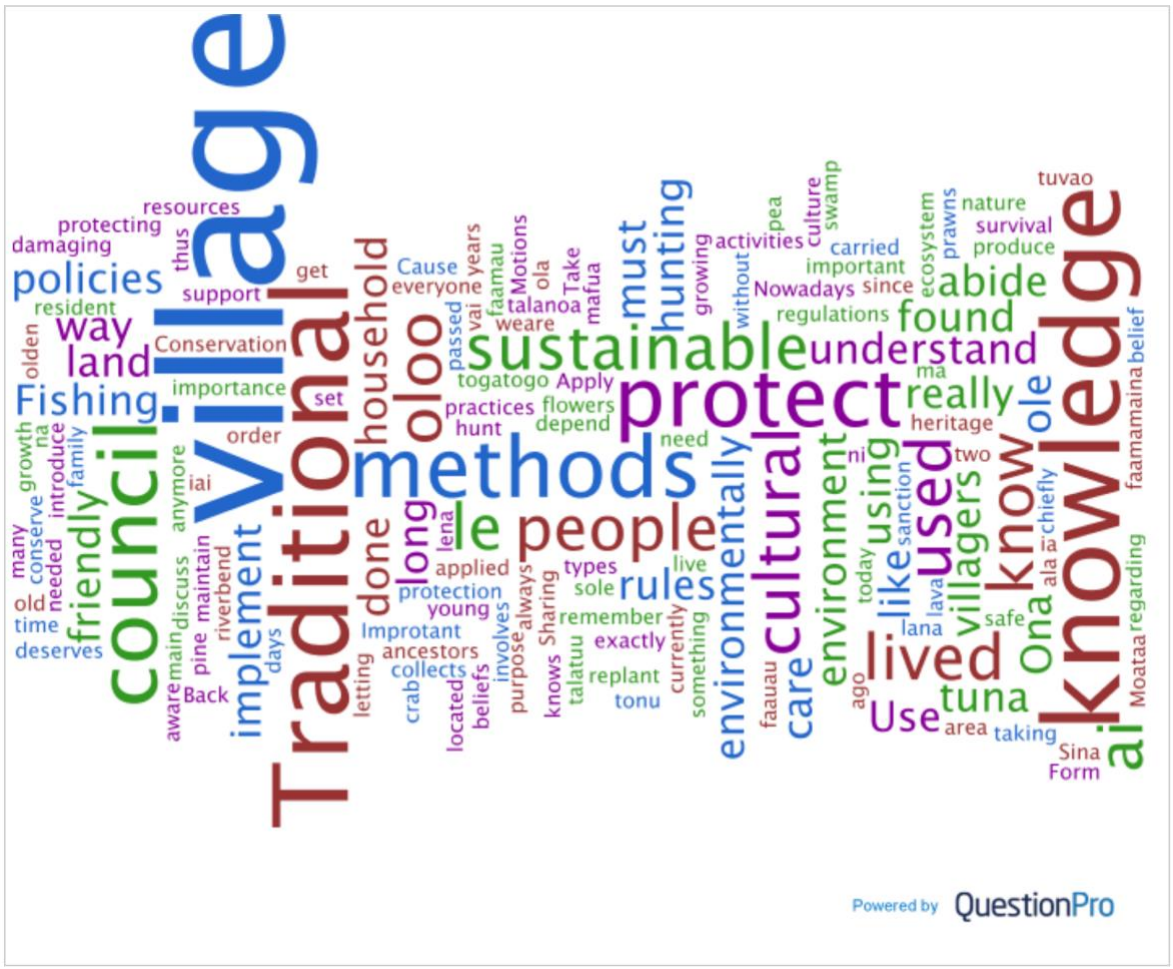
TRADITIONAL KNOWLEDGE AND PRACTICE IN MOATA'A

In this section, we discuss the precise ways the community of Moata'a values and uses traditional knowledge and practice in their management of the mangroves. Mangroves are valued very important to culture and traditional practices. When questioned about traditional knowledge, a higher percentage of men offered stories about traditional knowledge and practice than women in Moata'a.

Forty-five per cent (45%) of households draw on traditional knowledge/ practice in the way the interact with, and value the mangrove environment (Figure 8). Traditional methods of hunting are used, 'because that's what we've always done'. Households also fish, 'using the old methods' because they are 'sustainable and environmentally friendly'.

> 'Traditional methods of fishing and crab hunting are safer for the environment. I like letting other people know this, so that they can get resources from the mangroves without damaging it.' (Woman 7, 25-34 years old)

Figure 9. Wordcloud response to the question, 'Why and how to you use traditional knowledge for your own mangrove practices?'



Households acknowledge traditional knowledge/ cultural practice and beliefs in general (including awareness raising and talanoa, sharing, and taken-for granted knowledge/ practices embedded in customary relationships to Land) as practice that 'takes care' of the mangroves, that 'knows exactly how mangroves need to be maintained', 'in a sustainable way, the way ancestors have done'. Here, there is emphasis placed on a reciprocal relationship – if we care for mangroves they will provide for and protect us.

