A thesis submitted to the Department of Environmental Sciences and Policy of

Central European University in part fulfilment of the

Degree of Master of Science

Adaptation, livelihoods and ecosystems in Fiji: the use of ecosystem-based adaptation to climate change

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June 2018

Budapest

Erasmus Mundus Masters Course in Environmental Sciences, Policy and Management

MESPOM

This thesis is submitted in fulfillment of the Master of Science degree awarded as a result of successful completion of the Erasmus Mundus Masters course in Environmental Sciences, Policy and Management (MESPOM) jointly operated by the University of the Aegean (Greece), Central European University (Hungary), Lund University (Sweden) and the University of Manchester (United Kingdom).

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Mace-Snaith, RMJ. 2018. *Adaptation, livelihoods and ecosystems in Fiji: the use of ecosystem-based adaptation to climate change.* Master of Science thesis, Central European University, Budapest.

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No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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ABSTRACT OF THESIS submitted by:

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for the degree of Master of Science and entitled: Adaptation, livelihoods and ecosystems in Fiji: the use of ecosystem-based adaptation to climate change

Month and Year of submission: June, 2018.

It is accepted that climate change will impact both humans and both must adapt to these impacts under what is termed climate change adaptation. The international climate change discourse has progressed since the 1992 Rio Earth Summit and the publication of the Millennium Ecosystem Assessment (MEA), with a growing recognition of the vital role ecosystems play in supporting societal climate change adaptation. This recognition of ecosystem services as vital to achieve sustainable development goals and climate change adaptation ambitions has led to a call for a multifaceted approach. One such approach is ecosystem-based adaptation (EbA) which has been defined by the CBD (2009) as "*the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change as part of an overall adaptation strategy*". EbA is a relatively new concept that has gained substantial support in recent years, due to claims that it offers 'win-win' outcomes and 'low regrets' solutions. This research aimed to understand whether the extra benefits (win-win outcomes) believed to be associated with EbA compared to sectoral approaches are realised. The study used EbA in the context of a specific place-based project in the small island developing state of Fiji. The major finding was that the concept of EbA may not achieve all the outcomes it claims to produce in practice. However, to properly evaluate EbA's potential it will require a considerable amount of time to pass, due to the timescales at which climate change adaptation must take place.

Keywords: environment, climate change, climate change adaptation, ecosystem approach, ecosystem-based adaptation, SIDS, Fiji, PEBACC, resilience

Acknowledgements

I would like to briefly acknowledge all those that have made this thesis possible. I am particularly grateful to those from SPREP and the PEBACC project; Herman, Filo and Jilda. I thank the PPOA project and specifically Shannon for all the support afforded to me. I thank all those in Fiji, who helped me, from research participants to new found family and friends, Vinaka! To the family, friends and loved ones back in Europe and elsewhere I thank you for your support.

I thank my supervisor Laszlo Pinter for his patience and time. I also thank Anika Terton for all the time she gave up answering my long-winded questions regarding EbA and the ALivE Tool.

Finally, I wish to show my gratitude and appreciation to the Lydia Press Memorial Fund and CEU for the financial assistance they offered me, without which this research would not be possible.

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List of Abbreviations

ALivE	Adaptation, Livelihoods and Ecosystems Planning Tool
BES	Biodiversity and ecosystem service
BMU	German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety
CBA	Community-Based Adaptation
CBD	Convention on Biological Diversity
CBNRM	Community-based natural resource management
CCA	Climate change adaptation
CLICS	Climate Change Integrated Conservation Strategies
CMIP5	Coupled Model Intercomparison Project Phase 5
CRiSTAL	Community-based Risk Screening Tool-Adaptation Livelihoods
COP	Conference of Parties
EbA	Ecosystem based adaptation
eco-DRR	Ecosystem-based disaster risk reduction
DRR	Disaster risk reduction
ESRAM	Ecosystem and Socio-economic Resilience Analysis and Mapping
FEBA	Friends of EbA
FLMMA	Fiji Locally Managed Marine Area
GHG	greenhouse gasses
GSR	Great Sea Reef
ICDPs	Integrated conservation and development projects
IIED	International Institute for Environment and Development
IISD	International Institute for Sustainable Development
IKI	International Climate Change Initiative (of BMU)
INDC	Intended Nationally Determined Contributions
IUCN	International Union for Conservation of Nature
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated water resource management
LMMA	Locally-based Marine Management Area Designation
M&E	Monitoring and Evaluation
MCA	multi-criteria analysis
MEA	Millennium Ecosystem Assessment
MPA	Marine Protected Area designation
NAP	National Adaptation Plan
NBSAP	National Biodiversity Strategy and Action Plan
NCCP	National Climate Change Policy

NGOs	Non-Government Organizations
NRMS	Natural Resource Management Strategy
PACCSAP	Pacific-Australia Climate Change Science and Adaptation Planning Program
PAR	Pressure and Release model
PEBACC	Pacific Ecosystem-Based Adaptation to Climate Change
PPOA	Pacific Partnership on Ocean Acidification
PSIDS	Pacific Small Island Developing States
RESCCUE	Restoration of Ecosystem Services and Adaptation to Climate Change
SES	Socio-ecological system
SDGs	Sustainable Development Goals
SIDS	Small island developing states
SPREP	Secretariat of the Pacific Regional Environment Programme
TEEB	the Economics of Ecosystems and Biodiversity
TNC	the Nature Conservancy
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USP	University of South Pacific
WCS	Wildlife Conservation Society
WWF	World Wide Fund for Nature

Glossary

Dalo	Taro root (crop)
Gleaning	A fishing method used in shallow coastal, estuarine and freshwaters waters or in habitats exposed during low tide
iTaukei	Indigenous Fijian
Matagali	Traditional landowners, clans
Qoliqoli	Traditional fishing grounds
Tabu	Forbidden (implied for an area or activity during this study)
Tikina	District
Talanoa	Traditional way of sharing knowledge
Vanua	Numerous uses, social concept of traditional Fijian society in which the elements of people, spirits and places.
Yaqona	Kava root (crop)

1. Introduction

> "The Fijian people, along with every Pacific Islander, live on the front lines of climate change. The rising seas, changing weather patterns and severe weather events are threatening our development, our security and the Fijian way of life, along with the very existence of some of our low-lying neighbours."
>
> Fijian Prime Minister and President of COP23 Frank Bainimarama 2017

In 2007 the Intergovernmental Panel for Climate Change (IPCC) reported that there was scientific consensus that 'warming of the climate system is unequivocal' (IPCC 2007b) and that evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases (IPCC 2007a). Subsequently, in the decade or so that has passed, we as the forbearers of our actions have begun to implement ways to mitigate climate change. However, as President Bainimarama highlights, some families, communities, islands, nations and regions are already looking climate change in the eye. Climate change presents a threat to our well-being and livelihoods through the increase in climate hazards and risk associated with the impacts of climate change such as global warming, weather extremes and pattern changes etc. (IPCC 2012). These impacts are guaranteed and will likely exceed expectations under present climate change and emission trajectories. This, as Solomon *et al.* (2009) states, means 'adaptation to climate is necessary'. Unfortunately, it is the poorest and most marginalised who need to adapt the most as they lack the adaptive capacity to deal with current and future challenges (Mimura *et al.* 2014). It is clear there is a correlation between development and adaptive capacity, so any adaptation strategy to address climate change impacts must also tackle the issue of sustainable development in tandem (IPCC 2012).

It's not just humans that must tackle climate change, nature must also adapt to the impacts and changes it brings. This has been recognised in the ecosystem approach which has been well documented and implemented in the last few decades. This can be directly linked to its adoption by the Secretariat of the Convention of the Secretariat on Biological Diversity (CBD) as their main implementing framework in 2000. Many national and international conservation bodies have reinforced its necessity and merits for not just conserving the non-human biosphere, but also society, as we know it. The international climate change discourse has progressed, and particularly since the 1992

Rio Earth Summit and the Millennium Ecosystem Assessment (MEA), there has been a recognition of the vital role ecosystems play in supporting society to mitigate and adapt to the impacts of climate change. This recognition of ecosystem services as being vital for sustainable development and climate change adaptation (CCA) has led to a call for a multifaceted approach. One such approach is ecosystem-based adaptation (EbA) which has been defined by the CBD (2009) as:

> *"the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change as part of an overall adaptation strategy."*

Further, elaborated in 2010 through Conference of Parties (COP) decision X/33 (j) (CBD 2010):

> *"…ecosystem-based approaches for adaptation may include sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities"*

Although the term is relatively new, it has garnered considerable support and interest in project implementation under the auspice of international conservation organisations. There has also been integration of EbA principles into disaster risk reduction, leading to ecosystem-based disaster risk reduction (Eco-DRR) (Sudmeier-rieux 2016).

EbA cut across fields such as conservation and sustainable development and differs from more traditional conservation and development strategies. In the climate change adaptation discourse internationally EbA has been discussed as a win-win strategy, but there are calls for case-based evidence to support its implementation, effectiveness, mainstreaming and scalability from ongoing and completed projects (Reid *et al.* 2018; Andrade *et al.* 2010; Ojea 2015; Rizvi *et al.* 2015; Lo 2016; Seddon *et al.* 2016; Reid 2016, 2017).

This thesis will consider the case of Fiji and the Adaptation, Livelihoods and Ecosystems Planning Tool (ALivE)[1] to address how the concept of ecosystem-based adaptation (EbA) is applied and implemented, what makes effective EbA solutions and what are their limitations

[1] *The tool is being developed by the International Institute for Sustainable Development (IISD), in partnership with the International Union for Conservation of Nature (IUCN), as part of the activities of the EbA South project, a Global Environment Facility (GEF)-funded initiative implemented by UN Environment (UNEP) and executed by the National Development and Reform Commission of China of China, through the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences*

1.1 Research Definition

Climate change impacts are already felt across the globe, particularly by some of the world's poorest and most vulnerable communities. EbA has emerged as an approach to adapting to current and future climate change impacts and hazards, while also meeting sustainable development and biodiversity outcomes, leading to claims of it being a 'win-win' approach with 'no regrets' solutions (Mimura et al. 2014; Reid and Alam 2017; Munang *et al.* 2013; Mensah *et al.* 2011; UNDP 2015; CBD 2016; Raza *et al.* 2014; Chong 2014). Although EbA has picked up some momentum, there are still calls for more substantial, clearer and coordinated case-based evidence to support this claim (Lo 2016; Seddon *et al.* 2016; Reid 2011; Rizvi 2015; Munang *et al.* 2013; Munroe *et al.* 2012; Huq *et al.* 2017). The evidence required also needs to illustrate the 'ecological, social, and economic effectiveness of EbA projects relative to alternative approaches' (Reid *et al.* 2018; Travers *et al.* 2012; Doswald *et al.* 2014; Reid 2011).

In support of understanding EbA's potential as a multifaceted, win-win approach, we must understand how EbA is being translated from a concept to project and how EbA differs from more traditional adaptation and conservation strategies (see Figure 1). One important element of EbA achieving these multiple outcomes requires the community to be central to the planning and implementation process. There has been calls for evidence of whether what Reid (2016) calls a 'principle of EbA' is being applied.

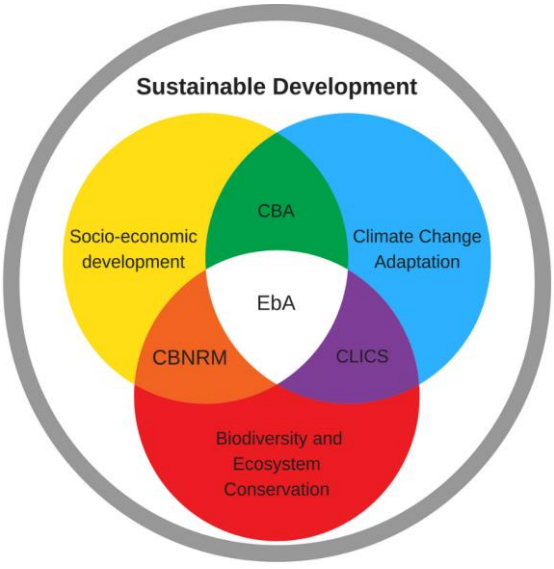

Figure 1 EbA as a win-win approach and relation to other traditional strategies (Adapted from: Midgley *et al.* 2012; FEBA 2017)**.**

As such this research will contribute to the case-based evidence on how the concept of EbA is being interpreted and implemented at the project level. This will afford a greater level of knowledge of the approach and its ability to meet biodiversity, climate change adaptation and sustainable development ambitions simultaneously. This is important as many decision-makers remain sceptical about EbA and are requesting to see evidence that demonstrates how EbA can help countries meet the targets set out in global agreements in practice (UNDP 2015), including CBD's Strategic Plan for Biodiversity 2011-2020 (Aichi Targets), Sustainable Development Goals (SDGs), The United Nations Framework Convention on Climate Change (UNFCCC), and the Paris Climate Change Agreement (INDCs).

1.1.1 Vulnerability of Small Island Developing States

Climate change impacts are already preventing small-island developing states (SIDS) from following a pathway to sustainable development (Lo 2016). SIDS are trying to be heard in an increasingly crowded space. Progress has been made in recent years and there is a growing recognition of the risks they are facing internationally (Kelman *et al.* 2014; Mercer *et al.* 2012; Kelman 2010; Mercer *et al.* 2014; Robinson 2017; Robinson and Dornan 2017). Chandra and Gaganis (2016) sum up the current situation faced by SIDS:

''the adaptive capacity of small islands is weak and further delays in committing to mitigation targets mean high cost of adaptation measures in a region comprised of low populations spread over a large area of sea.''

There are many reasons for the level of vulnerability of SIDS, including their geophysical attributes. In comparison to continental regions the geomorphological and geographical history and future renders them susceptible to current and future climate change hazards and impacts (Petzold and Ratter 2015). We only need to look at the relative short-term history to see how SIDS have been impacted by extreme climatic and weather events like hurricanes and tropical cyclones e.g. Hurricane Matthew in the Caribbean, tropical cyclones Pam and Winston in the South Pacific. These events have been linked to climate change, with many of these examples proving to be the strongest on record in their relevant regions. These weather events have huge impacts on the ability of SIDS to develop. To make matters worse a significant sea-level rise has already been observed and is expected to continue in the future (Mimura *et al.* 2014; Nurse *et al.* 2014).

If we accept the concept of EbA as offered by the CBD, it would appear to be an extremely relevant adaptation strategy in the context of SIDS. By learning from the successes and challenges of EbA at the project level in the context of SIDS, we can better argue its suitability in the adaptation strategies of SIDS.

1.2 Case study: Fiji

Fiji, with its population of approximately 900,000 distributed over 110 islands, presents an ideal opportunity to assess EbA in the context of SIDS. Due to its geographic, geological and social setting, Fiji is vulnerable to both short-term and long-term climatic events and changes (Government of the Republic of Fiji 2012; Fijian Ministry of Economy 2017). It faces many of the climate change impacts other parts of the world are yet to fully witness. This is one of the reasons why Fiji co-hosted the United Nations Ocean Conference in 2017 and more recently presided over the 23rd annual Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change (COP23). As one of the South-Pacific's most developed nations, Fiji supports regional development through its economic and development activities. Furthermore, Fiji is recognised as one of the leading countries in the Pacific for its actions on climate change and often leads the way for other Pacific Island Developing States (PSIDS). This was exemplified by Fiji becoming the first country globally to ratify the Paris Climate Change Agreement on 22 April 2016 (Republic of Fiji 2017).

Another reason Fiji offers a valid case study, is due to the fact they have a strong and ongoing history of implementing climate change adaptation and DRR projects at the Pacific, national, regional and local levels. Nationally Fiji has several current and scheduled policies, strategies and plans that consider climate adaptation and disaster risk, which integrate sustainable development and community resilience to varying extents. Importantly Fiji recently released a '5-Year and 20-Year National Development Plan' (November 2017) that aims to 'transform' the nation while meeting its commitments to the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change. A key aim of the 20-year plan is to ensure GDP increases four-fold per person over the this time period, while achieving net-zero global GHG emissions by 2050 (Republic of Fiji 2017). This is a substantial and ambitious goal as Fiji recognises that it must adapt rapidly to the impacts of climate change

including sea-level rise and increasing strength of climatic events such as tropical cyclones (Fijian Ministry of Economy 2017). Fiji is significantly vulnerable to shocks from climate change and climatic events (Figure 2), particularly as 44 percent of the rural population and 26 percent of the urban population still live in poverty (UN-Habitat 2013).

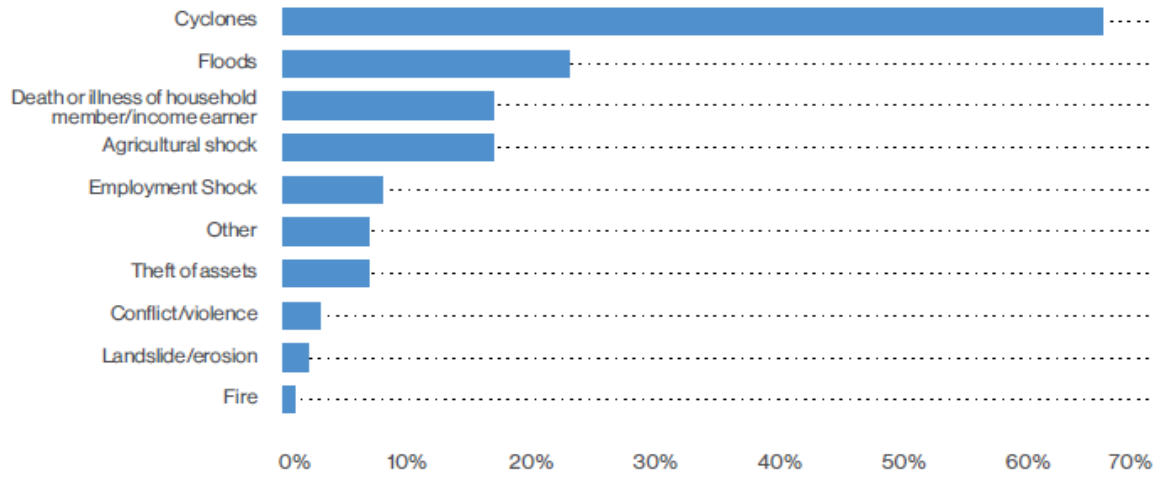

Figure 2. Percentage of the Fijian population that have experienced climatic or non-climate-related shock in the last year - As can be seen cyclones and floods are the two largest shocks, which are strongly tied to climate change. Fiji has been assessed as having a social resilience indicator of 56% by the World Bank (World Bank 2017; Hallegatte *et al.* 2015).

As previously mentioned Fiji is already feeling the negative impacts of climate change, this was demonstrated by the devastation caused by Tropical Cyclone Winston in 2016. It was the 'biggest storm ever to make landfall in the southern hemisphere', killing 44 and displacing thousands of Fijians. The damages and loss to infrastructure, equated to one third of Fiji's GDP (est. $1.4 billion) and cut economic growth from 3.8 percent to 1.3 percent with the rebuilding project still ongoing (World Bank 2017). Another huge and combining factor highlighted in Fiji's National Climate Change Policy (NCCP) (Government of the Republic of Fiji 2012) is sea-level rise. The NCCP stated there has been a '6mm increase in its sea level per year, greater than the global average'. It predicted that by the end of the century sea level change will have doubled in Fiji (Government of the Republic of Fiji 2012; Fijian Ministry of Economy 2017). This has led to recommendations to relocate over 40 of the most vulnerable villages to higher ground, with three relocated and two partially relocated thus far (McNamara and Des Combes 2015; Government of the Republic of Fiji 2012). This tactic has been

referred to by the Fijian government as a last resort option, following consideration of socio-economic and cultural factors (COP23 Presidency 2017; World Bank 2017).

A recent vulnerability assessment of Fiji (World Bank 2017) concluded that although many actions were taking place 'significant residual vulnerability exists in every sector of the Fiji economy'. Furthermore, it identified 'conserving ecosystems and the local environment' as one of five areas of interventions. The current and future rise in the sea level not only increases the direct risk to humans and infrastructure, but also leads to contamination of soil and water sources due to the saltwater intrusion. This leads to a reduction in the capacity of ecosystems to provide many of the important services (provisioning, regulating, supporting and cultural), that many Fijian's depend on for their livelihood and well-being (ranging from timber, sugar cane, mangroves for water filtration, pristine coral reefs for food and tourism etc.) (World Bank 2017). This is further compounded by warming seas, which alter or damage fisheries and leads to the bleaching of coral reefs (Government of the Republic of Fiji 2012). Fiji has been actively highlighting and setting-out the investment needs for pursuing ecosystem-based interventions (World Bank 2017).

The iTaukei people have strong emotional and cultural ties to their natural environment and have a long history of taking a more ecosystem approach when interacting with nature. For instance the term '*vanua'* encompasses more than the literal translation of 'land', but represents an extension of oneself and conceptualises one's life, sustenance, community and custom and thus could be considered to recognise a socio-ecological system of human-nature relationships (Ruddle and Akimichi 1984; Baines 1989; Sutton 2005; Lin 2015). Many villages are seen to be responsible for an individual species of plant or animal and its subsequent protection and sustainability (Sutton 2005). Women also play a role in the management of ecosystems in Fiji as they're often involved in the collection of food sources such as bivalves (Aalbersberg *et al.* 1997). Much of the traditional knowledge and approaches pre-date western ecosystem management and are beginning to be more formally recognised in Fiji, although there must still be an awareness that there are examples of unsustainable use by some communities (Sutton 2005). Recently, there has been an emphasis by the national government to return towards more traditional natural resource use through community natural resource ownership, which applies a more sustainable usage compared to private ownership (Ministry of Strategic Planning 2014). An

example of this is seen by the Fiji Locally Managed Marine Area (FLMMA) which has returned fishing rights to local communities in manner to conserve stocks (SPREP 2018a).

The strong linkage in Fiji between adaptation, livelihood and ecosystems entails the suitable utilisation of ecosystem-based approaches to both CCA and DRR. Fiji as one of the more developed nations is currently developing its National Adaptation Plan and has already produced policies such as the Green Growth Framework which aims to accelerate the combined efforts to address climate adaptation and disaster risk reduction with an ecosystem focus. There is a strong commitment nationally from Fiji to demonstrate itself as a leader in CCA and there becoming more recognisable efforts by local government to include CCA in their plans. Therefore, Fiji has been selected as the case study area for this research, as it affords assessment of EbA in the context of current and future climate change.

1.2.1 The Pacific Ecosystems-Based Adaptation to Climate Change (PEBACC) project

The PEBACC project is an ongoing project run by Secretariat of the Pacific Regional Environment Programme (SPREP), which is currently attempting to utilise the EbA approach to strengthen the resilience of communities in Fiji, The Solomon Islands and Vanuatu to climate change. The project runs from 2013-2019 with €4.95million in funding coming from the German Federal Ministry of Environment (BMU) International Climate Change Initiative (IKI). The SPREP has stipulated that their key objective is to raise the profile of EbA as an appropriate response to climate change in the Pacific region by demonstrating its capabilities through the PEBACC project. The intended outcome of this is its incorporation in relevant policy and planning processes. Furthermore, the PEBACC project says it aims:

"to identify what climate change factors and what suite of other circumstantial factors are limiting socio-economic resilience, particularly as it pertains to ecosystem services and the resilience of these services through time, and to prescribe a range of EbA actions that can broaden the range of possibilities for communities through the enhancement of ecosystem services."

(SPREP 2017a, 2017b, 2017c)

Interestingly, the PEBACC project in Fiji focuses on delivering EbA measures at two different scales and locations; firstly, at the provincial scale selecting Macuata Province and secondly at an Island level selecting the island of Taveuni. This thesis will focus

on these two field sites and as such the PEBACC projects efforts in Fiji, as its case-study. Figure 3 demonstrates the target field sites of the project, where following an initial information gathering the project aims to implement EbA options at the two differing scales on a demonstration basis, so as to highlight the potential of EbA in the region at various scales. SPREP already has some experience of implementing EbA labelled projects in Samoa, but this project covers extensively more locations.

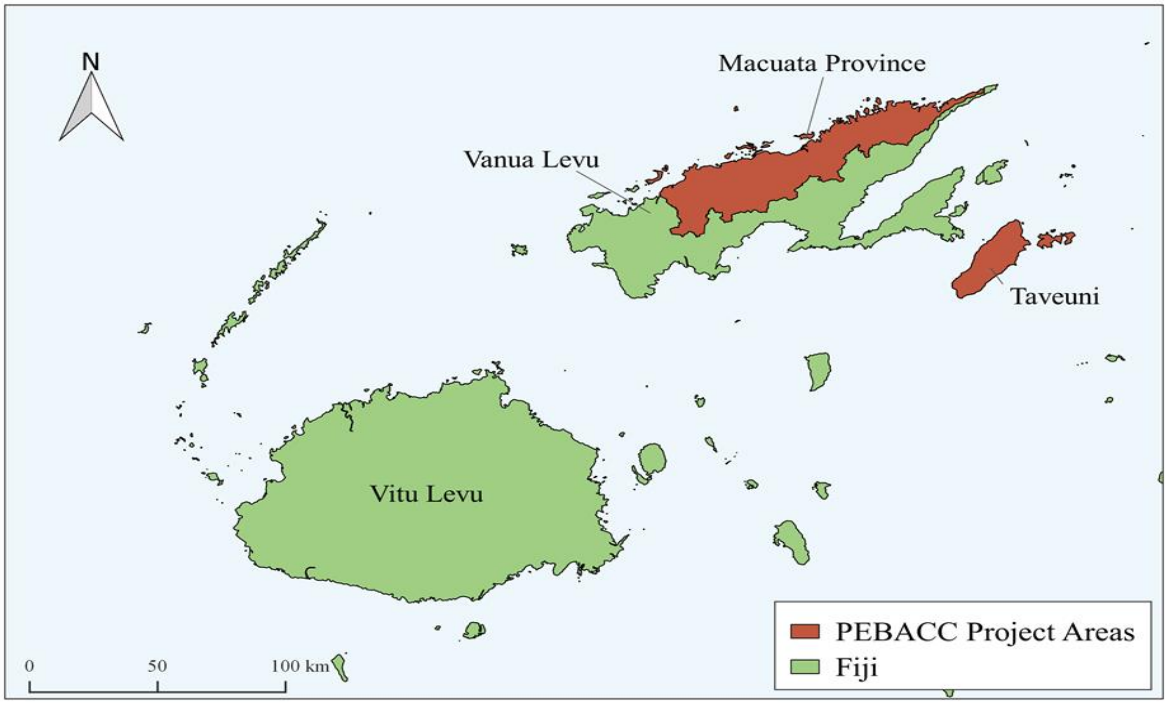

Figure 3. The location of the PEBACC project sites in Fiji – Illustrating the two project areas and scales; Macuata Province and the Island of Taveuni (part of the Caukadrove Province)

The PEBACC project has been designed in four phases and is currently undertaking phase 3:

Phase 1 – Baseline technical assessments (ESRAMs)

Phase 2 – EbA options identified and evaluated; EbA plans developed.

Phase 3 – Implementation of EbA demonstration activities

Phase 4 – Policy integration

Phase 1 was conducted for both field sites by consultants who utilised the Ecosystem and Socio-economic Resilience Analysis and Mapping (ESRAM) approach. This was meant to collate all current relevant documentation and include stakeholder information, as part of a data gathering phase. This information then informed the design of EbA options including evaluation by both PEBACC and relevant stakeholder

culminating in a plan of implementation of the finally selected EbA options. Currently PEBACC are undertaking phase 3, by implementing the EbA options plan, which when complete will require an assessment of how these EbA options can intergrate into subnational and national policy and strategies.

1.3 Aims & Objectives (Research Questions)

Understanding how EbA as a concept (as detailed by the CBD and agreed upon in the literature) is translated and applied in practice is the central aim of the research. In doing so it studies how the EbA approach addresses climate change, sustainable development and biodiversity issues in SIDS. The thesis will achieve this by investigating using the PEBACC project in Fiji as a case study. Which has been selected due Fiji's prominent role in UNFCCC, the fact Fiji has already begun experiencing what is determined as climate change impacts; is the regional leader in pacific in implementing new CCA strategies and that the PEBACC has detailed their strong aim to implement the EbA approach in Fiji.

An important component of EbA is ensuring that the community plays a central role in the planning and implementation stages. Subsequently assessing how successful the PEBACC project been in achieving this, forms another aim. The research will provide both practitioners and decision-makers with evidence of EbA's practicality.

To achieve the above aims the following research questions are answered:

RQ1: What is the implementation approach to EbA in the context of a specific place-based project in a small island developing state?

1.1: How was the focus of the project established, which was the basis for the information collected?

1.2: How was the collected information used to identify and develop EbA measures?

RQ2: How do the EbA options that PEBACC are implementing display the attributes of effective EbA measures?

2.1: How do the PEBACC EbA options meet and rank under the ALivE effectiveness criteria?

1.4 Thesis Structure

The first chapter introduces the context of the research problem and subsequent aims and objectives. The structure then allows for the exploration of the key background and concepts that underpin EbA. Chapters 2 – 6 refer to the literature reviewed for the thesis. The concepts explored in the literature review provide the background for the conceptual framework, which enables a theorisation of EbA in practice that is then explored through the research itself. This is presented in the third chapter and details how the ALivE framework acts as tool for the theorisation of these concepts for the basis of this research.

Chapter 7 details the methodological approach and conceptual framework that was harnessed by the study and also includes detailed description of the methods used and analysis approach.

Chapters 8 directly address the research questions through the presentation of the results and analysis. Followed by the discussion of these results in chapter 9. Finally chapter 10 offers the conclusions of this research.

2. Climate change adaptation

Climate change has been defined as a 'statistically significant change in the state of the climate that persists for decades or longer' (IPCC 2007a) and evidence shows it is affecting most elements of the biosphere (IPCC 2007b). Initially, following the global acceptance of this phenomenon, after early research was dominated by climate modelling and prediction in the early 1990s (Mimura *et al.* 2014), the focus shifted to climate change prevention under the auspice of climate change mitigation; defined as 'a human intervention to reduce the sources or enhance the sinks of greenhouse gases' (IPCC 2007b; Lo 2016). Following this, there was a realisation and greater understanding that climate change would incur change to the global climatic system that would lead to severe impacts on the planet; including but not limited to increases in the frequency and magnitude of extreme climatic events and disasters (IPCC 2012; Doswald *et al.* 2014). As these impacts and others caused by global warming were increasingly brought into the global discourse on climate change, the term climate change adaptation (CCA) garnered greater attention (Mimura *et al.* 2014).

Field *et al.* (2014) describes CCA as 'the process of adjustment to actual or predicted climate change and its effects' by limiting, avoiding or capitalising on them. It should be clear though that adaptation in itself is a response to not just climate change but also to various other non-climatic pressures, and delineating these from climate change impacts can often be difficult (Adger *et al.* 2005; Thomas and Twyman 2005; Mimura *et al.* 2014). One aspect that must be considered as part of adaptation is that there must be a constant looking forward, as the environment offers a fluid and dynamic respondent to climate change and because of this we may have to adapt to circumstance we struggle to envision, which as Reid (2016) states may require transformational adaptation. Transformational adaptation is recognised as seeking a 'fundamental change to a system or systems at greater scale and ambition than incremental adaptation' such as changing livelihoods or migrating elsewhere for new livelihood options (Mimura *et al.* 2014; CBD 2018). Incremental adaptation is what many authors suggest is the status quo at present and in a simplistic sense is adaptation that maintains current systems such as technological, institutional, governance through continual small adjustments e.g. becoming more efficient with irrigation (Kates *et al.* 2012). Furthermore, many authors state that CCA is not uniform

and is location specific that requires local level action by the community and local government (Corfee-Morlot *et al.* 2009; Glaas *et al.* 2010; Mukheibir *et al.* 2013).

An important element of literature to review regarding CCA, which is vital to grasp for understanding EbA, is what makes successful adaptation, although there appears to be a lack of consensus on the topic (Spearman and McGray 2011). This is likely to provide a challenge when addressing what makes successful EbA (Doswald *et al.* 2014). Successful adaptation has been described as relating to; 'efficacy, feasibility and acceptability' by Yohe and Tol (2002), effectiveness of the impact on vulnerability by Adger *et al.* (2005) and in the most recent IPCC assessment (AR5) the authors state that successful adaptation and life depends humans intervening or encouraging natural systems to adapt to the ongoing changes, so that we maintain or increase the deliverance of ecosystem services (Mimura *et al.* 2014; CBD 2018). If we return back to the definition of CCA and the need for adjustment, then the statement made by Doria *et al.* (2009), following review of expert opinions; ''that any adjustment that reduces the risks associated with climate change impacts, to a predetermined level, without compromising economic, social and environmental sustainability'', affords a greater explanation of what successful CCA requires. This linkage to social and economic aspects also brings in the theory that CCA is highly connected, if not interlinked, with development (Mimura *et al.* 2014). Much of the literature highlights this linkage through the fact that the 'most attractive adaptation options' (Mimura *et al.* 2014) are the ones that also support development (Klein *et al.* 2007; McGray *et al.* 2007; Hallegatte 2009).

2.1 Maladaptation and sustainable adaptation

An important concept to understand with regards to CCA is the potential for maladaptation. This is where an action or process that aims to support adaptation leads to increased levels of vulnerability. This commonly occurs when measures are implemented for short-term gain, but in the medium to longer-term increases vulnerability to climate impacts; it may also include trade-offs (CBD 2018). Some authors have identified that many adaptation strategies may lead to unrecognised reductions in socio-economic or environmental progress such as livelihood diversification, resource access or biodiversity (Næss *et al.* 2005; Eriksen and Lind 2009). As mentioned this appears particularly likely as a trade-off, for example one

group benefiting at another's detriment (Eriksen and O'brien 2007). This concept has led to claims for 'sustainable adaptation' principles to be considered:

"first, recognize the context for vulnerability, including multiple stressors; second, acknowledge that differing values and interests affect adaptation outcomes; third, integrate local knowledge into adaptation responses; and fourth, consider potential feedbacks between local and global processes."

(Eriksen et al. 2011)

Sustainable adaptation discusses the need to recognise the adaptive responses of multiple respondents including socio-ecological systems over varying spatial and temporal scales. If sustainable adaptation is promoted it is said to potentially increase the adaptive capacity of multiple groups.

3. Adaptive Capacity, Vulnerability & Resilience

In much of the literature and in many of the CCA strategies it is extremely likely they will talk about enhancing adaptive capacity, reducing vulnerability and building resilience. Gallopín (2006) does an excellent job of describing each one and their interrelation to one another within the context of the socio-ecological system (SES); which he defines as a system that includes 'societal' and 'ecological' interacting subsystems. Similarly, to the concept of the ecosystem (discussed later), SES can be applied at any given scale e.g. local to global. As such these are important and valid concepts to consider when establishing the background for EbA, due to their frequent use in the EbA literature. Adaptive capacity, vulnerability & resilience concepts are often integrated with one another (Gallopín 2006; Engle 2011), as undertaking actions that affects one of them, will generally impact the other two (illustrated in

Figure 4).

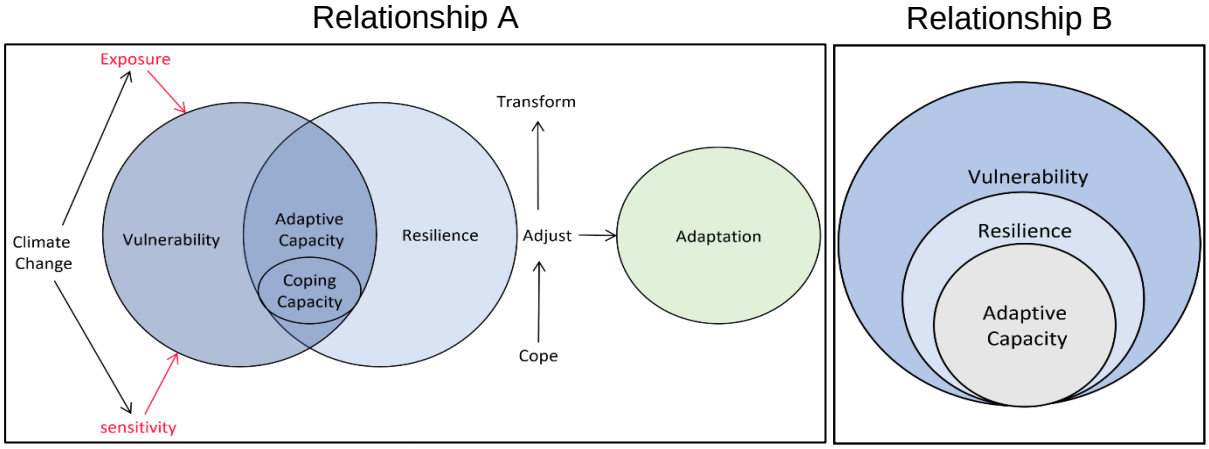

Figure 4 Linkage of Vulnerability, Adaptive Capacity and Resilience (Adapted from: Engle 2011; Zhou *et al.* 2016; Cutter *et al.* 2008; Berman *et al.* 2012)

3.1 Vulnerability

Vulnerability plays a vital role in adaptation to climate change, although it is a term used in many different genres which leads to a multitude of interpretations and uses. Adger *et al.* (2005) concluded from their review of social and natural science literature that vulnerability can be deduced as exposure and sensitivity to stresses or shock, and the capacity to adapt. Gallopín (2006) further notes that one system maybe vulnerable to a shock that another system does not, due to sensitivity and exposure. Considering this it would be sensible to suggest then that vulnerability is the potential to be impacted. When distinguishing vulnerability from resilience, van der Leeuw (2001) states that vulnerability revolves around ability to maintain a system, while resilience considers the ability to recover it.

3.2 Resilience

The aforementioned view of resilience and vulnerability, though is merely one opinion in a sea of views on the matter (Gallopín 2006). Field *et al.* (2014) suggests that resilience includes some form of preservation, in the shape of 'responding or reorganising so that structure, function and identity are maintained, while the capacity for adaptation, transformation and learning is also maintained'. A solid example, using the city of New Orleans, to demonstrate the difference between vulnerability and resilience is given by Alverson and Zommers (2018). They say that New Orleans decreased its vulnerability to sea-level rise and storm surges by constructing dykes and levees, this though had catastrophic effects when Hurricane Katrina hit in 2005. The dykes and levees had given people the sense of safety and thus many houses were built on low lying land. These developments were completely flooded during the hurricane as defences could not cope with the magnitude of storm. The city is still tackling the impact to this day (i.e. yet to fully bounce back) and this has led the authors to suggest that resilience was actually reduced by the construction of the vulnerability measures (the dykes and levees). There are numerous other theoretical aspects of resilience that could be explored further such as adaptive cycles, nested adaptive cycles, the concept of 'panarchy' and basins of attraction (Walker *et al.* 2004; Folke 2006; Gallopín 2006), but this unnecessary for this research. For the purposes of this research we will utilise the IPCC's (2007a) definition:

'the ability for a sociological or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation and the capacity to adapt to stress and change'.