> 'We protect it because nature deserves something like we do and through that, we replant mangroves.' (Woman 11, 45-54 years)
>
> '(Taking care of the mangroves is) important for our survival.' (Man 11, 45-54 years old)
>
> (We protect and conserve the mangroves) because we have lived and depended on this ecosystem since we were young.' (Man 2, 65+)
>
> 'Taking care of mangroves is our cultural heritage.' (Woman 17, 35-44 years old)

> ‘The water that keeps the mangrove area alive is the cause of the legend Sina and the eel! The water source is kept clean because of its cultural significance.’ (Woman 16, 18-24 years old)
>
> > *Samoan translation: ‘Ona ole vai tonu lava oloo ola ai le togatogo na mafua ai le talatuu ia Sina ma lana tuna! Ole ala lena oloo faauau ai pea le faamamaina ona oloo iai ni pine faamau’*

Households value government advice only slightly more (4.38) than they value traditional knowledge for mangrove conservation/ management (4.12). Households agree both are extremely important to mangrove management. Seventy-one per cent (71%) of households agree traditional knowledge is ‘extremely important ‘(47%) and ‘very important’ (24%) to mangrove management. Twenty-four per cent (24%) note it as ‘moderately important’.

For traditional knowledge and government advice, in both instances, men were more likely to say these were extremely important than the women.

Despite this, just over half of all households (58%) said they **do not use** traditional knowledge for their own mangrove practices. Men were more likely to do this with 52% of men but only 42% of women using traditional knowledge for their mangrove practices.

Also notable is that the highest yes was in the 45–54-year-old group (65%) where the lowest was the 55-64 group (25%). The 45-54 age-group category was the age with the most men in it – 42% men.

The folk story of Sina and the Eel was highlighted by many households as a significant story. The story of Sina and the eel (Appendix 1.) is said to originate from Moata’a village. Sina and the eel is a creation story that is very important in Samoan culture. It connects the village and the rivers that flow through and around the village of Moata’a with other rivers in Upolu, and with villages on the island of Savai’i, such as Safune. Some of the rivers in Moata’a are named after the main plot of the story. There are many stories about Sina and the eel all over the Pacific region. But the Moata’a community emphasises its uniqueness of the story to the Moata'a mangrove and the Peninsula of Taumeasina. In personal email communication one Moata’a resident (Male, aged 55-64) further explained the legend of Sina and the eel.

> ‘This is the only place in the Pacific region where it shows the 3 pools that the eel used to live in (Puna Tele, Puna Se'e, and Puna Lilo). There is also a spot on the other side of the mangrove where the eel was killed. The name Taumeasina in Samoan when you tell the story to the kids has a meaning of this place where Sina landed when she was swimming from a pool in the big island of Savaii trying to run away from the eel… This place is where the Taumeasina Island Resort is built.’’

Some residents believe there is an opportunity for Moata’a to build tourism around this story and there is a drive by some community leaders to do more with the story, to make a movie, or translate the story into Chinese, for example.

Another common point of nostalgia for households was the burning of mangroves for firewood.

> ‘In the old days the mangroves used to be cut down for firewood. The firewood sourced from the mangrove would burn strongly and would be extremely hot, thus the name *Togoaasa* which means Burning Mangroves.’ (Woman 40, 65+ years old)

One point is made clear by the community, loss of biodiversity has impacted traditional practice. Villagers are no longer prawn fishing and the mullet festival that marked the beginning of mullet season (a social time for villagers to come together) no longer happens as the mangrove area that supported mullet migration no longer exists.

Many of the top-down regulations enforced in the village have been aimed at environmental protection and conservation. Villagers are no longer cutting down mangroves, practicing hunting methods, or even partaking in recreation activities that would impact negatively on the environment.

> ‘The mangrove area was used back then as a playground area for the village. It's not the same case these days.’ (Woman 27, 45-54 years old)

> ‘In the old days the use of mangroves as firewood was common and it earned the name *Togoaasa* because of how hot a fire burning from this kind of wood was so hot.’ (Woman 42, 65+ years old)

> ‘No longer practicing extensive hunting methods that would greatly impact the environment.’ (Woman 40, 65+ years old)

> *‘Togo ula* used to make ula and then another mangrove type called *Togo le'a.*’ (Man 14, 65+ years old)

> ‘Mangroves were used back then by the village to make ula/lei when the flowers blossom. These days, this activity hardly done.’ (Woman 37, 65+ years old)

For most households, the decisions to refrain from these activities in the name of environmental management and protection, were made outside their control. This is demonstrated in the following section.

DECISION-MAKING AND RESPONSIBILITY IN MOATA’A

In Moata’a, village systems (such as the village council) and village by-laws that set out the ‘rules that villagers must abide by’ are valued and supported by households as traditional knowledge/ practice that ‘protect the mangroves’. At the same time, village by-laws are also noted by households as impacting traditional cultural practice. Figure 9 demonstrates these contradictory feelings villagers have towards village management. When asked about ‘other care’ for the mangroves, we see a combination of the words including, on the one hand ‘stop’ (restrict), ‘regulation’, ‘penalties’, and ‘enforce’ and on the other ‘encourage’, promotion’, and ‘protect’. This sentiment was also reflected in the open-ended responses.