Furthermore, it is recognised that adaptive capacity, absorptive capacity and transformative capacity are vital components of resilience, while it is agreed that 'increasing resilience is a broader task than reducing vulnerability and in a sense seems more appropriate to seek from adaptation outcomes' (Alverson and Zommers 2018).

3.3 Adaptive Capacity

'Societies and communities are resilient to climate change when they have the adaptive capacity to minimise its negative impacts, and even take advantage of opportunities' (UNDP 2015). Adaptive capacity is an important concept in various arenas, but particularly so when discussing CCA or EbA. Lo (2016) defines it as ability of an individual, community, society or organisation to adapt by either limiting the impacts, exploiting the opportunities or controlling the damage of climate change. This may be achieved by a person or entity utilising the strengths, attributes or resources available to them. In the fifth IPCC report on climate change (Mimura *et al.* 2014), following review of the literature the authors detailed that 'adaptive capacity signals potential but does not guarantee adaptive action'. This comment reverberates with relevance to adaptation approaches such as EbA, in the sense it may be easy to identify adaptive capacity, but the challenge clearly lies in unlocking it. The IPCC give further clarification to this point, by suggesting low-income developing countries must commonly entertain 'weak institutional environments', while high-income countries hold institutional barriers; that prevent the 'mobilisation of adaptive capacity' in both settings. Adaptive capacity is not equally distributed and varies with context and system type (Adger *et al.* 2007; Engle 2011). The role of intuitions has been described as the most important by much of the literature (Yohe and Tol 2002; Eakin *et al.* 2014; Engle 2011; Gupta *et al.* 2010).

As previously mentioned adaptive capacity plays a large role in vulnerability, as it affects it by 'modulating exposure and sensitivity' (Yohe and Tol 2002; Adger *et al.* 2007); this means that adaptive capacity largely shapes levels of vulnerability. The

greater the adaptive capacity, the less sensitive and exposed an entity may be, thus less vulnerable to a hypothetical risk (Figure 5).

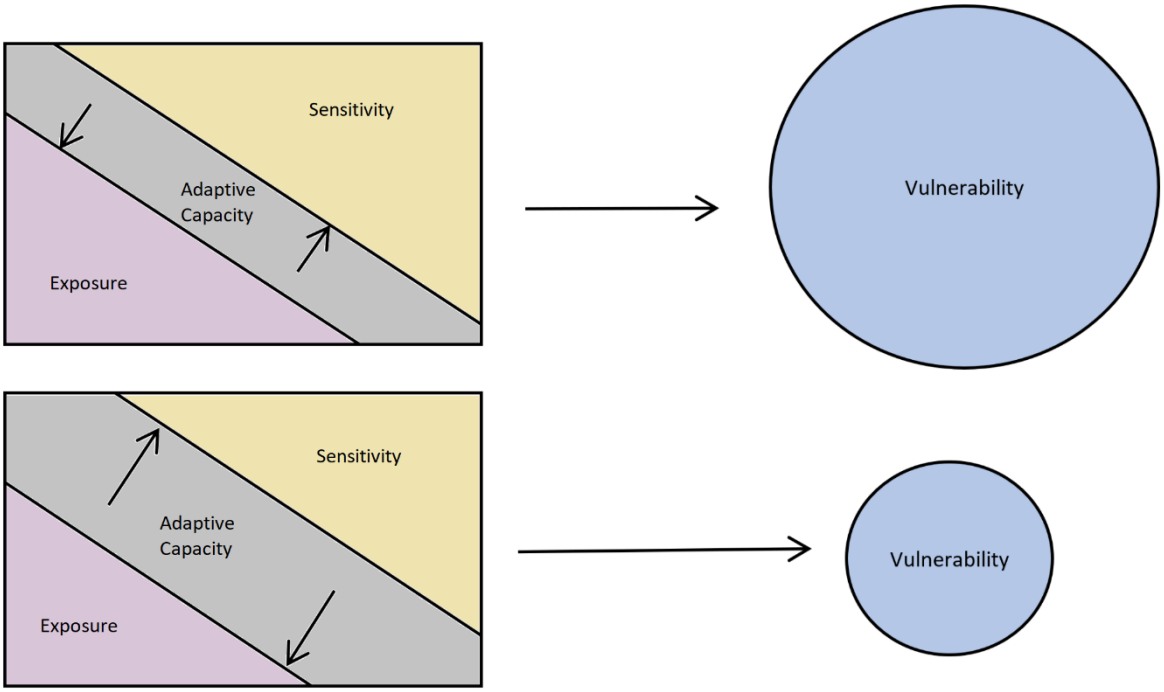

Figure 5 - The role adaptive capacity plays in regulating sensitivity and exposure, which has a profound effect on vulnerability (Adapted from: Engle 2011)**.**

Adaptive capacity in resilience is described as the 'capacity of actors in the system to manage and influence resilience', and is often labelled as adaptability (Walker *et al.* 2004). In simplistic terms this means that the more adaptive capacity in a system, particularly SES, then the system is likely to emit greater levels of resilience. Adaptive capacity will also enable, in the terms of resilience and SES, a 'transformation' to a new state when desirable (Folke 2006). Engle (2011) gives an example of adaptive capacity during a drought. If adaptive capacity of a SES is high, it will maintain better options of managing its water resources, to return to its original state following the shock (part of the adaptive cycle) (Holling 1973; Walker *et al.* 2004). Furthermore, if the drought is so severe that a tipping point is passed then the SES is more likely to be able to transform to another stable state, than one with low adaptive capacity (see Figure 6).

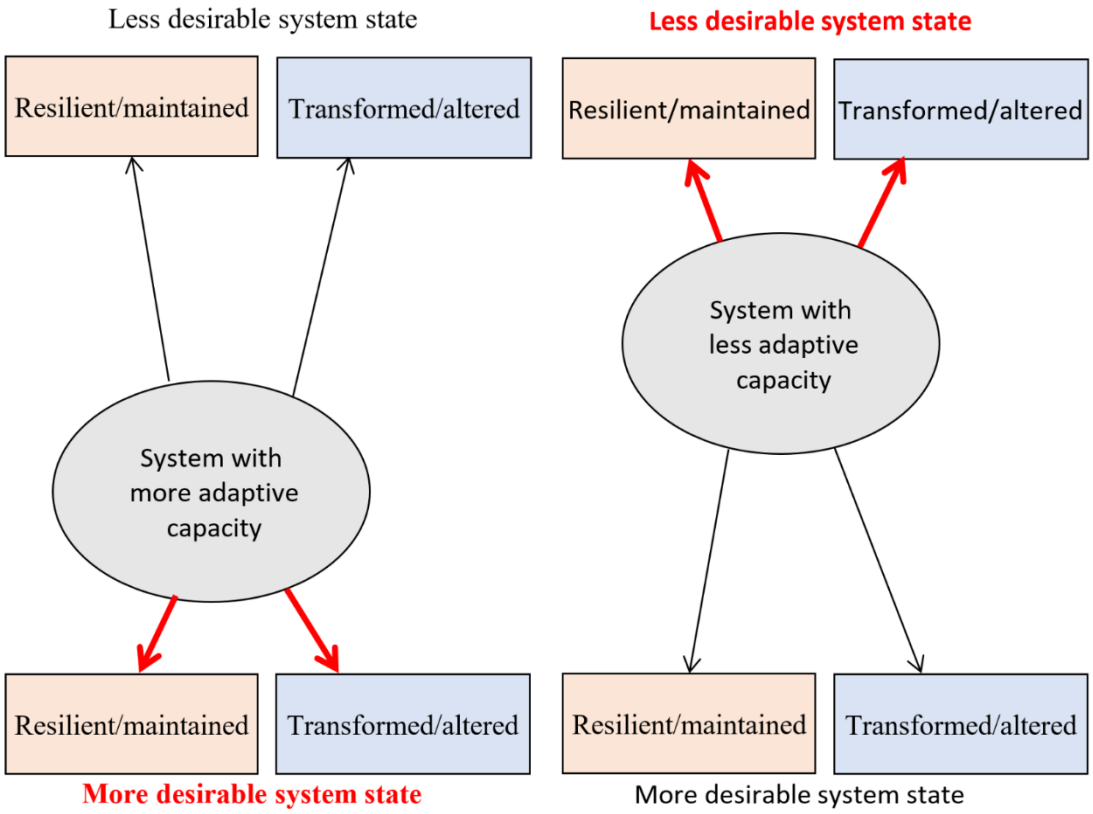

Figure 6 Adaptive Capacity's Role in Resilience - (Adapted from: Engle 2011)

A lack of adaptive capacity is seen typically in the poorest communities, meaning impacts of climate change is likely to have the greatest effect on the populations of developing countries. Human adaptive capacity relies on multiple factors, but two key factors have been identified in the literature; firstly, governance and institutions (Engle 2011); and secondly, ecosystems and more specifically the services they provide (Seddon *et al.* 2016). Although interpretations of adaptive capacity vary (Gallopín 2006), it is agreed that it is a desirable property when attempting to reduce vulnerability or build resilience. Thus, this is important when considering adaptation strategies, including EbA.

4. Adaptation Strategies

In the latest IPCC report adaptation strategies were defined as 'a general plan of action for addressing the impacts of climate change, including climate variability and extremes' with an overall aim to reduce vulnerability (Mimura *et al.* 2014). There is a broad spectrum of adaptation strategies that are individually visited in the literature but are too many to consider individually here. However, there are some relevant

publications that aim to categorise these strategies. Jones *et al.* (2012) for example characterised strategies as either; 'soft' e.g. political or social solutions or 'hard' e.g. physical approaches including infrastructure-based solutions. Following on from these a further two additional types were identified in the literature: strategies that use 'green options' such as conserving, restoring or managing ecosystems; and strategies that use 'hybrid options', described as mix nature and engineering including nature-based solutions, green infrastructure grey-green options (CBD 2018). It is clear from the literature that predominantly 'hard' strategies have been employed to combat climate change impacts, with engineered infrastructure solutions such as; sea-walls to combat sea-level rise and increase tide and wave power, have been implemented.

We must also acknowledge that climate change adaption faces huge amounts of uncertainty, due the fact that no matter how much we predict and model future change, we cannot be sure of what the longer-term future holds (Adger *et al.* 2007). This presents a huge problem when deciding on an adaptation strategy, for example one might need to consider that a certain strategy today, may not be the best strategy in 50 years' time. Hallegatte (2009) tried to consider this uncertainty by suggesting five types of strategy that would tackle:

1. *No-regret strategies* – that yield benefits even in the absence of climate change e.g. development of resistant crops or insurance, warning and evacuation scheme in coastal zones, improvements in public health systems, restrictive land use planning.
2. *Reversible strategies* – that are flexible and keep the cost of being wrong as low as possible compared to irreversible selections e.g. early warning systems, demand control and water use.
3. *Safety margin strategies* – that reduce vulnerability at null or low costs e.g. improved building standards, irrigation.
4. *Soft strategies* – non-technical solutions such as institutional or financial tools, they are also likely to be reversible e.g. institutionalisation of long-term prospective.
5. *Strategies that reduce decision-making time horizons* – as uncertainty increases the further we look ahead; this strategy aims to reduce the lifetime of investments e.g. building cheaper houses with a shorter life in an area that

could become a flood zone in the future (without certainty of when) e.g. easy-to-retrofit defences, forestry with a shorter rotation time.

As mentioned earlier there are countless other strategies, and these appear to be influenced by the origin of ones objectives or ideology such as development or conservation. Mawdsley *et al.* (2009) demonstrates this by clustering 16 CCA strategies related to wildlife management and biodiversity conservation, into four categories: i) 'land and water protection and management, ii) direct species management, iii) monitoring and planning, and iv) law and policy', with solutions under theses including 'land and water conservation, ecological restoration, agri-environment schemes, species translocation, captive propagation, monitoring, natural resource planning, and legislation/regulation'.

4.1 Community-based adaptation

"The world's poorest people will be worst hit by climate change because they live in vulnerable areas and have the least capacity to cope. Poor people are also disproportionately reliant on natural resources such as timber, fish, grazing and wild medicines for their subsistence, wellbeing and livelihoods"

(Reid 2016)

As discussed earlier vulnerability is a key feature of CCA and stem not just the sensitivity and exposure to climate change impacts but also as it is a factor of development. Community-based adaptation (CBA) draws on the theory that good adaptation is amounted from good development practice (Ayers *et al.* 2012). CBA is based on the premise of community participation and ownership of adaptation to impacts of climate change. It utilises awareness in communities of their needs, priorities, knowledge and capacities and should allow them to frame the problem not just the solution (Reid and Alam 2017; Ayers *et al.* 2012). It has been largely promoted as a tool by development practitioners in adaptation strategies, to empower local people and increase uptake of implemented activities. Reid *et al.* (2009) describes the need for CBA, as climate change-risk related interventions do not focus on the diverse and multiple issues in a community. These include issues such as income, health, conflict prices of food among others, that impact a community's development and adaptive capacity. CBA differs from traditional development strategies in the sense it considers climate change observation and knowledge (both scientific and traditional)

when considering impacts on livelihoods and vulnerability (Reid and Huq 2007). Furthermore, CBA has been identified as an effective way to deliver ownership of adaptation to communities that are most vulnerable to climate change impacts, such as those in poverty (Girot *et al.* 2011; Reid and Huq 2014). There has however been some criticisms over the capability to mainstream CBA due to a lack of vertical integration above the community level, which could jeopardise the success of the approach (Dodman and Mitlin 2013; Reid and Huq 2014).

5. The Ecosystem Approach

''A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way'.

(CBD 2009; CBD 2018; Lo 2016)

As EbA according to the CBD follows the principles of the ecosystem approach it is essential to fully understand what the term means, particularly as it predates EbA. The CBD adopted the ecosystem approach as their main working framework to achieve the three objectives of The Convention on Biological Diversity (1992 Rio Earth Summit): i) conservation, ii) sustainable use, and iii) the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources. The CDB describes its use to apply scientific methodologies, using the ecosystem as the functional unit (valid at any spatial scale), that strongly focusses on biotic and abiotic ecology (CBD 2009). It includes humans as a fundamental component of most ecosystems. Garcia *et al.* (2003) highlights five principles the approach should operationalise:

1. focus on the functional relationships and process within ecosystems.
2. enhance benefit sharing.
3. use adaptive management practices.
4. carry out management actions at the scale appropriate for the issue being addressed, with decentralisation to the lowest level as appropriate.
5. ensure intersectoral cooperation.

Furthermore, traditional knowledge is a vital component of the ecosystem approach as it can complement science based knowledge and observations on climate, weather, disaster and biodiversity (Lo 2016). The ecosystem approach includes many solutions

such as integrated watershed or coastal zone management, community-based natural resource management and forest landscape restoration (Reid 2016; UNDP 2015). We can recognise its use by its common formulation as 'ecosystem approach to… e.g. fisheries' (Garcia *et al.* 2003).

The ecosystem approach can been applied to adaptation due to the importance of ecosystem services which support humans in various aspects of adaptation such as storm surge protection (disaster risk reduction), fisheries and agro-forestry (food security), sustainable water management and increasing resource use options (livelihood diversification) (Munang *et al.* 2013). The CBD in 2016 (Lo 2016) claimed:

"healthy and functioning ecosystems help reduce climate change vulnerability and disaster risk by:

a) *Reducing physical exposure to hazards by serving as protective barriers or buffers and so mitigating hazard impacts, including wetlands, forests and coastal systems and;*
b) *Reducing socioeconomic vulnerability to hazard impacts… sustaining human livelihoods and providing essential goods such as food, fibre, medicines and construction materials, which strengthen people's resilience to disasters"*

6. Ecosystem-based Adaptation

"the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change that may include sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities"

(CBD 2009; CBD 2010)

The concepts discussed this far have set the scene in a sense for EbA, and one can see from the variances in what has been discussed this far that it is a multi- and interdisciplinary field, covering aspects such as adaptation, conservation and development. In this section the relevance of the previous text will become apparent in its need for comprehension when we discuss the various attributes of EbA; seen in the current EbA literature. EbA in general is an ecosystem-based approach to climate change adaptation, following the nomenclature by Garcia *et al.* (2003) that was highlighted in the previous section. This demonstrates how it is linked and formulated from the ecosystem approach to some extent. The key human linkage is the recognition of ecosystems (and humans as a major component of them) and the services they provide to us, known as ecosystem services, that support adaptation. These services help adaptation in various sectors of development including 'disaster

risk reduction, food security, sustainable water management and livelihood diversification (Munang *et al.* 2013). As such it has been suggested that EbA addresses the links between the fields of climate change, biodiversity and sustainable development by conserving and restoring ecosystems that aids mitigation and adaptation to climate change (Naumann *et al.* 2011).

6.1 Discourse history

EbA is a relatively new concept, but it strongly builds on and overlaps with many existing practices from areas such as biodiversity and ecosystem conservation, CCA and livelihood development (Lo 2016). One such practice includes community-based natural resource management (CBNRM) which became popular in the 1970s and 1980s as a conservation strategy (Reid 2016). CBNRM saw the creation of many national parks and natural resource plans that Roe *et al.* (2000) claims removed access to natural resources for locals who relied on these for the livelihoods. EbA also builds on interventions and approaches such as integrated water resource management, forest landscape restoration, community based-adaptation (CBA), climate change-integrated conservation strategies (CLICS) and other natural resource approaches, but with a CCA lens (UNDP 2015; IPCC 2012; Twigg *et al.* 2013; Lo 2016). EbA differs from the aforementioned approaches because it achieves all three outcomes (biodiversity and ecosystem conservation, CCA and livelihood development) according to the IPCC (2012).

Alongside CBA which is described as its sister by Reid (2016), EbA has become part of global discourse on adaptation due to its described potential to increase long-term social and ecological resilience in a cost-effective manner (Seddon *et al.* 2016). EbA and CBA did not originate from the same roots according to (Ayers *et al.* 2014), EbA appears to have originated from environment groups and CBA from the development groups. These groups hold different agendas on aspects such as funding sources and institutional backing. Reid (2016) states that:

''Good EbA should (but does not always) have a strong community/participatory focus. Good CBA should (but does not always) have a strong consideration of ecosystems and ecosystem services.''

Conservation organisations such as the International Union for Conservation of Nature (IUCN), The Nature Conservancy (TNC) and the World Wide Fund for Nature (WWF)

have largely pushed for the inclusion of EbA in adaptation strategies (de Block 2018). This appears to aim at bringing conservation and biodiversity goals into a climate change context; similar to the way it was brought into the sustainable development concept (Newsham et al. 2018); see literature on 'the new conservation debate'.

In 2004 the conference of parties to the CBD initiated the basis for EbA following decisions (XII/15, XII/20) to push for management of ecosystems to support CCA. Following this the term EbA appeared at the UNFCCC negotiations at the fourteenth session of the Conference of the Parties (COP) to the UNFCCC in 2008. It was brought into global discourse further under the 2010 UNFCCC Cancun Adaptation Framework, which demanded 'an approach that includes transparency, stakeholder participation, gender sensitivity, consideration of vulnerable groups, communities and ecosystems, use of indigenous knowledge and the best available science, and integration of adaptation into relevant social, economic and environmental policies and plans' (Lo 2016). Further, this framework requested member states to undertake processes that build resilience of socio-economic and ecological systems through economic diversification and sustainable management of natural resources (UNDP 2015). This international drive was continued by the COP to CBD's decision X/33, which invited parties to include ecosystem-based approaches into 'adaptation plans and strategies, national action plans to combat desertification, national biodiversity strategies and action plans, poverty reduction strategies, disaster risk reduction strategies and sustainable land management strategies.'

Munang *et al.* (2013) claims that Rio+20 was the first-time governments and businesses accepted that ecosystems are key to fight climate change at the same time as meeting sustainable development goals. This was said to stem from intrinsic relationship between sustainable development and to ecosystem maintenance. EbA is now supported and mentioned by all the three Rio conventions (CBD, UNFCCC, UNCCD) (Scarano 2017) and more recently the UN 2030 Agenda and the Paris Agreement on Climate Change have called for the use of ecosystem-based approaches and EbA. Although in a practical sense there still seems to be some distance between policy and implementation, due to a hesitation from decision-makers to undertake EbA alongside traditional adaptation strategies (CBD 2018; Doswald 2014).

6.2 Definition

Although the interpretation and the terminology surrounding EbA at times seems to vary in the literature, the actual definition used usually refers back to the CBD 2009 wording, and more often enough includes the elaboration that was made in 2010 in some form (Reid 2011; IPCC 2012; Munroe *et al.* 2012; UNDP 2015; Reid 2016; Scarano 2017;Seddon 2017; Newsham *et al.* 2018). There does however seem to be interchangeable use of the term ecosystem-based approach and EbA at times. This can be confusing, as it is generally seen that EbA is part of a broader set of ecosystem-based approaches that include ecosystem-based disaster risk reduction (eco-DRR) for example. Munang *et al.* (2013) uses the phrase ecosystem-based approaches to adaptation and EbA in their publication, without much explanation to the difference between the two. Use of the term ecosystem services-based adaptation has also been witnessed (Huq *et al.* 2017), which may be aimed at highlighting a core attribute of EbA; the use of ecosystem services, but again leaves potential for confusion. There is however in a practical sense an assumption that EbA utilises ecosystem services flow to reduce vulnerability, when actually as Vignola *et al.* (2009) points out, EbA should aim to ensure or promote ecosystem services. Scarano (2017) sees EbA as a policy mix that has can drive sustainability transitions (bridging the gap between socio-ecological and socio-technical research) as well as adapting to climate change and he further states there if often different interpretations of EbA in sense of whether biodiversity and ecosystem service (BES) are is the central aspect of EbA or not.

A major error in the literature that has already been highlighted by some authors (Scarano 2017; Munroe *et al.* 2012) and particularly by Doswald *et al.* (2014), whom offer a comprehensive review of the EbA literature, relates to the subject of the adaptation. It has been witnessed by this researcher and in the literature that some organisations commonly state that EbA is the adaptation by ecosystems, whereas it should be the adaptation to climate change by humans through the use of ecosystems. This confusion makes it difficult for EbA to be properly evidenced and thus accepted into policy and planning. Another important point to consider is that the there is considerable amount of EbA approaches that have used inconsistent terminology and thus makes it hard to identify valid ones (Doswald *et al.* 2014). The authors further state that there are EbA relevant projects which aim to reduce vulnerability to climatic

extremes and variability; and EbA projects that consider long-term aspects of climate change to reduce vulnerability. In all the literature covered though there is a clear agreement that EbA has an objective and meeting that objective requires a recognition of the importance of ecosystems to humans. This involves the integration of biodiversity and ecosystem services into an adaptation strategy to increase the resilience of society to the adverse impacts of climate change. This thus means the objective of EbA is a desirable state or outcome, and as Newsham *et al.* (2018) highlights, this theory suggests that the only way to study EbA empirically is to assess the interventions are used or could be used to achieve this objective. This is particularly pertinent as EbA focusses on generally what could be conceived as a long-term objective. The UNDP (2015) offer some criteria of what EbA is:

1. The intervention reduces the population's vulnerability to climate change.
2. The intervention directly or indirectly increases the resilience of biodiversity and ecosystem services
3. The intervention uses biodiversity and ecosystem services in a sustainable manner, without damaging them, and in some cases, enhances them.

6.3 A 'win-win' approach with 'no-regrets' solutions

EbA has often been described as win-win approach due to its supposed ability to meet adaptation, conservation/biodiversity and development outcomes (Mensah *et al.* 2011; UNDP 2015; CBD 2016; Raza *et al.* 2014; Chong 2014). Munang *et al.* (2013) went as far as calling it as a 'quadruple-win approach in terms of climate change adaptation and mitigation; socio-economic development; environmental protection and biodiversity conservation; and contributing to sustainable economic development'. As mentioned earlier 'the most attractive EbA options to many, are the ones that also offer development benefits' (Klein *et al.* 2007). This win-win idea has also been true to meeting SDG goals and Sendai Framework targets, as well as the individual sectors mentioned before such as sustainable development e.g. poverty reduction (Huq *et al.* 2017; Reid and Alam 2017). There has though been criticism from some corners of the classifying EbA as win-win. Newsham *et al.* (2018) refers back to integrated conservation and development projects (ICDPs), which predate the EbA concept, but also were said to meet conservation and development objectives. The authors say that

those practitioners who attempted to put in to practice ICDPs in the 1990s largely said they failed as one of objectives will always suffer when attempting to do both.

EbA has also been described as a 'no-regrets' strategy, similarly to the win-win framing due to its ability to hit multiple objectives, but additionally because it is said to offer benefits even if the predicted impacts don't materialise e.g. reducing ecosystem degradation (Munang *et al.* 2013; Colls *et al.* 2009). Similarly, eco-DRR has also gained this label; with both approaches said to provide 'multiple social, economic and environmental benefits from sustainable management of ecosystems' regardless of the exposure to climate or disaster impacts (Sudmeier-rieux 2016). The no-regrets basis also leads to claims that EbA avoids maladaptation (Munang *et al.* 2013).

The CBD though has moved away from using this term and instead prefers the term 'low regrets' citing 'that there is always a possibility of unforeseen or unintended consequences' (Lo 2016).

6.4 Benefits and co-benefits

Leading on from the concept of win-win and no regrets as overall descriptions of EbA approaches, we must understand how these terms have come about in the sense of what are the direct benefits of using EbA? One of the most well-known examples of an EbA measure is mangroves restoration, because it clearly demonstrates the multiple benefits attributed to EbA. A mangrove forest for example can offer protection to coastal communities from storm surges, offer food sources, purify water as well as other health (e.g. access to protein) and livelihood benefits (Mensah *et al.* 2011). As with the mangrove example socio-economic adaptation and improvements are greatly associated with EbA, such as 'increased food security by securing food production; improved livelihoods through delivery of ecosystem services and income diversification' (Naumann *et al.* 2011). As previously mentioned when discussing CBA, good EbA can supposedly deliver local level social benefits by strengthening capacities and empowering local level actors by affording them greater access and control over ecosystems and natural resources (Girot *et al.* 2011). The literature also acknowledges the co-benefits that EbA can contribute which support climate mitigation such as; carbon sequestration through conservation or restoration of forests, wetlands, coastal vegetation, and preventing deforestation and land degradation (Doswald *et al.* 2014; CBD 2018). Furthermore, Lo (2016) states these benefits can be achieved at local,

regional and national scales. Appendix A highlights some of the examples in the literature of EbA measures; the impacts they target; and the benefits they are expected to produce.

The aforementioned are the direct benefits of EbA approaches, but clearly, we must identify how this relates back to adaptive capacity, vulnerability and resilience as these are the key to CCA. Across the literature there was predominantly a consensus that ensuring environments are healthy and biodiverse, and providing high levels of functioning ecosystem services will maintain or even improve people's resilience to climate change and reducing vulnerability to its impacts (Reid 2011). It is the poorest communities that are most vulnerable to climate change impacts because these groups are most dependent on natural resources and ecosystem services for not only their livelihoods but also their well-being (UNDP 2015; Mensah *et al.* 2011). This can be related to livelihood diversification, for example if there are more or stronger ecosystems services in a community following EbA interventions which restored or conserved an ecosystem then it is likely that there will be more livelihood options (Colls *et al.* 2009). Vice versa if livelihood enhancement or diversification moves people away from unsustainable practices and ecosystem degradation then there will be an increase in social and environmental resilience, through a greater adaptive capacity. This has been shown in two sites in Bangladesh where an increase in natural resource availability and diversity, increased the amount of subsistence and livelihood options, which in turn increased resilience in the local communities (Reid and Alam 2017).

The implication of the above is that EbA approaches should undertake vulnerability assessments, which examine community perception, institutional integration, land practices and planning etc. to guide the selection of appropriate EbA measures (Lo 2016). There are various tools to do this, for example Newsham *et al.* (2018) followed a Pressure and Release model (PAR) that looked at 'five dimensions of vulnerability; livelihood strategies, wellbeing, individual capacity, collective capacity and governance'. They particularly aimed at ensuring their assessment was gender and age inclusive by talking to males, females, youths, elders separately, while also considering different wealth groups. This is vital in identifying which groups maybe the most vulnerable to climate change impacts (Seddon *et al.* 2016). Reid and Alam (2017) make an important statement regarding resilience and adaptive capacity relating to EbA. They state that 'ecosystem services is just one component' that contributes to

increasing resilience and adaptive capacity and that non-ecosystem related components such as political and institutional structures will prove vital to increasing these aspects.

6.5 Traditional knowledge use and gender responsiveness

Similar to CBA, EbA heavily involves local communities and requires the inclusion of traditional knowledge, this allows greater success to be achieved when implementing EbA measures (UNDP 2015). In most cultures there has been a long history and culture of managing variability and uncertainty, as such this knowledge should be utilised according to the CBD to complement scientific evidence and understanding (Lo 2016). The Cancun Adaptation Framework under the UNFCCC strongly encourages parties and governments to recognise the role of traditional and indigenous knowledge and include these in climate adaption planning and implementation processes (UNFCCC 2013). Chong (2014) highlights a good example of this in a small island developing state context (SIDS), where in Samoa the recognition of customary law ensures that local communities fully participate in the design and implementation of adaptation strategies by ensuring their views and knowledge is heard.

The MEA (2005) reported that the loss and degradation of ecosystem services was predominantly felt by the poor and within that group, women and children. It has been widely accepted that climate change impacts do not choose gender, but vulnerability to the impacts can in some cases be attributed or hold gender or age variances (Gell 2010). EbA aims to consider the inequalities and vulnerability of women and children in its' approach, this is particularly important as it is recognised that different genders use ecosystems and ecosystem services in varying ways (Lo 2016). An example of this is how women or even children when water is scarce may be forced to travel further to collect it, as this may be seen as their family-role. In children this can have impacts on schooling for example if time is lost or school is even skipped due to the need for water (Nellemann and Corcoran 2010). Also what is important to recognise if we keep the water example, maybe excluded from decision making process that could improve or alleviate the situation, thus EbA aims to ensure women and other vulnerable groups are engaged in the planning and selection of EbA options (UNDP 2015; Reid 2016).

6.6 Effectiveness and cost-effectiveness

Reid and Alam (2017) described two principles of effective EbA: i) ecosystem resilience and ii) the maintenance of ecosystem services; these themselves have certain requirements (see Figure 7)

PRINCIPLES	REQUIREMENTS	DETAILS
Maintenance of ecosystem services	• Valuation of ecosystem services • Determine climate change impact scenarios • Identify options for managing ecosystems or managing use • Involve user communities in adaptation action • Trade-off analysis	Maintaining ecosystem services is key, and conservation practitioners must improve their understanding of how to design and implement actions to do this, and their ability to effectively measure benefits provided.
Promotion of resilient ecosystems	• Modelling of projected climate change • Revise systematic planning • Revise protected area systems design • Involve local communities in restoration and management • Adjust management programmes and actions	EbA approaches cover a broad spectrum of land management, policy and project activities. Promoting ecosystem resilience for the benefit of communities is the first and most obvious set of actions.

Figure 7 – The 2 principles of EbA (Reid and Alam 2017).

In their comprehensive review of EbA-relevant interventions Doswald *et al.* (2014) came up with three appropriate categories to measure EbA effectiveness: (1) biophysical/environmental; (2) social; and the (3) economic effectiveness, when they applied it to the case studies they were investigating they found positive results, saying that EbA reduced vulnerability in each of the three categories and also provided benefits in these areas. However, in other literature it was found authors make what seems like hypothetical claims of effectiveness, particularly as with many of the EbA projects it will take some time for the benefits to be clear (Munang *et al.* 2013; Munroe *et al.* 2012; Huq *et al.* 2017). This may well be down to the fact there is little agreement on how to best measure effectiveness at different levels; local, regional, national (Seddon *et al.* 2016).

This also appears to a problem when measuring cost-effectiveness, which is often the case when trying to place a monetary value on ecosystem services that do not produce physical commodities. Some estimates on general ecosystem protection has been done by The Economics of Ecosystems and Biodiversity initiative (TEEB 2010), who have claimed that if US$45 billion per annum was afforded to protecting ecosystems then it could amount to US$5 trillion per year in benefits. Another study suggests that

the total global value of ecosystem services in the sense of what they provide to 'sustainable human well-being' was US$125-145 trillion per year, as of 2011 (Costanza *et al.* 2014). A well cited valuation in EbA literature is the UNEP (Nellemann and Corcoran 2010) claim that well restored ecosystems can provide a 'benefit-cost-ratios of 3-75' in investment return, they even say this could prove attractive as an public investment. These valuations are important for recognising cost-effectiveness of EbA, but there remains many difficulties in placing a monetary value on ecosystem services, particularly ones that offer emotional or cultural benefits (Ojea *et al.* 2012; Rao *et al.* 2013).

Most of the cost-effective evidence is collected from other studies that may not be directly looking at EbA, predominantly from the conservation field, where there have been some valuations placed on biodiversity. An example of this includes cited study by (Emerton *et al.* 2009) that estimated conserving reefs through marine protected area (MPA) establishment, would cost US$34 million to start, US$47 million per year to maintain, but would bring US$10 billion worth of in co-benefits per year. A good overview of EbA and EbA relevant valuations can be review in the compilation of case studies made by Emerton (2017). Although similarly to effectiveness of EbA, there has been overarching statements made about EbA being cost-effective, particularly in comparison to hard infrastructure or engineering works without direct site-specific studies (CBD 2009; Munang *et al.* 2013; Ojea 2015; Reid and Alam 2017; Reid 2016). It is clear though there is a lack of studies that present evidence of the true economic benefit of the EbA approach, in quantitative terms (Lo 2016; H Reid 2011; Rizvi 2015). Again similarly to measuring effectiveness there is a problem with there being a consistent way of measuring cost-effectiveness. Emerton (2017) sums this up with the statement ''there is no such thing as the best EbA valuation method."

6.6.1 Lami Town, Fiji Case Study

One of the few studies done that compares engineered and EbA measures for CCA from an economic viewpoint, was done by Rao *et al.* (2013) in Lami Town, Fiji. They identified EbA measures (following a vulnerability assessment that identified coastal vulnerability as a high priority due to sea-level rise, run-off flooding and pollution) such as replanting mangroves; replanting stream buffers; reducing upland logging; reducing coral extraction and monitoring and enforcement. While engineering options included protecting river banks with gabions or reno mattresses; building sea-walls and

increasing drainage. They found out of all these options that reducing coral extraction for Lami Town was the most effective in the sense of damage avoided per dollar spent at 1$ spent equalling $749 saved in avoided costs (assuming a 25% damage avoidance). In fact, all of the EbA options apart from mangrove planting offered greater savings per dollar spend in damage avoided compared to the engineered options at 50%, 25% and 10% damage avoided assumptions. Furthermore, the authors stated that the benefits of taking action in using any option outweighed the cost of doing nothing (overall damages were estimated to cost FJ$463 million over a 20-year timeframe). Additional to the damages avoided, the study also considered the monetary value of some of the ecosystem services that the local ecosystems around Lami Town provided; they noted that this is challenging, and thus did not an extensive calculation of all services provided; stating the figures were on the conservative side (Figure 8).

Ecosystem	Type of value	Value (FJD)	Unit/year		Benefits (FJD year^{-1})
			Hectare	Household	
Mangroves	Direct	$41	-	200	$8,200
	Indirect	$471	320	-	$150,720
			Ecosystem benefits of mangroves		$158,920
Coral reefs	Direct	$521	-	10	$5,210
	Indirect	$471	1,387	-	$653,277
			Ecosystem benefits of coral reefs		$658,487
Mudflats/seagrasses	Direct	$123	-	200	$24,600
	Indirect	$139	330	-	$45,870
			Ecosystem benefits of mudflats/seagrasses		$70,470
Upland forests	Indirect	$7	1,151	-	$8,057
			Ecosystem benefits of upland forests		$8,057
Streams	Direct	$60	32.5		$1,950
			Ecosystem benefits of streams		$1,950
			Total ecosystem benefits for Lami Town		$897,884

Figure 8 Ecosystem Service Valuation in Lami Town, Fiji (Rao et al. 2013).

In order to make recommendations to Lami Town Council Rao *et al.* (2013) formulated four scenarios of what could be implemented for a comparison basis; (1) 100% EbA options; (2) Predominantly EbA options with 25% of measures implemented being engineered works; (3) Predominantly engineered measures implemented, with between 20-25% use of EbA options; and (4) 100% Engineered options. They afforded their comparative results as a benefit-to-cost ratio that considered; avoided damages in terms of health costs and potential damage to businesses and households;

ecosystem services maintained or enhanced value, while they used a temporal scale of 20 years and a discount rate of 3%. They found that EbA options at 10-25% assumed damage avoided amount, was the most cost-effective with a ratio of $19.50 for every $1 spent. Respective ratios were; Scenario (2) - $15 (25% assumed damage avoided); (3) - $8 (25% assumed damage avoided); (4) $9 (25-50% damage avoided). It should be noted that the damage avoidance related to what they predicted as being most likely from a storm surge, with hard structures generally avoiding more damage than EbA options. Another important aspect to note is that this study is probably the most widely cited in the EbA literature, as demonstrating the effectiveness and cost-effectiveness of EbA. We should however be weary of make generalisations from this study; as the authors make it clear there was huge assumptions and data gaps in their work, while the data itself will be specific to the Lami Town or at least the Fiji context (e.g. climate change predictions used). An important point to add to this case study though is that engineered solutions generally offer benefits immediately while EbA benefits may take some time to be felt (Seddon *et al.* 2016).

6.7 Trade-offs

When highlighting the benefits of EbA the CBD (2009) also disclosed that EbA may be able to increase the supply of certain ecosystem services at the expense of others. They gave the example of wetlands for coastal protection that may lead to increased siltation and thus a loss of biodiversity or even recreation services. Citing this example they state analysis of these trade-offs should be done prior to implementation of any EbA measures. Newsham *et al.* (2018) claims that EbA should be measured on the basis of these trade-offs, due to the lack of consensus over effectiveness measuring. Their focus on two sites in Mexico where agriculture was the main livelihood strategy, found that there was a trade-off between an EbA strategy that increased reforestation and the loss of traditional farming activities due to the loss of land e.g. locals abandoned cattle farming. The authors concluded that there were key issues that if an organisation begins with the aim of implementing EbA it may not see other non-EbA measures that could be more suitable and beneficial to the people and the adaptation required.

Other cases of trade-offs have been identified in the literature including in a study of two sites in Bangladesh; where integrated water resource management (IWRM) for

irrigation has improved income and economic development but increased the risk from flooding and drought (Rouillard *et al.* 2014). Reid and Alam (2017) identified that trade-offs may occur 'temporally, spatially and between social groups or stakeholders'. Spatial trade-offs occur when one location/community benefits from an EbA location at the expense of another. This can occur in watersheds where upstream actions impact those downstream, furthermore there may also be trade-offs when ecosystem and administrative boundaries do not align (Reid and Huq 2014). The full extent of trade-offs appears to not yet be fully understood, with the trade-offs between different wealth groups seemingly not covered in the case studies looked at by Doswald *et al.* (2014). Due to the lack of monitoring and evaluation of EbA projects a difficulty arises in identifying trade-offs, particularly as there is generally a lack of scientific evidence quoted in the literature e.g. biophysical data collected before, during and after EbA implementation.