> ‘The use of the mangroves to us has usually been the main form of support for families, with food, shelter, et cetera. This is no longer present because of village sanctions.’ (Man 6, 45-54 years old)

For the most part though, it is the significant environmental and climate changes facing the community and the multiple threats as a result of the combination of these changes that has impacted village traditional cultural and social practice, including festivals and recreational activities.

The Moata'a community feel that the village council (ranking 2.25) should be responsible for managing the mangroves, followed by the women's group (2.76) and individual households (3.42). Households place less responsibility on the government managing the mangroves through the Ministry of Resources and Nature Environment (4.28). Currently in Moata'a the village council do take control of decision-making in consultation with household head.

Just over half of all households in Moata'a report that they are consulted about development/ and or conservation plans for the village. The majority of households (54%) said they had been consulted, 34% said they had not and 12% were unsure.

In Moata'a, a significant component of household level decision-making is made up of decisions made by members of the household who no longer reside in the village; of the 80% of households with family members living outside the village, the primary household decision maker lives outside the village in 60% of cases. In these cases, 80% of primary decision-makers are men. Men are more likely to be in this decision-making position because of a chiefly title (38% for men, 27% for women), whereas women were more likely to be in the decision-making position if they were the main earner (23% for women, 8% for men).

Figure 10. Word cloud responses for the question, 'Other care for mangroves', outside of those selected for the question, 'How do you care for mangroves?'

FUTURE IMPACTS AND FUTURE PLANS

Given the changes that are already taking place in Moata'a it is unsurprising that the Moata'a community are concerned with a future of rising sea level (89%), flooding (87%), increased intensity of weather events (86%), increased air temperature (86%), increased waste and pollution, increased cost of living. Households are less concerned about the future impacts of erosion and tourism. Regarding tourism, the opposite is true – most villagers speak about tourism in very positive terms. Only one household noted the impacts of tourism as a reason why they would leave Moata'a if given the chance.

> 'With lots of visitors coming by to see the mangroves, it is a disturbance to our family.' (Woman 21, 18-24 years old)

Local participation in mangrove management that is underpinned by local worldviews is paramount for sustainability and resilience in Moata'a. Acknowledging the role and custodianship of Moata'a residents should underpin designing strategies to ensure continued

access to natural resources while protecting biodiversity (Latai 2009). While centering traditional management practices should not lead to a simple reversal of dualisms and over-romanticisation of traditional knowledge and societies, the hybrid approach underpinning much of the IEM has in practice meant that the western epistemological foundations of EM remain dominant (Latai 2009). It is this dominance of western knowledge systems that has largely led to frameworks such as IEM essentially failing in more traditional societies such as Samoa. Instead, Latai (2009) argues that democratic decentralisation and recognition of situated knowledges will lead to more effective coastal governance.

While raising awareness of the significance of mangrove conservation for resilience in Moata'a is key here, climate adaptation practices more generally need to move beyond Western understandings of environmental management towards a more relational, place specific lens (Johnson et al., 2021). The cultural ecology lens, as advocated by Latai-Niusulu et al., (2019) should underpin policy and environmental management practices, that take seriously Samoan worldviews and knowledges in the context of physical location and dynamic socio-cultural systems.

FUTURE RESILIENCE: ENVIRONMENTAL EDUCATION AND ECOTOURISM DEVELOPMENT

Conventional Western-style protected area management has been criticised for being unsuccessful in meeting conservation outcomes in Samoa, as such methods usually involve isolating an area of land from the local community populations. Research suggests biodiversity conservation needs to be considered in the context of sustainable development and livelihoods and with the participation of all stakeholders (Techera 2006). The Samoan way of life and culture (*fa'aSāmoa*) must be intricately interwoven with rural entrepreneurial activity if success and sustainability of community development outcomes are to be ensured (Cahn 2008; Iakopo 2006; Latai 2009).

Recognition of local societal values in management can be a bridge that leads to sound governance because it enables inclusion of local knowledge and empowers people by giving them a sense of ownership in the processes and goals of management (Iakop 2006; Latai 2009). Foregrounding the social and cultural expertise of the community will enhance community resilience through diverse livelihood initiatives. Here we foreground the Moata'a community's aspiration to be a prime site for eco-tourism development and environmental education in Samoa.

The Moata'a community overwhelmingly support eco-tourism development as it will 'benefit the community' by providing an addition 'source of income'. Sustainable, community based eco-tourism can lead to resilient and sustainable livelihoods by providing alternative economic practices to extractive activities that damage natural environments (Chassagne & Everingham 2020). Sustainable tourism is defined as 'tourism which meets the needs of present tourists and host regions while protecting and enhancing opportunity for the future' (Butler, 1999, pg.10). Much tourism research looks at the importance of resilience in this context (Berbés-Blázquez& Scott 2017; Cheer & Lew 2017; Hall, 2018; Lew & Cheer 2018).