6.8 Vulnerability of Pacific Small-Island Developing States (SIDS)

Geographical location and socio-economic stressors are a key reason for the vulnerability of SIDS such as lack of natural resources, social fragmentation, reliance on imports and inability to access global markets (Petzold and Ratter 2015). Interestingly, Campbell (2009) argues that SIDS are 'inherently not vulnerable places'. He highlights that historically SIDS were highly resilient due to their vulnerabilities such as limited resources and climatic variables. This he said was down to the development of centuries old adaptation strategies, which comes with dealing with such vulnerabilities for so long. Furthermore, SIDS traditional structures have allowed them to develop strong 'networks of support and reciprocity'; a shared sense of identity and inter- and intra-island cooperation that most developed countries are not able to replicate, even with huge investment (Campbell 2009; Turner *et al.* 1996; Kelman 2018). This has led to the claim that SIDS hold high levels of social capital and the concept of islandness (Petzold and Ratter 2015; Kelman 2018).

This islandness theory in particular goes against the general narrative that the populations of SIDS will inevitably become climate refugees. Instead it suggests that many of the people living on SIDS can and will use their unique social capital and islandness to set their own adaptation pathway and won't settle for the thought of migration. As identified the cause of SIDS's vulnerabilities are particularly cross-cutting

from socioeconomic and socioecological perspectives, specifically their reliance on ecosystem services. It seems sensible then to use the EbA approach in the context of SIDS. In fact Jones *et al.* (2012) states that for many SIDs EbA interventions may represent the only feasible option for adapting to climate change.

7. Conceptual and Methodological Framework

‘*’Even carefully collected results can be misleading if the underlying context of assumptions is wrong”*

Bernd Heinrich 1984 (Cited by Maxwell 2012)

A conceptual framework creates a ‘tentative theory’ (Maxwell 2012) of the phenomena and contains multiple assumptions that ‘play a epistemological and ontological role’ that inform us of ‘the way things are’ and ‘how things really work’; leading us to construct what it can tell us about the ‘real world’ (Guba and Lincoln 1994).The conceptual framework used in this research holds multiple components and concepts and is defined by them (Deleuze and Guattari 1994). To some extent this is derived from the manner in which EbA is cross-cutting and interdisciplinary, which enables a comprehensive understanding of the phenomenon (Jabareen 2009). Figure 9 illustrates the overall conceptual framework of this research, showing how the concept of EbA will addressed through the lens of the ALivE framework and criteria derived from this when assessing the PEBACC project.

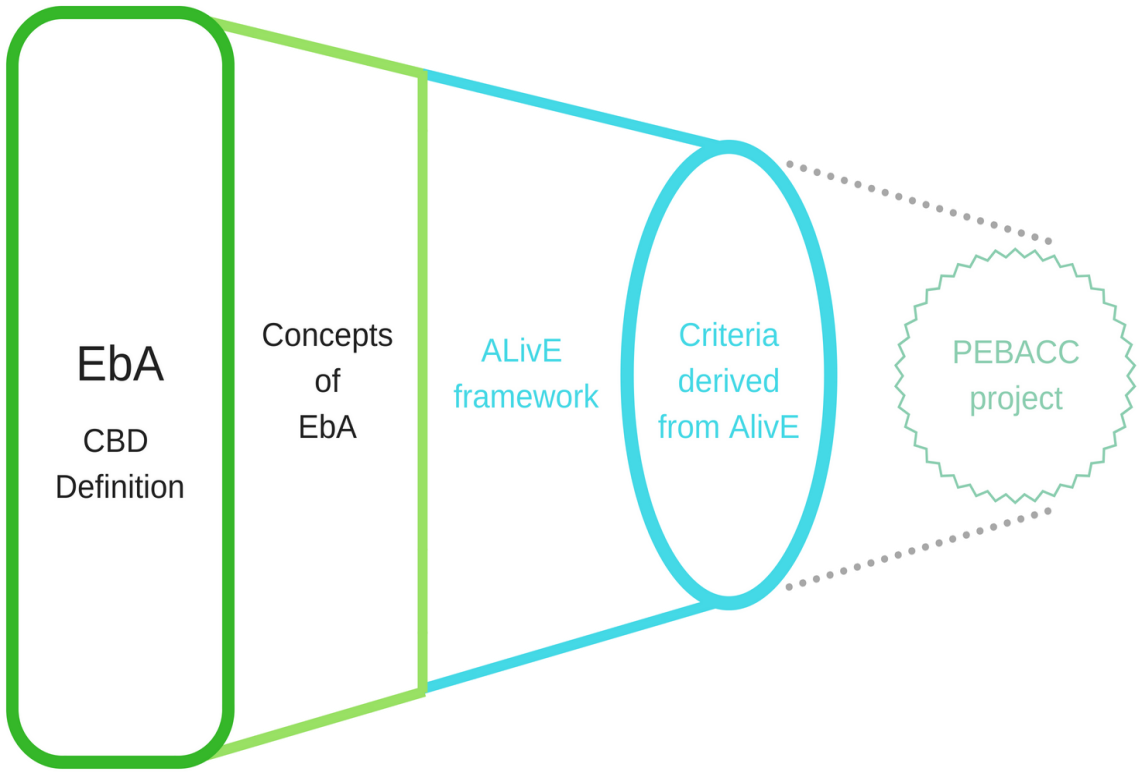

Figure 9 Overall Conceptual Framework

7.0.1 Delimitation and classification

The synthesised literature review has explored the key themes and concepts of EbA and thus demonstrates the boundaries of the term and limits to how these concepts can be applied when using the framework for data collection and analysis. As has been demonstrated in the literature over the past decade the CBD (2009 and to some extent the 2010 elaboration; quoted below) definition of EbA is the one widely accepted both in practice and in academia, globally and nationally.

"the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change that may include sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities"

As such this definition sets the boundaries of this research in terms of trying to establish key evidence and facts that demonstrate how in practice an EbA project applies the conceptual meaning of EbA.

Clearly, such a term that touches upon conservation, adaptation and sustainable development aspects holds multiple concepts. These concepts must be deconstructed to identify their main 'attributes, characteristics, assumptions and role' (Strauss and Corbin 1998; Jabareen 2009). The Adaption, Livelihoods and Ecosystems (ALivE) Planning Tool (Terton and Daze 2018) and more specifically the framework from which it is derived, breaks down these concepts in a manner that allows this research to create categories and criteria that work within and under the boundaries of the CBD definition and conceptual meaning of EbA. This research will utilise these categories and criteria to identify data and identify how the PEBACC applies and translates these EbA concepts, to understand how the approach is applied in a practical sense.

7.0.2 The EbA planning process and ALivE framework

The AlivE framework (Figure 10) is directly derived from the official CBD 2009 definition and 2010 elaboration of what the term EbA means. The ALivE planning tool has been developed by IISD and other partners as a tool that allows 'rapid qualitative assessment' and analysis of linkages between ecosystems, livelihoods and climate change. It draws heavily from the Community-based Risk Screening Tool – Adaptation Livelihoods (CRiSTAL) , which has seen considerable application and support. ALivE

will be available as a computer-based tool that aims to guide the user in identifying and prioritising EbA options that can be then implemented, monitored and evaluated. Furthermore, the tool offers guidance on the information required to undertake the assessment and identify entry points for integrating EbA into national and subnational policies and plans (Terton and Daze 2018).

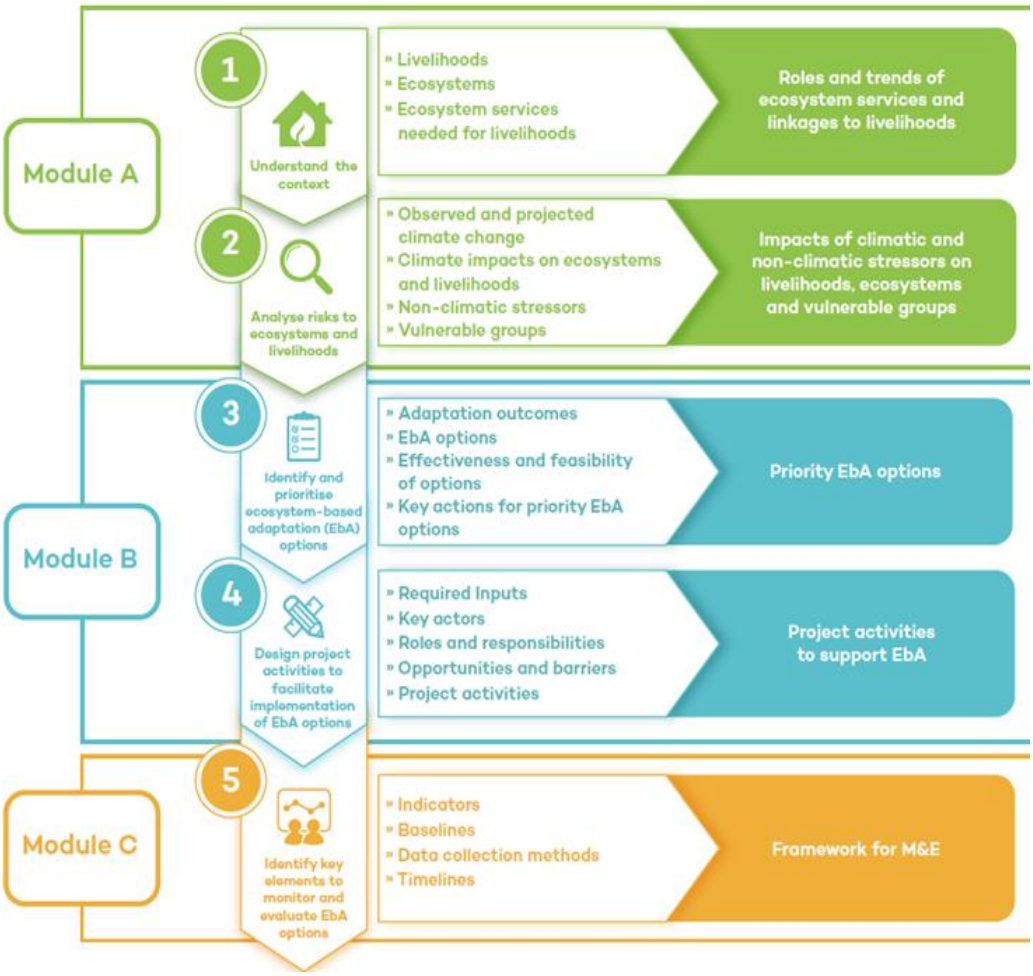

Figure 10.ALivE Framework (Terton and Daze 2018)

The tool itself is should be applied as part of a broader EbA planning process, which can be summarised into three main parts:

Phase 1 – Data Gathering: project and location specific information to undertake analysis.

Phase 2 – Analysis of the information collected in the first phase to identify suitable EbA options. The ALivE tool is applied at this stage.

Phase 3 – Identify entry points into national and subnational policies and plans.

Although the computer-based tool itself was not used for this research, the researcher did however exploit the framework on which the ALivE tool is based. The ALivE framework affords a suitable systematic linkage and breakdown between the key concepts (described in the literature review and summarised in Appendix B) and what characteristics EbA should display to achieve EbA labelled outcomes. The ALivE framework also considers the guidelines from major organisations and many of the principles that have been suggested in the EbA literature (CBD[2]; IIED, IUCN, UNEP, UNEP-WCMC[3]).

ALivE also includes to a large extent the three elements and five sub-criteria that FEBA (2017) identify as what makes an EbA approach:

Element A: EbA helps people adapt to climate change

C1. Reduces social and environmental vulnerabilities.

C2. Generates societal benefits in the context of climate change adaptation.

Element B – EbA makes active use of biodiversity and ecosystem services

C3. Restores, maintains or improves ecosystem health.

Element C – EbA is part of an overall adaptation strategy

C4. Is supported by policies at multiple levels.

C5. Supports equitable governance and enhances capacities

ALivE has further described that interventions should aim to support climate change adaptation and sustainable livelihoods, while ensuring ecosystem health and resilience to climate change. Furthermore, AlivE breaks this down into six attributes illustrated in Figure 11. As such ALivE comes to recognise that EbA measures can be categorised by three types of activities:

1) the restoration;
2) conservation and/or
3) the sustainable management of ecosystems.

[2] *Guidelines for Ecosystem-based Approaches to Climate Change Adaptation and Disaster Risk Reduction (CBD 2018).*

[3] *'Framework for Assessing EbA Effectiveness' (Seddon et al. 2016) under the 'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy" led by IUCN, the International Institute for Environment and Development (IIED), and UN Environment World Conservation Monitoring Centre (UNEP-WCMC). This project is part of the International Climate Initiative (IKI). The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) supports this initiative on the basis of a decision adopted by the German Bundestag.* https://www.iucn.org/theme/ecosystem-management/our-work/ecosystem-based-adaptation-and-climate-change/eba-strengthening-evidence-and-informing-policy

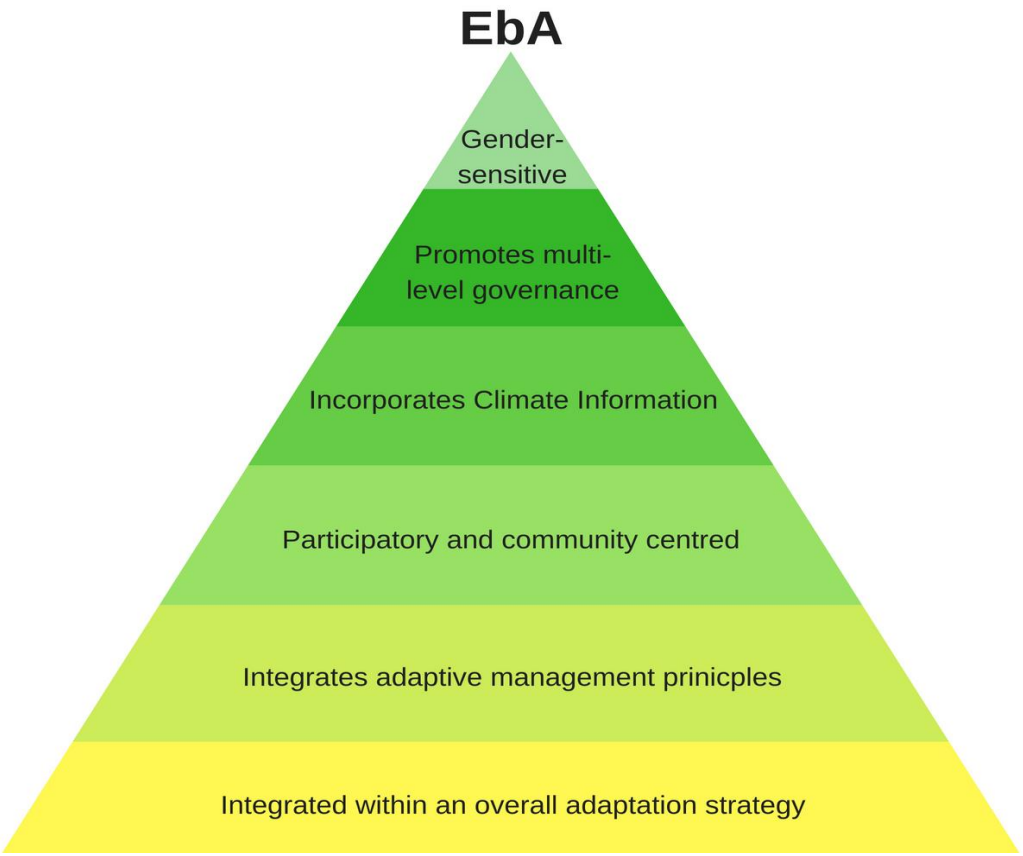

Figure 11 Attributes of effective EbA approaches

ALivE postures that EbA should differ from other approaches in the sense it should:

1) Be human-centric combining socio-economic and conservation goals.
2) Directly address current and future climate risks using local and scientific knowledge.
3) Places a central emphasis on the role of ecosystems in supporting adaptation (versus CBA which considers ecosystems) and the need to maintain ecosystem health for community adaptation.
4) Focusses on providing resilient and sustainable livelihood strategies, now and in the future, for the most vulnerable through community development and local governance processes.
5) Strives to promote the role of all stakeholders in the longevity of interventions.
6) Is not implemented in isolation but as part of sustainable development and natural resource management.

Overall, the ALivE framework affords a valid synthesis of the key intertwined concepts that underline EbA as interpreted from the CBD and relevant primary and grey

literature. The framework is well suited to bringing these concepts together throughout the whole planning process for EbA to aid better understanding of the research problem by answering the subsequent research questions. It represents the dynamic and multidisciplinary theoretical foundations of EbA that would be 'applicable to scholars and practitioners' aiming to understand EbA 'from varying disciplines' (Jabareen 2009).

7.1 Methods

''In our contemporary times, most social phenomena are complex and linked to multiple bodies of knowledge that belong to different disciplines. For this reason, better understanding of such phenomena requires a multidisciplinary approach.''

(Jabareen 2009)

The research design was purposely developed to ensure the appropriate methods were utilised to answer the stipulated research questions in the context of Fiji and more specifically the ongoing PEBACC project. Initially the literature review afforded a greater understanding of EbA. The research then followed an inductive case-based approach to evaluate and interpret how the PEBACC project is currently being implemented and how this relates to what is recognised to be an EbA approach under the conceptual framework.

Predominantly qualitative research methods were used as this was the most appropriate to gain empirical data in this complex setting (Jabareen 2009), which allowed exploration of the aims and objectives (research questions) of this research. Furthermore, these methods were most advantageous to collect and analyse data under the criteria established by the conceptual framework (ALivE). Triangulation was used with the aim of reducing the limitations of each method individually, by cross-checking primary and secondary data to gain a balanced view (Cohen *et al.* 2003). More specifically methodological triangulation (Denzin 2006) was employed by using multiple methods such as desk study data gathering, semi-structured interviews, talanoa, field notes and observations.

The methods used were deemed the most appropriate for gaining the perspectives of actors relevant to both the PEBACC project. As EbA is widely accepted to be strongly a community led process, it was extremely valuable to validate project related data, with primary data gained in local communities, understanding their inclusion,

experiences and views (Seidman 2013). It was decided that qualitative data was best to address our understanding of how EbA may offer unrecognised value in the community including social and cultural aspects, which have been highlighted to be important factors in the EbA approach. The research design will allow for the effective understanding of the linkages between community livelihood protection, socio-ecological resilience and climate adaptation governance. The sequential steps are shown in Figure 12 were.

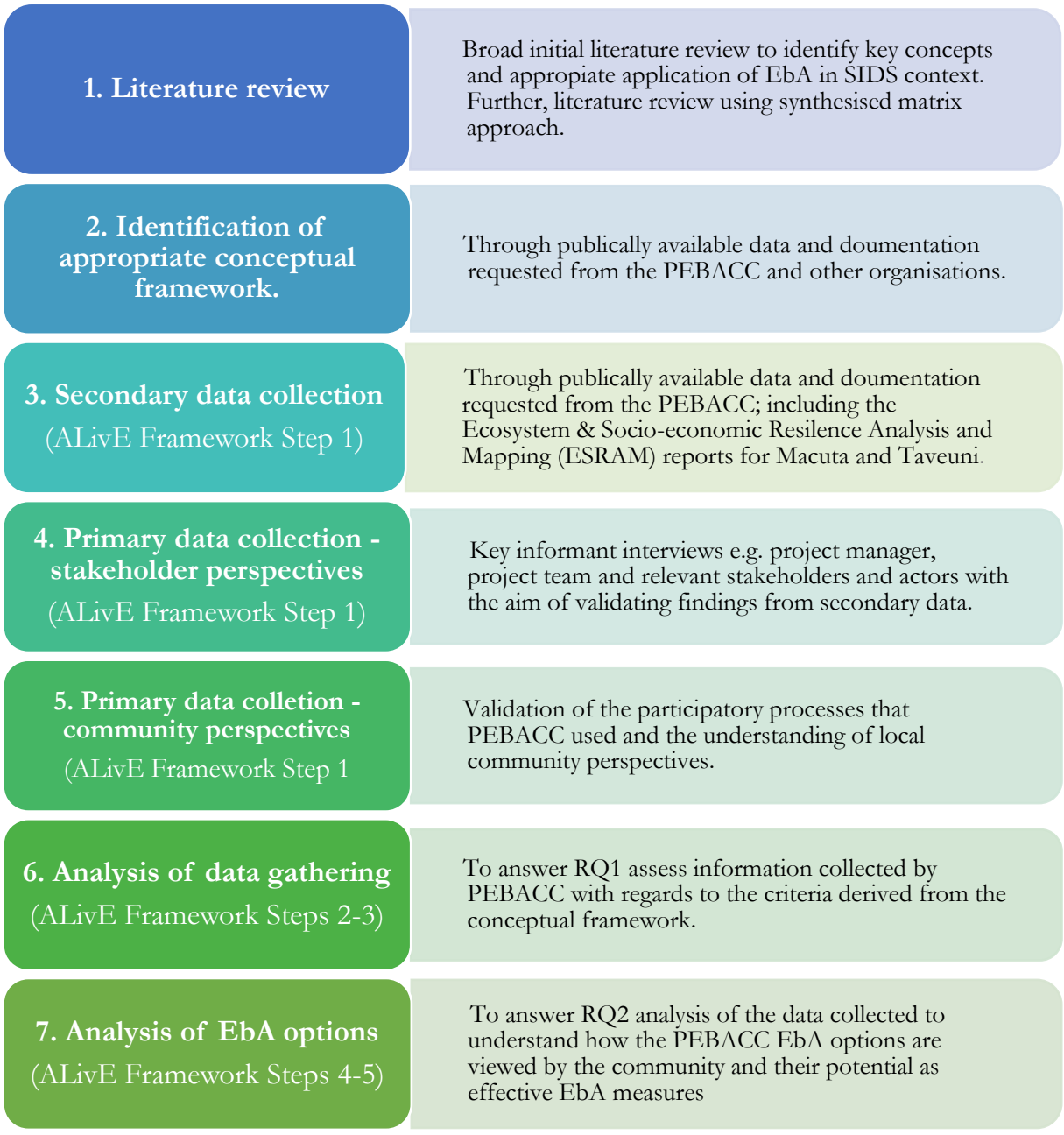

Figure 12 Research Design

7.1.1 Site locations and stakeholder selection

Table 1 Field site Characteristics

Site	Scale	Area	Number of Tikinas (Districts)	Population	Protected Areas	Land Tenure
Macuata Province (Island of Vanua Levu)	Provincial	2,000 km^2	11	65,983	15 FLMMA (some of which MPA and Tabu) Qoliqoli Cokovata RAMSAR	54% iTaukei 33% freehold 13% State land
Taveuni (Caukadrove Province)	Island	435 km^2	3	19,000 47% Female 53% Male	Taveuni Forest Reserve (11,000 ha) Ravilevu Nature Reserve (4,000 ha) Bouma National Heritage Park (3,800 ha)	91% iTaukei 7%: freehold 2% State land

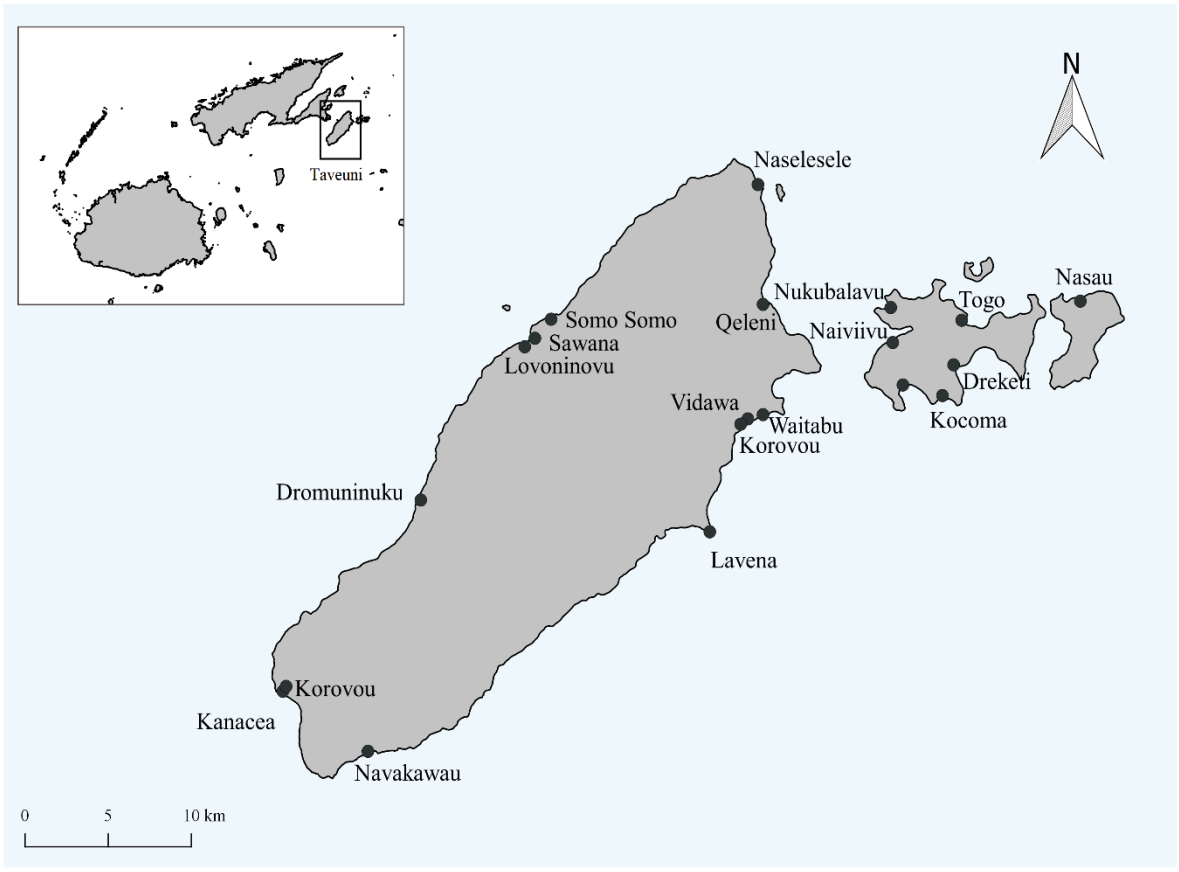

Figure 13 Map of Taveuni including main iTaukei villages – workshops were held in Naselesele and Lavena, visits were also made to Korovou, Waitabu, Vidawa, Somo Somo, Lovoninovu, Welagi, Matei and a settlement near Dromuninuku.

7.1.2 Data Collection

Initially secondary data was collated to investigate, gather and establish what information PEBACC collected and what tools they used to during this information gathering phase for both Macuata Province and Taveuni. This was done in accordance with required information to support analysis to answer RQ1. Primary data was sourced from a wide range of project stakeholders, to validate secondary data and to fill in knowledge gaps. It also offered a broad overview of stakeholder perspectives on the PEBACC project and EbA in Fiji. It also ensured a balanced and disaggregated range of perspectives was gained from outside of the viewpoints of PEBACC. As much secondary data was sourced such as workshop attendance sheets, consultant field reports etc. that supplement the information in the main PEBACC documents (ESRAM Reports; EbA Options Report; EbA implementation Plan). Other secondary data was collected from various sources but including grey literature from NGOs and national, regional and local government; ranging from national and provincial policies and strategies to project reports. Table 2 highlights the primary methods deployed during this study and the number and detail of participants in the research.

Table 2 Main research methods used and number of participants

Methods	Macuata	Taveuni
ESRAM Report	Assessed	Assessed
EbA Options Report	Assessed	Assessed
EbA Implementation Plan	Assessed	Assessed
Stakeholder interviews (Spradley 2003)	**8** Incl. SPREP staff; NGOs; Consultants; local government, sectoral government national government academia.	**15** Incl. SPREP staff; NGOs; consultants; local government; sectoral government
Community interviews/ talanoa (Nabobo-Baba 2008)	N/A	**33** Incl. 8 female/ 24 Male 3 Districts/13 Villages 6 Elders/19 Adults/8 Youths 6 Traditional Leaders
Ethnographic research (Gusterson 2008)	N/A	Participant observations & Participation in 2x3-day workshops
Informal discussions and site visits	N/A	Incl. Mataqali smallholdings and Qoliqoli areas

Snowball sampling (Biernacki and Waldorf 1981) was used to expand the pool of identified and relevant stakeholder groups and individuals, following semi-structured interviews with project managers and secondary data analysis (Seidman 2013). Interviews with members of the local communities were undertaken in local iTaukei villages primarily around two 3-day workshops, in which the researcher also participated (Gusterson 2008). The interviews generally followed a traditional talanoa[4] structure, this gained mutual trust and respect. Often the discussion would be led by the researcher's questions followed by short story-telling by the participant. Predominantly this was on a more informal basis, as the researcher was welcomed into the villages under the PEBACC's previous acceptance. However, it was communicated to all participants that researcher was independent of SPREP and the PEBACC project. Furthermore, an informed consent process was followed in all interviews and discussions; ensuring participants understood the purpose and impacts of their involvement (Gusterson 2008). As part of this process consent was given by all participants including stakeholders, on the basis of anonymity. As such the research does not reveal the identities of those interviewed. Information that may lead to identification through association is also withheld to the best of the researcher's ability. Interviews with local community members were not audio recorded but instead recorded by note-taking as permission warranted. Most interviews with stakeholders were audio recorded and transcribed on a verbatim basis for later analysis.

7.1.3 Analysis

"Any researcher who wishes to become proficient at doing qualitative analysis must learn to code well and easily. The excellence of the research rests in a large part on the excellence of the coding."

(Strauss 1987)

Primarily the Nvivo software was used for analysis of both primary and secondary data predominantly using 'Grounded Theory' (Miles and Huberman 1994; Strauss and Corbin 1998; Corbin and Strauss 2008). To support RQ1 analysis of the PEBACC documentation listed in Table 2, a criterion was deduced from the conceptual framework and can be viewed in Appendix C. The relevant documents were coded

[4] *"Talanoa: sharing knowledge. In indigenous research among iTaukei people, talanoa rather than interviews are used to request the knowledge the researcher is seeking. Talanoa in the Fijian cultural context refers to the process where two or more people talk together or when one person is the storyteller" (Nabobo-Baba 2008).*

against these criteria to build up an overview of what information was used, how it was collected and its content; from a partly empirical basis (Ryan and Bernard 2003). This also allowed information regarding the project activities to be deduced and related back to the concepts of EbA, in essence a form of theoretical sensitivity (Strauss and Corbin 1998). In summary for RQ1 the early specific codes were matched to the prescriptive criteria.

Opening coding of interviews was used to validate the findings from the secondary data analysis, this afforded theme generation that then could be assessed against the initial criteria, but also allowed the identification of key issues, categories and concepts (Corbin and Strauss 2008). Primarily descriptive coding was used as this was determined the best way of documenting and categorising the various opinions of the participants (Saldaña 2015). Open coding utilised many of the techniques suggested by Ryan and Bernard (2003) such as looking for themes by:

1) Repetitions;

2) Indigenous Typologies or Categories;

3) Metaphors and Analogies;

4) Transitions;

5) Similarities and Differences;

6) Missing Data.

Clearly during interviews in the local community indigenous categories was particularly relevant to this type of analysis. Multiple cycles of coding was undertaken to collate and refine the categories, themes and concepts and undertake axial coding and followed a codes-to-theory model (Corbin and Strauss 2008; Saldaña 2015). These theories were then addressed to the alongside the conceptual framework to establish relevance to RQ1 and RQ2. Regarding RQ2 the themes and codes represented an expression of the questions asked, but was also to bring how the communities and stakeholders felt the concepts of EbA were practiced while also addressing their underlying relations to climate change.

Finally, considering all the data collected and analysed the EbA options that were selected for both Macuata Province and Taveuni were subjected to a multi-criteria analysis (MCA) using five EbA effectiveness criteria taken from ALivE.

1. Makes sustainable use of biodiversity and ecosystem services to build resilience	2. Potential to improve peoples' adaptive capacity to climate change	3. Potential to generate benefits for vulnerable social groups and enhance gender equality	4 Potential to reduce risks associated with current and future climate hazards and changes	5. Build resilience of ecosystems to current and future climate hazards and changes

These criteria allowed for an assessment of the potential of the EbA options, based on the planning and design phases (i.e. RQ1 related information), to achieve outcomes expected from EbA measures. The MCA allowed for further exploration of the PEBACC project and EbA options apply the concepts of EbA and views of participants to be related back to it. The MCA uses a score basis to judge under each criterion the potential effectiveness of each EBA options (3 = high, 2 = medium 1 = low potential). Furthermore, the five scores can be added together to give an overall score and ranking, comparatively to one another. Those that score under threshold set at 10 are labelled 'unlikely to produce desired results of EbA interventions' and those above are classed as 'likely'. This further supported the answering of RQ2 - *How do the EbA options that PEBACC are implementing have the potential to be effective in meeting the intended outcomes of an EbA approach?*

8. Results and Analysis

The next sub-sections cover the results that directly answer the research questions, but also allude to other subordinate but relevant findings that came out specifically through the interviews, observations and informal tallanoa discussions. The two project sites are addressed in the results and analysis, firstly Macuata Province which aims to implement EbA at a provincial scale and secondly, Taveuni, where EbA is being implemented at the island scale.

8.1 Macuata: EbA at the provincial scale

As mentioned in earlier sections the PEBACC project focussed their efforts at two different scales and geographical locations. As Fiji is administratively divided into 14 provinces, PEBACC were keen to demonstrate the ability of EbA to operate at this scale. Accordingly, they chose Macuata Province located on the second largest Island in Fiji, Vanua Levu.

8.1.1 Macuata Province data gathering: RQ1 - What is the implementation approach to EbA in the context of a specific place-based project in a small island developing state?

An assessment of the key reports produced for the province was undertaken to address the first research question. This included the Ecosystem and Socio-economic Resilience Analysis and Mapping (ESRAM) report (SPREP 2017b); Ecosystem-Based Adaptation Options Assessment (SPREP 2017d) and the Ecosystem-Based Adaptation Implementation Plan (SPREP 2017e). The results of these were validated through interviews with relevant project stakeholders and those with knowledge of Macuata.

The results from this assessment showed that the project had predominately engaged government stakeholders and active NGOs in Macuata Province; primarily WWF-South Pacific. Information was generally derived from these meetings and discussions. Indicating there was little to no community level participation, aside from interviews done in the field, which predominantly addressed human induced impacts. As such information relating to climate change trends and impact observations utilising local knowledge was limited and in general was taken from secondary research. Climate change projections were taken from The Pacific-Australia Climate Change Science and Adaptation Planning Program (PACCSAP) web-based tool called ‘The Pacific

Climate Futures', which runs uses the CMIP5 suite of climate models (this is the same that the latest IPCC assessment report uses). These projections give a national level view of the future climate for Fiji, but do not offer projections for Macuata Province. Furthermore, there was little scientific data detailing current baseline conditions of ecosystems or modelling of future climate change impacts on ecosystems; aside from some GIS elements. This included some simple use of a Digital Elevation Model that focussed on the Labasa area to demonstrate potential inundation from flooding and sea-level rise. Table 3 (next page) highlights the key information identified during the multiple coding cycles that utilised criteria derived from ALivE (see Appendix C for the hierarchal structure of the criteria and coding system).

Interviews validated the coding results that there had been little community participation in the information gathering, planning or decision-making processes. Furthermore, there was a consensus from some of those interviewed that undertaking the EbA approach had been challenging at this scale and that a lack of community involvement may prevent successful outcomes. An example of such a comment came from one participant:

"Yes, I think what they are doing is good…money is not a big thing, they need to use the other buttons, not the government that is money, you need other things. Everything should start with the vanua… When everyone goes you need the people, there is too many reports and not enough implementation."

The results also showed there was a large focus on non-climatic stressors and that this was predominantly the focus over climate change impacts. This most likely stemmed from the fact that there was little climate data of expected impacts or change, due to the use of national level scale. Those associated with the project identified the need for scientific data to not only design appropriate EbA options but to also allow effective monitoring and evaluation; which appears challenging without baseline data.

Information from the reports had a strong focus on the larger populated areas surrounding Labasa, which did make sense from a vulnerability perspective, due to urbanisation and higher human induced stressors in this area. Though it makes it challenging to see how the project addresses EbA at a regional scale and from discussions it did appear that field interviews and visits were to the same areas of focus, leading to questions of how much other parts of the province had been assessed. Due to the global importance of the Great Sea Reef (GSR; locally known as the Cakaulevu) and subsequently its local importance as one of the major food and

livelihood sources in Macuata; it does make some sense to some extent that this and the Qoliqoli Cokovata (main fishing grounds) gained a large focus.

Table 3– Key information identified during coding of the reports on Macuata that meet the conceptual framework and ALivE criteria of what information should be collected to support EbA options design.

Climate Change Trends and Impacts (O-observed) (P-predicted)	Increase in sea and air temperature – associated ocean acidification – O, P An increase in extreme rainfall (storms and droughts) leading to food shortages and loss in revenues - O, P Sea-level rise -O, P Tropical Cyclone intensity increase – O, P Increase in impact and frequency of major flooding events in low-lying areas– O, P
Major Ecosystems	Coastal and marine ecosystems: barrier reef (Great Sea Reef - area of 'Global Significance' in terms of biodiversity); coastal and island mangroves; coastal marshes and seagrass; coral reefs, deep lagoons; habitats of 12 species on the IUCN red list. Terrestrial ecosystems: freshwater rivers and lakes; tropical forest; grasslands.
Livelihoods	Traditional communities largely subsistence based including farming and fishing. Commercial fishing and agriculture Sugar cane production
Non-climatic stressors impacting ecosystems	Deforestation through logging operations, mining preparations, or agricultural conversion – 760Ha lost between Aug 2016 – Aug 2017. Overexploitation of reef fish and marine invertebrates Run-off of effluent, wastewater and sediment into watercourses and marine environment – leading to habitat degradation. Urbanisation and pollution. Land use – land degradation and soil erosion. Material extraction. Channel dredging. Exploitation of surface and groundwater.
Challenges	Institutional capacity and resources. Political will and lack of integrative multi-level governance. Levels of government complexities – conflicting sectoral governance and singular authoritative bodies. Local level project durability. Lack of clear strategy and framework at the provincial level. Compartmentalisation in sectoral and local government.
EbA Options	**1. Review and Update of the Macuata Province Integrated Natural Resource Management Strategy (NRMS)** led by WWF, Macuata Provincial Offices, Ministries of iTaukei Affairs, Agriculture, Forestry and Fisheries, Health and Natural Resources, and the Labasa Town Council. Aims: *1. Strengthen sectoral management of natural resources through awareness, capacity building, legislation and empowerment,* *2. Conserve and protect the biological diversity and integrity of ecosystems, and;* *3. Promote sustainable development within the provinces.* **2. Support large-scale resource conservation of marine resources** by supporting Great Sea Reef (Cakaulevu) management, including a Ramsar designation and development of appropriate management plans, which extends to focus upon marine management in the Qoliqoli Cokovata area.
Information gathering methods applied	National level meetings and interviews with key ministries. Workshops, meeting and interviews in Labasa (Macuata Province) and Savusavu (Caukadrove Province) with provincial representatives from ministries and local government. Meetings with NGO organisations (particularly WWF-Pacific) and consultants currently active in Macuata. Field-trips and rapid surveys. Interviews with farmers, fishermen and women, and citizens of the province.