Men and women both strongly support development of the village and mangrove area in this way. They are supportive for several interrelated reasons: economic benefit and job

opportunities, environmental conservation, and protection (including from climate change and for future generations), and educational outcomes.

> ‘It will help generate money for other projects that will benefit the village.’ (Man 12, 45-54 years old)

> ‘I agree (with eco-tourism development) because this vital resource is rare in other villages and so it is main reason by Moata’a is known, because of the mangroves.’ (Woman 29, 25-34 years old)

> ‘In my opinion, it will generate money for the community and in turn help to protect the mangroves.’ (Woman 4, 25-34 years old)

> ‘(Ecotourism development) will help us in protecting our families.’ (Woman 23, 45-54 years old)

> ‘It will protect the mangroves and will be helpful for the future generation of Moata’a.’ (Woman 21, 18-24 years old)

> ‘It helps us to reduce the impacts of flooding on our family.’ (Woman ?, 25-24 years old)

> ‘Because as we see today, it will great job opportunities for youth and benefit village people for the protection of mangroves.’ (Woman 45, 25-34 years old)

> ‘It provides food for our communities.’ (Woman 6, 45-54 years old)

> ‘Encourage people of the village to keep the mangroves clean.’ (Woman 31, 25-34 years old)

> ‘Because it helps not only the students, people and also the village as well.’ (Woman 9, 45-54 years old)

> ‘Because the people of Moata'a gain a lot of benefits from tourists who visit the mangroves.’ (Man 9, 35-44 years old)

It will benefit the community financially, it will promote protection of the mangroves, it will support and protect families, the conservation of the mangroves will mean food provision. A feeling in general is that it will have ‘a good impact on the society’. This raises the importance of not only protection but also regenerating the mangroves. This is also positive in terms of education for mangrove protection:

> ‘It will contribute to the education of the younger generation as well as the village to enhance mangrove management practices and hopefully generates some money for the village.’ (Woman 27, 45-54 years old).

> ‘This would be very good, not only for our children for the many years to come, but also for the environment.’ (Man 13, 45-54 years old)

> ‘The mangroves attract tourists if the people take care and conserve the mangroves. Provide food for family and leisure activities for tourists.’ (Woman 54, 25-34 years old)
>
> ‘It's important to the environment and is important for education and student knowledge.’ (Woman 34, 25-34 years old)
>
> ‘It will help enhance the education of our young generation on how to protect and manage the mangroves from degradation. It is also a very important aspect to the tourism industry.’ (Woman 46, 25-34 years old)

Again, the focus is on ‘working together’ to ‘better our village and sustain our mangroves’.

> ‘Working together to save mangroves can stop soil erosion and provide more food.’ (Woman 55, 65+ years old)

There is also emphasis on ‘new’ and ‘exciting’ opportunities for Moata’a as a tourist attraction. The positive attributes of tourism are noted in the word cloud responses of residents (Figure 11). If developed as a tourist site, 95% of households state they like to be involved in eco-tourism activities. This was strong for both women and men.

Figure 11. Word cloud response to the question 'Do you support the development of the Moata'a mangroves into an environmental education and ecotourism site and why?

The Moata'a community have the skills to promote environmental education and eco-tourism development in their community. Cultural assets are important for business, for example, crafts and other expressions of culture such as song and dance are important for tourism business enterprises. Certain traditional activities are accorded status (e.g., hospitality or fine mat weaving) and can also be of great advantage to rural Samoan business enterprises (Cahn 2008). When asked what skills they could bring to such development villagers responses include:

- 23% said public speaking
- 14% said education
- 10% said storytelling
- 10% tour guide
- 8% singing
- 6% food cultivation
- 6% cooking traditional foods
- 6% project management
- 5% lei making
- 5% weaving
- 4% dancing

There was not a significant gender difference in these responses, although women were more likely to choose storytelling, tour guide, and lei making than men, while men were more likely to nominate public speaking, singing, dancing, and education.

To facilitate the Moata'a village with their plans for ecotourism development it is important to understand the ways in which development and economic entrepreneurism can be

embedded within a Samoan way of life, as well as the effects modernisation and capitalism have had on traditional social and cultural structures. While *fa'aSāmoa* provides motivation and support mechanisms that can enhance entrepreneurial activity and bottom-up development, changes in *fa'aSāmoa* have led to more individual systems of economic production – away from the *'āiga* towards individual families and households and matai have less control over financial resources and labour (Cahn 2008). Attention to gender relations must also be acknowledged. For example, families have more influence on what economic enterprises they engage in, and women are more likely to be supported by family members if they are in business. It is now more likely that women's *matai* will be a husband, brother, or father, which makes it easier for her to obtain approval to do business (Cahn 2008).

THE FRANGIPANI FRAMEWORK FOR REGENERATIVE TOURISM DEVELOPMENT IN MOATA'A

Tourism is an important economic sector in the Pacific and offers significant opportunities for economic growth, employment, and sustainable development (Wong et al., 2013). However, the impacts of climate change can also be potentially disastrous for tourism (Wong et al., 2013). Wong et al., (2013, 69) identify the following actions and adaptions necessary for tourism to support resilient livelihoods, that will need to be supported more broadly by government and business:

1) Technical adaption, e.g., Climate proofing coastal infrastructure

2) Business management, e.g., managing potential changes in demand in the context of tourism, including possible shifts in seasonality and the need to develop alternative tourism products.

3) Behavioural adaption, e.g., Adapting tourism activities according to climate variability.

4) Research and education, e.g., identifying the risks associated with climate change facing the tourism sector, and educating tourism operators about those risks

Considering these challenges, and to ensure host communities gain maximum benefits from tourism (economically and socially), with least effects on local eco-systems, local communities' voices should be foregrounded (Chassagne & Everingham 2020). For local communities to be empowered by tourism, their voices and needs should guide tourism development (Scheyvens 1999; Higgins-Desbiolles *et al.,* 2019). Empowerment for local communities requires communities themselves to define the parameters of this empowerment within their own worldviews and cosmologies, so that communities affected by tourism become the 'producers of tourism knowledge', rather than merely the 'objects of tourism research' (Chambers & Buzinde, 2015; p. 3).

The well-being of local communities should also underpin tourism development (Scheyvens et al 2021). In their work on tourism in the Pacific, Scheyvens *et al.,* (2021) note that well-being requires Pacific people sustaining connections to land and local knowledge systems. Collective notions of well-being contrast significantly with individualistic western notions of well-being. In Pacific notions of wellbeing, the relationalities between physical, mental, spiritual, community, and ecological dimensions need to be recognised. Tourism

development must consider these inter-relationalities. Schevens et al (2021) put forward the 'Frangipani Framework' model to describe the importance of being attentive to well-being from a holistic Pacific perspective, highlighting the relationships between the social, spiritual, mental, physical, and financial aspects.

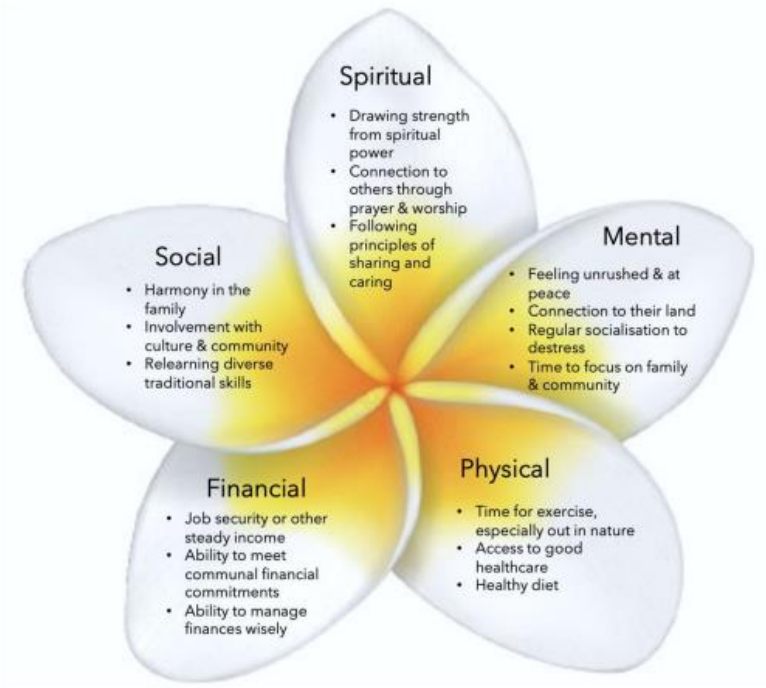


Figure 1: 'Frangipani Framework: Pacific Peoples' Well-Being Through Tourism'

In the Pacific the frangipani is rooted within Indigenous cultures and identities, used in wedding ceremonies and for other important occasions, symbolising union and togetherness (Thaman et al., 2012). While the frangipani looks delicate, its five petals are quite firm and strong, so the flower is naturally tougher and more resilient than many other tropical flowers. The Frangipani Framework suggests tourism can lead to more resilient livelihoods; however tourism practices also need to be underpinned by local knowledge, foregrounding community well-being to also be resilient in the face of increasing effects of climate change.

The Moata'a mangroves are a symbol of resilience that should be celebrated. In a sign of hope for the future, villagers highlighted their regrowth,

> 'Just to note that we have seen mangrove seedling growing around our houses. It seems that mangroves are spreading in the village'

The approaches to tourism taken by the community of Moata'a reveal the potential for creativity and proactive change that can come from community initiatives. The community has the capacity to engage with tourism to regenerate environments, support cultural links to place and promote sustainable livelihoods in a form of *regenerative tourism*. The approach taken by the community emphasises links to land, place, community and heritage, as well as the importance of the community leading initiatives including through the Village Council and Women's Group.