In general, there was limited information relating to the vulnerability of local communities and livelihoods to climate change impacts, but there was considerable information relating to the threats to major ecosystems from both land and marine based human activities. Review of documentation detailing meetings and workshop attendance showed there was generally more males in attendance though attendance was relatively low, it may also be explained by there being less women in national, sectoral or local government positions. In the ESRAM and EbA options report. There was no specific gender sensitivities to climate change identified. Furthermore, there was no specific identification of groups that are particularly vulnerable to climate such as children or women. Interviews though provided an insight into the livelihood strategies of men, women and youths. If was found that predominantly men would fish out on the GSR (Waitui [deep sea][5]) and women and youths would go gleaning on the Sawana [intertidal zone]. One participant stated:

"Well, the main fisher folk, are the guys here, I mean you get some women, and their roles are different. The men are usually the main one that will go out at night and you get very, you know, on a very few cases you get women going out diving too, but the women are the ones that just put out the net, and some of the young guys put out nets and they glean in the mangrove patches. They focus on the gleaning"

Due to the utilisation of the provincial system for undertaking engagement and interviews, it appears there was low engagement with stakeholders outside of iTaukei system or sectoral ministries, aside from active NGOs and actors related to sugar cane farming. This would lead to questions of how other stakeholder's views were considered and included in any planning or decisions on EbA solutions. Although the focussing on iTaukei (native Fijian) communities and land in Vanua Levu makes sense due to the 91% of Vanua Levu coming under iTaukei stewardship. Never the less with 7% freehold land it would be relevant to assess the differences in vulnerabilities etc. Furthermore, as PEBACC noted considerable amounts of iTaukei land is leased out for agricultural purposes and interviews emphasised that there are large contingents of Indo-Fijians (either taking up these leases or working in these areas). Indo-Fijians accounted for 58.7% of the population in Macuata in 2007[6] (Fiji Bureau of Statistics

[5] See Appendix D for infographic detailing and translating traditional iTaukei terms for areas from ridge-to-reef.
[6] Best available data. No data on ethnicity has been collected for the 2017 Census according to the Fiji National Government.

2007) and the ESRAM and thus EbA reports have no reference to this. The ESRAM report highlights that some non-iTaukei people subsequently live in informal settlements. There is little further information offered regarding the vulnerabilities of these settlements apart from:

"These informal settlements are often located along the major transport routes including the rivers and roadways, and are expanding into native forests, mangroves, and critical riparian areas. These settlements lack basic services including access to clean water, wastewater treatment or disposal, and protection from climate extremes (e.g. flooding, drought)" (SPREP 2017b)

8.1.2 Macuata Province EbA Options: RQ2 - How do the EbA options that PEBACC are implementing display the attributes of effective EbA measures?

Table 4 shows the results from the MCA undertaken to assess the EbA options selected by the PEBACC to take forward in Macuata Province. The MCA follows uses the conceptual framework lens of ALivE and the subsequent 'effectiveness criteria' it uses to address how suitable an EbA option is at addressing the expectations of an EbA aligned measure.

EbA Option	1. Potential to make sustainable use of biodiversity and ecosystem services to build resilience:	2. Potential to improve peoples' adaptive capacity to climate change	3. Potential to generate benefits for vulnerable social groups and enhance gender equality	4 Potential to reduce risks associated with current and future climate hazards and changes	5. Potential to build resilience of ecosystems to current and future climate hazards and changes	Total	Rank
1. Review and update a Natural Resource Management Strategy (NRMS) for Macuata Province	Medium (2)	Medium (2)	Low (1)	Low (1)	Medium (2)	**7** unlikely to produce desired results of EbA interventions	**2**
2. Support the development of the Qoliqoli Cokovata marine area as a Ramsar site	Medium (2)	Medium (2)	Low (1)	Medium (2)	High (3)	**10** likely to produce desired results of EbA interventions	**1**

Table 4 ALivE multi-criteria analysis (MCA) of Mcauata EbA options addressing how they meet the ALivE criteria.

It should be noted though that the two options highlighted in the first column (Appendix F gives greater details of EbA options) are linked with option 2 acting as a pilot site for expanding the NRMS according to PEBACC. However, they were assessed separately, particularly as Qoliqoli Cokovata was designated as a RAMSAR site in early 2018. Further, this EbA option designated PEBACC to continue to support a 'Plan of Action and support a Management Strategy', while the NRMS is still in discussion

Following assessment of the EbA options utilising the conceptual framework (RQ1) and subsequent MCA undertaken as part of the analysis (RQ2) and review of the current 2014-2018 NRMS. Option 1 (EbA1) scored less than 7, below the threshold of 10 at which an EbA option is deemed likely to produce the results anticipated from an EbA intervention. Option 2 (EbA2) scored above the threshold and was deemed likely to produce EbA type outcomes. The rationale for the scoring and subsequent key findings were as follows:

1) **Lack of climate information:** The approach for the NRMS appears more EBM[7] and CBNRM related than EbA due to the lack of climate information. The only activity that directly considers CCA in the current NRMS is to ensure: '*All communities vulnerable to effects of climate change identified and adaptation plans developed and implemented'* (Macuata Provincial Office 2014). Clearly as an EbA project this would need to have already been achieved to some extent to appropriately deliver EbA results. The PEBACC documents do not offer much detail on observed climate change trends particularly from local communities which are required for effective EbA measures. Which was a key factor for the low scoring of EbA1 for criterion 4. EbA2 scored higher on this aspect not as the PEBACC documents detailed greater information on climate change, but because under the RAMSAR designation there is a greater potential to reduce risks e.g. protecting mangroves Qoliqoli Cokovata will afford, *inter alia,* protection from sea-level rise and wave inundation. Furthermore, the actions of PEBACC to support a PoA in the

[7] *"EBM lies in the extent to which the approaches focus on climate change impacts, with EBA having a particular focus on reducing people's vulnerability, and increasing their resilience to, climate change. EBM, if undertaken comprehensively, considers climate change, but only as one among the many different drivers impacting ecosystems, people and their interactions." (UNEP 2011, 2018)*

qoliqoli and GSR should hopefully reduce climate risk. When asked about the inclusion of climate change data one interviewee responded:

'There is a lot of information around, even at the provincial level but the gap we have in Fiji is the lack of coordination and appropriate utilisation'

2) **Strong strategic focus on natural resource management for increasing biodiversity but potential lack of funded action:** The current NRMS shows that of the 19 activities related to biodiversity, only 2 of them have some potential funding allocated for them, while from interviews it appeared there was little belief that may of the activities had been undertaken, specifically those without external support e.g. WWF. Furthermore, the funding that PEBACC allocates goes on providing capacity not directly funding activities such as *Capacity building for Sustainable Forestry Management at the district/tikina level* or *Tree Planting (Rehabilitation of degraded, deforested Area)* which if funded would provide direct support to communities and potentially increase their livelihood assets. Restoring resources was identified as an important need in Macuata during interviews:

'You have to manage that resource, but it's also about keeping an eye out for and on the restoration aspects'.

3) **Little community participation and gender inclusion in EbA option planning and design:**

"Macuata Province [project] was all about the government… We almost had hardly any interaction with communities at all. We interacted with the other NGOs and everybody else"

As detailed in the previous section there was evidence that showed there was little to no community involvement in the PEBACC EbA planning and design process. This was detailed as being vital in Macuata as many members of local communities are using resources unsustainably, as one participant said**:**

'You need to change the mindsets…most of the older guys are, they're really set in their ways…it could come down to the people and then it comes down to your average John and Jim.'

Relating to criterion 3 there appears to be no consideration of gender sensitivities or activities that seem likely to increase gender equality. Further, it was considered that as the NRMS is led by the provincial council, which deals with iTaukei Affairs, it does not include other stakeholders and social groups that fall outside of the traditional governance and vanua structures to the most point. Furthermore, a low

score was given to EbA2 since again the main actions are targeted at iTaukei communities, due to the focus on the Qoliqoli Cokavata.

4) **Leadership and coordination at the provincial level:** One theme that came up consistently in interviews regarding Macuata, was the need for strong leader to create action in both the traditional (vanua) system and governance aspect. One response was:

'governance and leadership is a big issue is in fact it's one of the main issues'

I was told that in Macuata even though there has been a NRMS in place for 4-years there were concerns about how much influence the document has. An example of seabed extraction was highlighted showing that the NRMS had failed to prevent bauxite extraction taking place in the province. This was described as detrimental to ecosystems and the NRMS itself, and had been driven by National Government agendas, who participants stated were generally more focussed on GDP growth than sustainable management of resources. When asked what the province did to prevent the mining one interviewee responded:

'they did not engage with the community and they should have done more…generally communities are not aware of the detrimental impacts'.

One participant highlighted an example in the province of Ra, Viti Levu; where the interaction with local communities had prevented seabed mining activities from taking place. The basis for this was that the province communicated with the local tribe of the potential impacts. Due to land ownership the local communities have the power to create community protected areas, but it generally requires agreement from all mataqalis with in a tribe on the issue. By supporting them in this discussion the province was then able to proceed to inform line-ministries of the decisions made through the traditional vanua system.

8.2 Taveuni: EbA at the island scale

This section focusses on results gained through data collection relating to the PEBACC Taveuni field site, which is where PEBACC are aiming to implement EbA at the island-scale. Data was collected through the methods detailed in the methodology section and then analysed using coding methods. This produced the results show in the next two sections that separately address the two research questions.

8.2.1: Taveuni data gathering: RQ1 - What is the implementation approach to EbA in the context of a specific place-based project in a small island developing state?

Figure 14 shows the results following coding and analysis using the conceptual framework guidance, that identifies the overarching themes of information used by PEBACC to support their findings in the ESRAM and EbA option design and selection. It was calculated based on how much of the information in the Taveuni ESRAM (SPREP 2017f) and EbA options reports (SPREP 2017g) were coded under these themes once aggregated from the various sub-categories used (Appendix C).

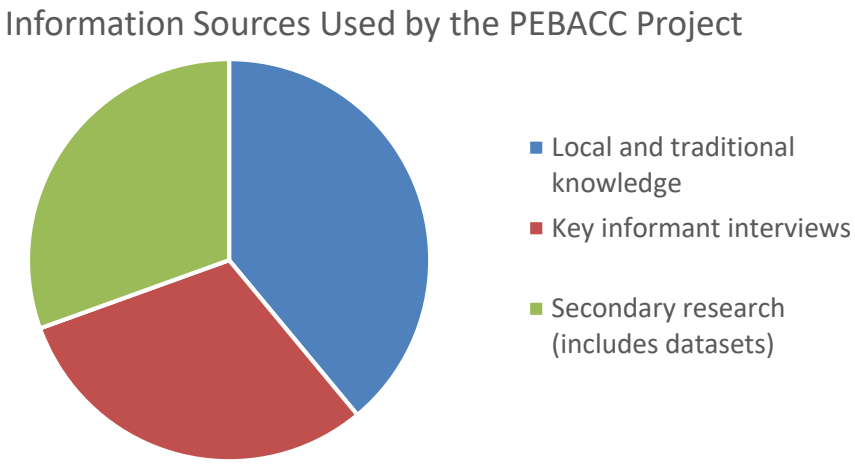

Figure 14 Information sources used by PEBACC during data gathering phase, as established through coding under the conceptual framework and analysis criteria (Appendix C)

The significance of these results relates to the sub-objectives of RQ1. This follows the conceptual framework that EbA should be largely informed through participatory techniques to ensure that both communities and other stakeholders are involved in the planning, design and implementation of EbA solutions. Participation allows for the identification of vulnerable groups and those that should be targeted for adaptation efforts. Further, it allows for recognition of underlying vulnerabilities, while helping to contextualize solutions and build ownership of the process and solutions The results demonstrate that there was a general balance between the sources of information used by the PEBACC project in developing the ESRAM for Taveuni and EbA option design. It was judged that 39% of the information came from local and traditional knowledge. The inclusion of other stakeholders was recognised under key informant interviews, which covered 31% of the information collated by PEBACC. The remaining 31% of information came from secondary sources which included national reports and policy, other project documentation, reports, datasets etc.

Figure 15 gives a detailed breakdown of these three major themes to explore the provenance of information and the means of collection. It was calculated from how much information was coded under the conceptual framework criteria (Appendix C) used to analyse the Taveuni ESRAM report and EbA options assessment. It shows that primarily data was coded under information based on workshops.

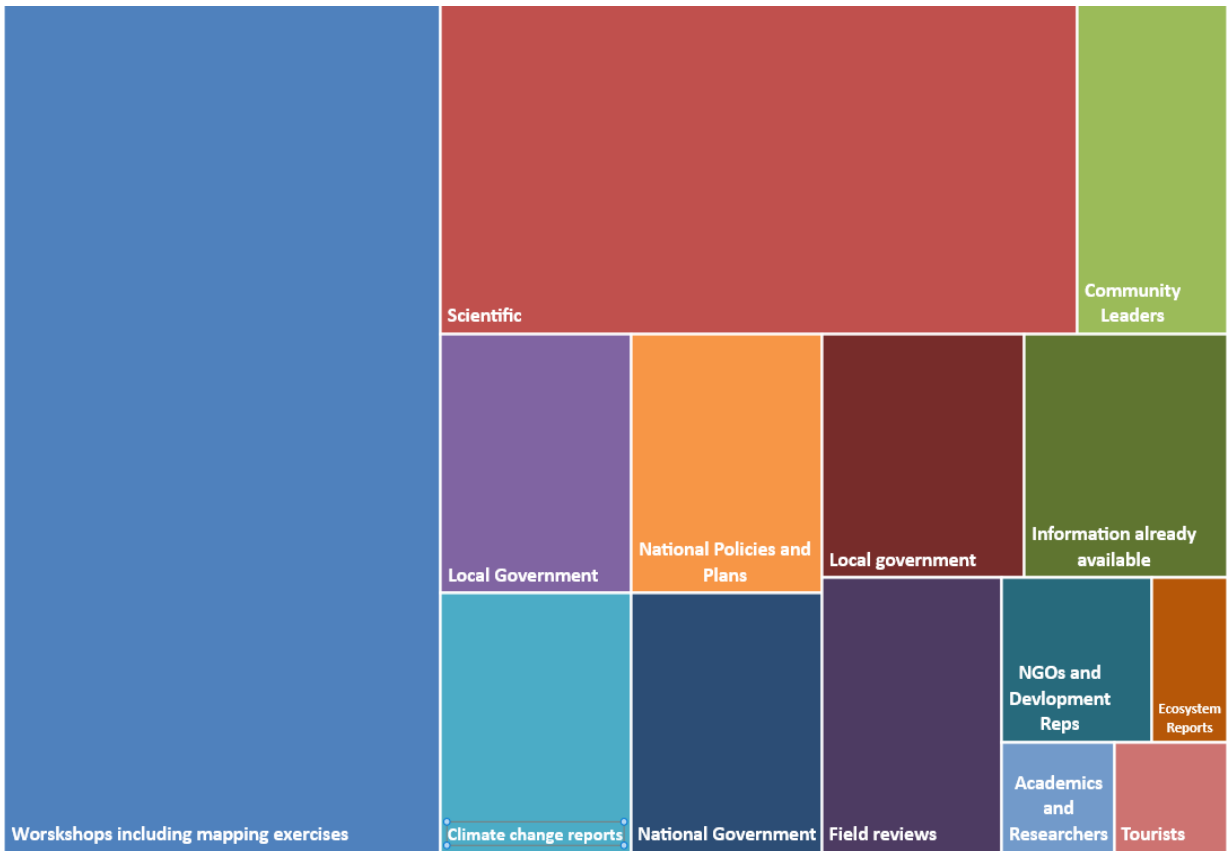

Figure 15 Proportional breakdown of the origins and tools used for data gathering by PEBACC as coded under the conceptual framework and ALivE criteria – Academics and researchers, community leaders, local government, national government, NGOs and development reps; and tourists all represent a breakdown of the theme 'key informant interviews'. Workshops include meetings, mapping exercises and community based talanoa that are a breakdown of the 'local and traditional knowledge' theme. Scientific was taken as a separate category for any modelling, GIS, surveys measurement etc. The rest of the categories fall under the 'secondary research' theme.

It is clearly visible from this infographic that information collected in a workshop setting was relied on twice as much as any other source, giving an early indication of community participation. Scientific data use represents the next largest source of information, followed by the various stakeholder interviews conducted by PEBACC to inform the reports.

8.2.1.1 Participatory approach and multi-level governance

One key characteristic of EbA is that it should be community-centred and participatory, while ensuring all stakeholders play a role. Results show PEBACC ran several workshops and meetings over the space of 2 years to collect and collate information

that went into the ESRAM report and supported the identification and selection of EbA options. The reports and interviews detail there was a strong focus on the iTaukei structures and communities, both traditional (vanua) and administrative (illustrated in Figure 16).

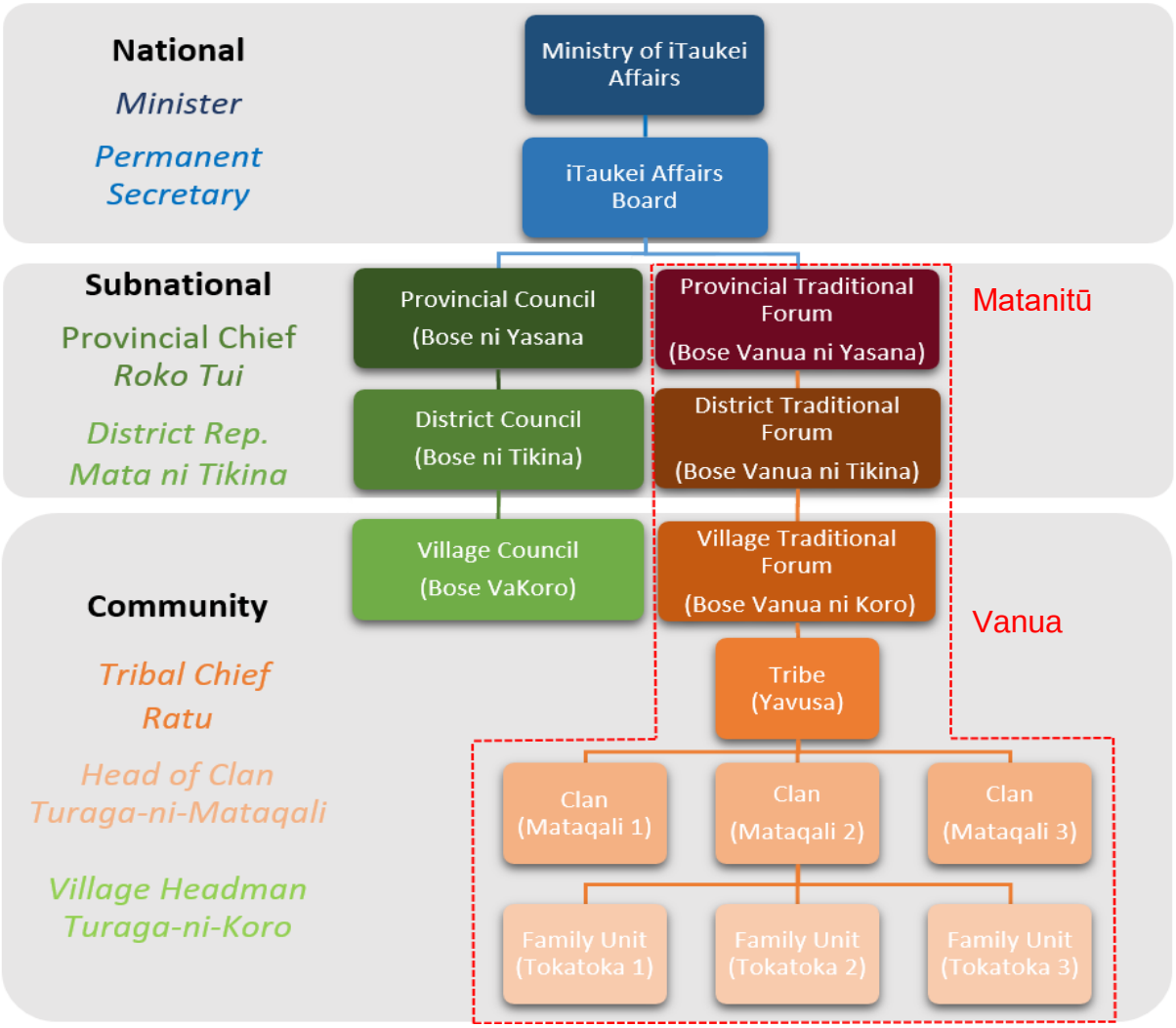

Figure 16 Diagram illustrating both the traditional chiefly system/vanua and administrative aspects of the iTaukei people.