The vision of the community highlights the potential for small-scale regenerative tourism to be a key climate adaptation strategy. While some approaches to conservation do not centre culture or communities, for Moata'a, the needs, cultural considerations and livelihoods of communities are centred. The vision of the community would suggest there is scope for regenerative tourism to help in this task.

CONCLUSION

The effects of climate change in the Pacific are dire in relation to rising sea-levels, tropical cyclones, and other climate related risks; Tia-Tia-Seath, Underhill-Sem and Woodward (2018) note that very few people in the Pacific will be unmarked by climate change which will have significant impacts on Pacific peoples' health, however traditional forms of knowledge and social organisation are strong. Far from being passive victims, the rich legacies of the Pacific contain visions of leadership and community with pluriversal possibilities for dealing with such crises and these voices and knowledge systems need to be foregrounded in conceptions of resilience (see Teaiwa, 2019; Wesley-Smith, 2016; Underhill-Sem and Woodward).

Taking a cultural ecology approach to understand the human-mangrove relationship in Moata'a has provided insight into human-mangrove relationships. This has included providing a sense of local communities' existing knowledge of climate and environmental change and the effects of change on local environments, culture, and community. The study has highlighted the importance of mangroves and their conservation to identity, connections to Land, ancestral lineage, and contemporary kinship relations. It has shown that the community values mangroves in integrated ways. This includes a high value placed on mangroves for their environmental contribution, but also on the role of mangroves to supporting a sense of place, identity and culture. The mangroves were also seen as a significant site of environmental, social, cultural, health and economic well-being.

The study also showed that the community has seen a wide range of impacts and changes in the mangrove environment. This includes flooding and climate change as well as integrated impacts relating to culture and identity. The study has revealed that loss and damage associated with climate change and inappropriate development is not only economic. There are other important lived experiences of loss that include cultural links to the mangroves and water, ancestral ties, relationships to land, heritage, subsistence activities, recreation and senses of belonging.

Our findings further suggest that while climate change is impacting the village, inappropriate development and fragmented western-oriented approaches to development and land management are also having dire impacts. Indeed, through the destruction of hectares of their mangrove environment in the 1970's and 1990's, through existing climate change impacts, and through ongoing issues with waste and inappropriate development, the Moata'a community have suffered incredible loss.

This study also shows a high involvement of the community in management, adaptation and care. As such, despite sustained loss, the human-mangrove relationship remains strong and

there is both a commitment, and capacity, to sustain it. These results of the survey ultimately demonstrate a multi-faceted meaning of resilience for the Moata'a community – a local Indigenised conception of resilience that prioritises mangrove conservation and takes cultural heritage forms.

The study found that experiences and responses within the mangrove environment were gendered. Women consistently rated their experience of change higher than men in most cases except for those 'experiences' that are more readily attributed to climate change in the climate science. Women were also active in management, adaptation and care activities.

The findings of this research aim to promote social, cultural, and economic self-sufficiency for the Moata'a community. The research has provided villagers the opportunity to impart their local ecological knowledge, and thereby raise awareness of the importance of this knowledge in the wider community. By including a large number of households in the household survey component of this study, we have informed inclusive development, improving cooperation and communication regarding the future plans of Moata'a village as a tourism site.

RECOMMENDATIONS

Mangroves are key to facilitating climate resilience and biodiversity in Samoa. Recommendations from the report centre around **four central principles**:

1. **Collaboration:** Climate adaptation and resilience activities in Moata'a should be understood and responded to through a collaborative multi-sectoral approach which sees environmental, cultural, land/heritage, recreation, and economic (livelihoods) aspects as intertwined and mutually reinforcing. Mangrove ecosystem health cannot be addressed by technical solutions alone. Key stakeholders include MNRE, MAF, MESC, STA, and MWCD.
2. **Integration:** Development plans and responses have the potential to be regenerative or destructive. Examples of both forms of development were revealed through the study. Plans for future economic, social, and environmental development should take a ridge-to-reef approach incorporating freshwater, terrestrial, and marine ecosystems, and be vertically and horizontally integrated with existing district development plans and mangrove management plans and done in a way that is both regenerative and socially, culturally, economically, and environmentally sustainable. This may include regenerative tourism initiatives.
3. **Indigenous and locally led:** Indigenous Pacific Islander perspectives, values, decisions, knowledges and priorities must lead climate adaptation efforts and future responses. These voices are diverse, and attention must be paid to knowledge authorities, including women, at all scales. Climate change responses should prioritise nature-based solutions that include Samoan culture and support community initiatives and

governance structures including the roles of the Village Council and Women's Committee with attention to gender and other forms of social inclusion.

4. **Action:** Based on the lived experience of the Moata'a community, immediate climate and ecosystem-based adaptation activities are required to address key challenges impacting the community, including drainage, water quality, waste and pollution, and inappropriate and ad-hoc development. This action should be based on the above principles to ensure it is planned, coordinated, collaborative, integrative and co-designed with the Moata'a community to support the regeneration of a healthy human-mangrove relationship in Moata'a in sustainable ways.

The following specific suggestions emerge from the study:

Community level

1. **Prepare an integrated multi-sectoral ridge-to-reef development plan for Moata'a**. This plan should include project goals and benefits including the identification of potential economic gains outlining how these will be distributed and/or invested, an outline of how the development plan will be managed which recognises the role of the Moata'a communtity as leaders in managing their resources, and a time frame for the implementation of activities. Key components should include:
    (1) Mangrove restoration, climate adaptation, and ecosystem-based adaptation with attention to mangroves and other culturally significant species including those that support diverse livelihoods such as pandanus
    (2) Fisheries
    (3) Waste management and pollution control, and circular economy principles: Locate places and processes to prevent, collect, and recycle waste that are easily accessible for all members of the community.
    (4) Recreation and education
    (5) Drainage and hydrology
    (6) Water quality
    (7) Regenerative tourism activities: In consultation with the Village Council and other village groupings including the Women's Committee, develop a Moataa village community-level tourism plan outlining community level tourism activity that can be promoted at the national, regional, and international level. This may include a pilot tour with University of Newcastle students to support the development of regenerative tourism plans.
    (8) Disaster Risk Reduction. Identify evacuation sites and plan disaster response
    (9) Environmental governance: Considering r**eviewing and updating village by-laws** where required in relation to the above integrated multi-sectoral ridge to reef development plan.

(10) Attention to livelihoods and social and cultural factors as cross-cutting themes.

2. **Waste and pollution prevention and management capacity development training.** Work with key stakeholders including SPREP and MNRE to strengthen capacity around waste and pollution prevention and management, and circular economy design to be included in integrated multi-sectoral development plan.
3. **Regenerative Tourism Principles and Activities Capacity Strengthening Training**. Work with key stakeholders include STA to strengthen the Moata'a community in the principles of regenerative tourism to support the village in the design and promotion of tourism activities to support village livelihoods.
4. **Social Inclusion:** Identify at risk households to ensure these households are part of the co-design of all future activities, particularly climate mitigation and adaptation plans that may impact them, including flood mitigation.
5. **Gender:** Ensure the Women's Committee are adequately supported and compensated for the development and conservation of the community.
6. **Citizen Science:** Capacity strengthening for citizen science at the community level in monitoring, for example, the health of the mangroves through water quality testing, waste audits.

National level

7. **National Adaption Plans (NAP)** should include activities that respond to preserving cultural identity and vital connections to place, as well as relocation (climate displacement) actions.
8. **Integrated Multi-Sectoral Approaches to action**: Future district level planning should be integrated so that, for example, mangrove conservation, management and development activities are addressed within one plan that incorporates attention to livelihoods, environmental and cultural components, and includes consultation with key stakeholders from all relevant ministries (MNRE, MAFS, MESCC, STA, MWCD). Mangrove conservation should be horizontally integrated in plans, policies, and strategies throughout Samoa.
9. **National-level regenerative tourism capacity strengthening training:** Develop and promote Samoa's capacity in regenerative tourism a key climate and ecosystems-based adaptation activity. Some tourism activities to consider might be mangrove and pandanus replanting, coral reef restoration, cultural heritage tours,
10. **Flood mitigation:** Urgent action to restore the mangroves hydrology and drainage.
11. **Science-policy nexus:** All interventions to mangrove environments from any sector should be informed by the latest science, bringing together social and physical sciences, and Indigenous local knowledge to minimise impacts to endemic species, the environment, and community.

12. **Promote traditional knowledge and practice** as key to climate and ecosystem-based adaptation in governance, environmental education, and tourist activities. Promote Moata'a as a site of significant environmental and cultural value. For example, highlight the relationship between the Moata'a mangroves and legend of 'Sina and the Eel'.

Regional

13. **Collate case studies detailing loss and damage** to land, culture, heritage, ancestral ties and other social and cultural aspects of environmental loss and damage to use as evidence of the Pacific regions experience of the impacts of climate change to amplify at the international level.
14. **Develop a regional regenerative tourism guideline/toolkit** for the Pacific region.

International

15. **Loss and Damage Financial Mechanisms:** Support the Pacific region to amplify their position to develop appropriate policy provisions, including financial mechanisms, that recognise and compensate for loss and damage to land, culture, heritage, ancestral ties, belonging and other social and cultural aspects of loss and damage.
16. **Promote small-scale regenerative tourism activities** as a key climate adaptation strategy.
17. **Locally-led design and decision-making.** Ensure responses are led by traditional knowledge, and are led by local knowledge authorities in decisions, including women.

APPENDIX 1.

Sina Ma Le Tuna (The Legend of Sina and the Eel)

Taken from the English translation by Rev Falevatu Enari

Once upon a time in the beautiful islands of Samoa, lived an angelic young girl named Sina. Travellers who visited the island spread tales of her beauty and it reached as far as Fiji, a small island hundreds of miles across the ocean.

When Tuifiti, the high chief of Fiji heard the tales, he fell hopelessly in love with Sina. Early one morning he made his way to the beach, where he used his magic powers to turn himself into an eel, and to start the long swim across the sea to find her.

In Samoa, telling stories at the village pool was something everyone looked forward to. Sina finished her work and ran to play in the pool with her friends. They were chatting, laughing and splashing when suddenly Sina felt something wrap around her ankle.

Frightened, she leapt onto a rock and looked down only to find the prettiest eel she had ever seen.

Sina had always wanted a pet of her very own and now her dream had come true. Saying goodbye to her friends, she gently picked up the eel and carried him home where she put him in a tanoa; a wooden bowl used to prepare food.

She did everything she could to make her new friend happy; feeding him the tastiest food she could find and changing his water every day.

As time past, her love for the eel grew and grew… but so did the eel. Before long the tanoa was too small for him.

So Sina took him back to the pool. As he slid into the water Sina followed him and they swam together happily. “This is much more fun than the tanoa” she shouted as they splashed around together.

Sina swam off and made the eel chase her while her friends watched, wishing they had such a loving pet.

Suddenly, everything changed! The eel was now fully grown and, as he leapt at Sina, she shouted “Stop! You’re too big for play fighting. It hurts.”

But the eel didn’t stop and jumped up and wrapped himself around her. Sina’s friends thought she was just having fun and they giggled as the eel tightened his grip.

Finally, she managed to pull the eel off and held him at arm’s length, staring into his face. Something was very, very wrong.

The eel stared back at her with a strange look in his eyes. “Wait! You’re not an eel!,” she cried. “What are you?”. She paused and with anger she half whispered “Are you a Spirit”?

Terrified, Sina threw the eel into the water and scrambled out of the pool, her heart pounding like a drum and her legs shaking with fear. “Oh no! My adorable little pet has grown into a hideous monster!” she cried, and her eyes filled with tears as she raced home.

She flew into her hut shouting “Mother! Father! Help!” but the hut was empty and she knew the eel would be following. There was only one thing to do – run away!

Sina made her way to the coast where a kindly fisherman agreed to take her to the nearby island of Savaii. “I’ll be safe now” she thought. “The eel will never find me here”.

But back in Upolu, the eel slithered from the pool and disappeared into the long grass. Day after day he searched the island looking for Sina.

Finally, he arrived at the sea and gazeed across to the island of Savaii.

“So that’s where she’s gone”, he thought, as he slid under the waves.

When he reached Savaii, he searched high and low, then finally settled at the village of Safune when he got news Sina was hiding there.

“There’s no hurry” he told himself as he slipped into the village pool to wait.

Next morning, Sina went to collect food in the forest.

When she returned with her basket brimming of fruit, the excited villagers were crowded around the pool, laughing and cheering.

“What’s going on?” laughed Sina as she rushed over to join in the fun.

When she got there she found herself staring into those bizarre, scary eyes. Although it was a warm afternoon, Sina shivered with fear as she yelled at the creature “Stop it! Go away! Stop following me!”

Soon fear turned into anger. Before she stormed away, she got closer growled almost in a half whisper “Look at the wicked eyes of that darned thing!” The worried villagers rushed after Sina to ask her why she was so upset.

As the villagers listened, they grew angrier and angrier.

They couldn’t allow this dreadful eel to keep chasing Sina, so they made plans to kill it.

Sina was upset because she had a kind heart and didn’t want the eel to die, so she told the villagers she would travel back home to Upolu instead.

However, as she made her way home, little did she know that someone was following.

“I just want to go home to my village”, she thought.

“I want to see my mother and father and my friends. I hope I never see that horrible, horrible, eel again!”

When she arrived, the village men were all in the sacred meeting house, which she rushed into.

Even though the sacred meeting house was taboo for women, everyone was delighted to see her and she was surrounded by a crowd of smiling faces.

For the rest of her long and happy life, whenever Sina took a refreshing drink of coconut juice, she thought of the little eel she'd met so long ago.

Today, that sacred spot, Falefatu, is the meeting place of the whole district.

If you look at a coconut, you will see that is has two eyes and a mouth. This is because it has the face of Tuifiti – the eel who loved Sina.

Few villages in the Vaimaugu District were named after events that took place during the eel's pursuit of the beautiful Sina.

TANOALEI'A village got its name from the bowl (TANOA) of (LE) the eel (TA) where Sina kept it as a pet

FUISA'A is a plot of land at the village of Vaiala where Sina sat drenched in the march (FUI) crying in hysterics kicking her feet (SA'A).

TAUMEASINA is a plot of land adjunct to Vaila, where the eel tried (TAU) to get intimate with Sina (MEA SINA).

A resort named Taumeasina Island Resort stands on that very spot today.

In the village of SAFUNE is the infamous village pool called MATA O LE ALELO named after the curse (that) Sina screamed at the eel.

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