Following inception and discussion with relevant administrative representatives from the national level down to the district level, under the iTaukei Affairs Board (TAB). PEBACC held an island-wide workshop on Taveuni with 'most' of the traditional leaders in attendance. The interviewee said that "13 chiefs and their delegations, about 55 people" attended this workshop. Subsequent workshops were then undertaken at the district level (Wainikeli; Vuna; Caukadrove), which covered attendees from most of the major iTaukei villages, although some where better attended than others. During one interview it explained how PEBACC used a vanua approach:

"We just did a workshop for everyone who was there on the vanua basis. So, for Wainekeli seen as the Turaga Tui is the highly respected chief, we worked under his authority in Wainekeli. So vanua Vuna, we look under their authorities and split them up into their own vanuas. After a whole of Taveuni workshop. Within their own vanua they were split up into their own youths and women etc. groups."

When exploring the tools used during these workshops, it was revealed that predominantly group mapping exercises were used to extract information from the participants. Presentation of these between groups also allowed for knowledge sharing. This included a 3D model of the island highlighting land use as located by the participants. Furthermore, the major aspects of the workshops were for participants to identify major natural resources/ecosystems; their significance to the community, threats to these and solutions they thought would be suitable. PEBACC utilised an approach that used the concept of the traditional *vanua,* relating the aforementioned to the *bure* and *Tua,* with the aim of establishing the traditional emotions and usages at a landscape level (see Appendix D. The Traditional Tua for details). This approach also allowed for a key aspect of the project to develop; the identification of watersheds. Watershed division plays a central role to the PEBACC project; acting as a unit of measurement; division of linked-landscapes and users. 11 watersheds were identified by participants at the workshops and these were delineated by the project using adapted to physical watershed boundaries using GIS. These watersheds became vital ways of grouping resources and communities during the following workshops, information presentation and for how EbA options are designed and implemented. This is summed up by the comment:

"they were asked to fill in certain things in the first round…to do like impact assessments on their watershed…we divided them into different sectoral groups based on their interest and their livelihood, so farmers together and fishermen together"

8.2.1.2 *Vulnerability and vulnerable group identification*

As part of EbA there is a key emphasis on vulnerability, particularly identification of vulnerable groups, because of this it is recommended that some form of vulnerability assessment is done. ALivE and the other guidelines suggest tools such as hazard mapping, seasonal calendars and historical timelines etc. as suitable ways to gather information on a participatory basis. Results showed there was no reference or use of any of these tools were found in the reports. When asked about the tools used, I was told by one participant:

"I would have liked to have seen them use things like seasonal calendars, a lot more, historical timeline…I think it would work very well in this context because you're talking about change. People

start thinking about how things were in the past and how did things change over time and then this helps set the way of thinking...But um, they didn't"

In general, there appeared to be a greater focus on the vulnerability of ecosystems than people and groups. When the issue of vulnerable groups was explored there was a shared belief in general from PEBACC, key informants and community participants that in Taveuni everyone shares the same level of vulnerability to climate change due to their social structures. One community member said:

"The whole village is the vulnerable group as they all face it together and share the same issues"

Another stakeholder commented:

"…they're all going to be impacted the same way. They all rely heavily on the marine resources."

This final comment also followed a discussion with many members of the community that said that for example men, women, youths, children all fish to some extent. As was mentioned with regards to Macuata, usually the women and children will glean on the intertidal zone, while the men will commonly go spear fishing at night on the edge of the reef in deeper waters. Similarly, when discussing farming there was a strong agreeance that the whole family is vulnerable by any impacts e.g:

"It's basically family. You know when you talk about farmers, you don't talk about my farm, its our family farm because everybody's involved. If something, if a farm suffers, everybody suffers basically."

Variances in the impacts of climate change on these different ecosystems and thus varying vulnerabilities to these groups was not apparently investigated by the project. Although a few comments stood out from some participants:

1) Some of the youths stated that they thought they were most vulnerable to climate change and as are were scared all the resources will disappear. Though this seemed primarily related to over-exploitation of resources.

2) Some participants suggested there is a sectoral and geographical vulnerability. For example, in the south/southwest of the island (Vuna District) they have experienced much greater impacts of severe drought, compared to the north/northeast where they generally experience greater rainfall due to easterly trade winds and orographic aspects of the island. While there is a greater focus on agriculture at a commercial scale in the southwest.

8.2.1.3 Community and stakeholder participation: who participates

A standout theme from the results was there was little mention of members of the community outside of the iTaukei people. This became apparent during review of the reports but also during interview coding in the field. I asked whether the strong focus on iTaukei people, was due to the fact they were deemed the most vulnerable group on the island. One respondent told me:

"I don't think climate change will choose gender or anything or you know, or race it affects everybody. So in terms of vulnerable communities, I think the project kind of just went through that, like dealing with iTaukei because it had a structure. It was easier to deal with rather than dealing with stakeholders that you know, that we're not in a registered community, that don't come under some kind of formal administration"

All the workshops that was undertaken were ran in iTaukei communities, using the vanua approach. When asked if other stakeholders attended the workshop in Vuna, where there is a large amount of freehold land I was told:

"PEBACC only brought in 6 freehold stakeholders but there is between 60-100 landowners in Vuna...so PEBACC need to bring in more to ensure things work"

One important stakeholder, who was not from the traditional iTaukei vanua, told me that he only attended the workshop as his cousin had invited him. Further, he said that PEBACC had visited stakeholders outside of the communities but had not directly invited them to the workshops. When I asked about who decided who attend the workshops I was told:

"We put it all out there and then we put it out there to the communities to invite people and they made the decisions about whether or not they did or didn't."

This issue of difference in governance appeared throughout the information received and witnessed in Fiji and appears to be a large hurdle for projects. One stakeholder who has witnessed numerous projects start on the island told me:

"a lot of the projects that come in, they see villages and they think of the native Fijian villagers. Whereas in Taveuni a lot of the land is owned by freeholders and the overseas aid groups they talk about communities and it has to be a community that lives together. Whereas you could have like a farming which are scattered. They have something in common. So community basically be a family because you have an old copra plantation and you have like 400 acres and it's one family, but because they have one name, they're not considered the community."

This was recognised as key for the project moving forward to engage the stakeholders who have been identified as creating the larger human induced problems of deforestation:

I think it was very focused around iTaukei. But I think that's one of the lessons learned was studying the stakeholders and those that were really contributing to the impacts here because a lot of Fijians farm but not at a commercial scale compared to the level of freeholders and you know their farming activity and the level of which they are farming the land and the impacts that they have"

Overall, the results showed there was a focus on the vanua structures and thus the iTaukei communities and by utilising these structures it was left to these communities to decide on the involvement of other stakeholders. This seemed an apparent issue of in ensuring all stakeholders played an active part in the phases of EbA, as many of the iTaukei communities appear to blame freeholders for many of the impacts they are witnessing to their ecosystems. This included some singling out Indo-Fijians with comments including: "*On freehold Indo-Fijians are using fertiliser";* "freeholders are *using diggers to clear forest, Indo-Fijians*"; "*So there's a big community up on this hill here near Welagi farming. They're mostly Indians.".* This segregation also appeared in interviews within local TAB governance, one representative explained the two systems as:

"What we are trying to do is try just try to work on what we are trying to do and the government runs with these other people. There are regulation that will be put up for them to be good"

An equally important and related finding was; who out of the communities attended the workshops and how they came about attending. It was found that the majority of those attending workshops were generally some sort of traditional leader Turaga-ni-Mataqali (TnM), tribal chief or administrative representative e.g. Turaga-ni-Koro (TnK) or Mata-ni-Tikina (MnT). Furthermore, where the workshop was held in a particular village you would see greater levels of attendance from that village particularly representatives of women and youth groups. Results showed that it was generally expected that these leaders would go back to their respective village and share the knowledge of the workshops while gaining the input of the others to be support decision making. Although the effectiveness of this was questioned by many e.g:

"MnK and TnK some are good and spread what they have learnt, but some TnK want workshops just to raise money through catering, hall rental etc. as it looks good for them in the village, then they don't spread what they learnt to others"

The reliance on these leaders as those attending also showed a relation to gender inclusion, as most of these positions are generally made up of men, so aside from the few women that may represent the women's group there was certainly less women in attendance and included. PEBACC show this clearly in their synthesis report which declares '83%' of participants were male and '17%' were female participants.

When asked if they had heard about the PEBACC project, the topics or the EbA options the majority of villagers who had not attended the project workshops, said that they had never heard of PEBACC. Furthermore, those leaders told me they did share the knowledge for example mataqali heads, shared it with tokatoka heads, but it was their responsibility to pass it down and receive information through the family meetings. There was clear agreement though from those that did attend workshops that they had learnt a lot about their natural environment and resource use, but this agreement also led to most participants suggesting that the workshops should be held in each village and involve the whole community; rather than leader selective and only in one village in each district. Furthermore, it was highlighted that the mindset of the leaders (i.e. conservation sympathising) was key to how the message would be fed down and also to the input PEBACC received back regarding EbA option design. Two further valid arguments related to these aspects were clear though, many villagers may not have attended if they feel like they will be identified for being culpable for some issues, i.e. in Taveuni there are large issues with deforestation and overfishing and many are aware of this but continue to do so. Secondly, a point summed up by the following comment and observed by the researcher at the workshops attended; is that many people do not voice their opinions when space is afforded for it:

"…people sigh and are scared to talk, because they are used to listening. They are often the listener in village meetings and it is the same people speaking even though they have the right to speak). It's always chiefs and mataqali head speaking"

8.2.1.4 *Incorporation of climate information*

A vital characteristic of EBA is that it clearly includes climate information both observed and predicted originating from both scientific and local knowledge to ensure EbA options address current and climate risk. It was clear from the reports assessment and validation through interviews that Taveuni is already experiencing some form of climate change and is predicted under a broad scope (national scale models) to feel increased impacts in the coming future.

Table 5 shows the analysis of the coding completed under the conceptual framework criteria. The results indicate that information pertaining to the major ecosystem of Taveuni were a key feature in the reports. Interestingly there was also a clear focus on non-climatic stressors that are impacting these ecosystems in the ESRAM and EbA options reports. In fact, information relating to non-climate stressors was presented

twice as much as that relating to the impacts of climate change. While data and information regarding observed and projected climate trends was considerably less overt the two reports. There was a strong an element of livelihood strategies identification but as previously mentioned, there was little on how these livelihood or associated groups may be particularly vulnerable to climate change.

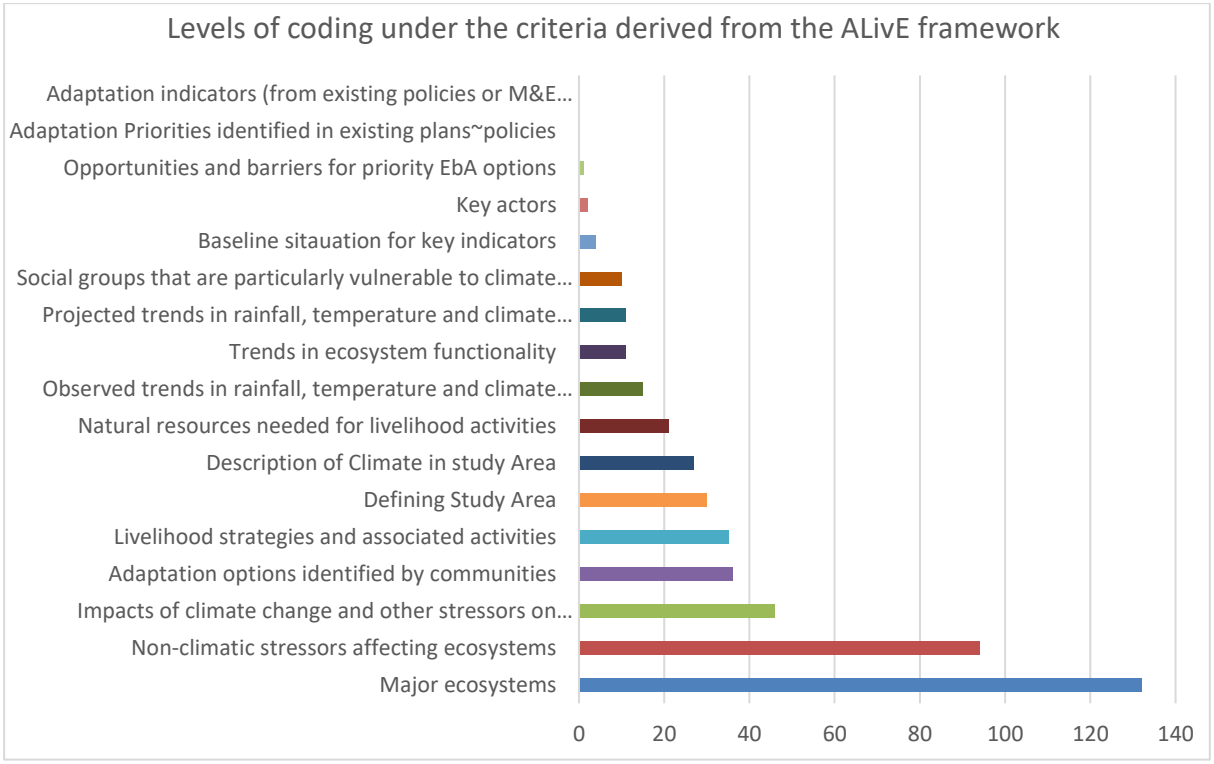

Figure 17 Graph showing the results from coding PEBACC reports

It is also key to note there was little mention of baseline conditions of ecosystems from a scientific perspective which could be essential in assessing current state and future improvement (M&E) following EbA implementation. I was also told by that the lack of specific scientific data such as biological monitoring or stream sedimentation outflux makes it difficult to actually say for sure that the impacts identified qualitatively are actually taking place and to what extent. The project intends to undertake these kinds of measurements during the implementation phase.

The focus on non-climatic stressors was also evident in the interviews undertaken with both project staff and consultants, while it was clearly the largest issue amongst the local community data collection and gives reasoning for behind its high priority in the text. This though is significant on whether a project really meeting the characteristics of an EbA approach and is one of the key elements that differentiate it from other

approaches such as EBM and NRM. When asked about the focus of the project, I was given the following responses:

"So with climate change, I'd have to say the only thing that we really did with climate change is said its going to be warmer, it's going to be drier and when it rains its going to rain heavier …Highlighting climate change with these people was not something we did, at best hardly at all…So I mean the PEBACC project of adaptation to climate change, we can get rid of the adaptation to climate change part because that just got it the funding."

"We are dealing with the impacts of human activities on the ecosystems. That's what we're interested in finding out how we can address those particular issues, is impacts."

In context of the project did highlight that most of these non-climatic stressors were a priority because it is those that are most likely to be exasperated by climate change and it is those ecosystems that are threatened, which provide ecosystems services that will be vital to climate change adaptation. Furthermore, it was found that the greatest concern to the community participants was the cutting down of forest and the degradation of land (five times as many people highlighted this as the key issue in their respective villages as any other problem); for two different participants explained to me:

"I used to plant taro, but its too small now, I think because of climate change…but its very difficult to deal with climate change because god made it"

"Fish are rare because of climate change"

In the community most see climate change as the change in weather, but they also strongly associate the damage to their reefs and forests to what they have heard through media, as climate change. Which presents a problem for the project to differentiate at the community level between man-made issues that will be driven further by climate change or direct climate change under a participatory led basis. Furthermore, another theme associated with the community's view of climate change was its strong association with it being a factor of God, adding another dynamic to recognising the issue and tackling it. This was exemplified by a comment by XXX who had just rebuilt his home uphill after his previous home was destroyed by high tides and waves.

"God makes climate change and so I love climate change because I love god. But I have to change my life because of it."

8.2.1.5 *The role in EbA options design*

As is presented in the results discussed so far, the iTaukei villagers that attended the workshops played a pivotal and central role in the planning phases of the project. It is

clear from both the reports and interviews that the community led the process of identifying the problems that they thought were threatening their natural resources that they rely on for their livelihoods. This also led to their strong involvement and in the design of the EbA options that the PEBACC project selected. It was gathered from the analysis that in general during the workshops the problems and solutions identified were suggested by the communities. This was then taken away by the consultants working on behalf of SPREP to formalise and prioritise EbA oriented options that would feasible; at a selection of sites chosen during a participatory mapping exercise. The majority of those interviewed that attended the PEBACC workshops said they highlighted following solutions:

1) *A return to original landscapes; tackling of deforestation including mangrove planting and nurseries for planting of native species of plants.*
2) *Government help to stop overfishing and more tabu areas*
3) *Education on sustainable natural resource management and planting.*

8.2.2. Taveuni island EbA Options: RQ2 - How do the EbA options that PEBACC are implementing display the attributes of effective EbA measures?

Assessing whether the Taveuni EbA options:

1) Taveuni watershed coordination network;

2) Youth stewardship programme with “living classrooms”;

3) Training: plant nursery construction, operation & management;

4) Training: native plant seed collection to enhance biodiversity;

5) Agricultural improvement & diversification trials (with training);

6) Training: agroforestry practices & management;

7) Training: plantation management & certified sustainable products

detailed further in Appendix G) selected to be carried forward and implemented by the PEBACC project, proves challenging due to the scale at which PEBACC are targeting outcomes (island-scale). As PEBACC won’t be just implementing measures in one location it provides different aspects to be considered compared to many of the examples of EbA seen in the literature. In a sense PEBACC have tried to afford EbA

measures that will support a wide part of the geographic locations in Taveuni, although it will require them to be specific for some of the measures e.g. the school nursery. Furthermore, the measures are an integrative portfolio that each combine the aspects of one or more of the others to ensure successful implementation. As such the measures have been considered in this research individually but also as a package of measures. Finally, these options should be considered alongside the findings under the previous section, in the fact they are targeted actions for iTaeukei communities primarily, although the project have stated they are extremely keen to engage other stakeholders. This can be justified in the sense that some of these options may best suited to areas of freehold, where there is larger commercialisation of farming.

Figure 18 shows the locactions mapped out by the PEBACC projects as areas for potential EbA measures. It should be noted that not all of these areas will be covered by the options but indicates where certain types of measures would be suitable.

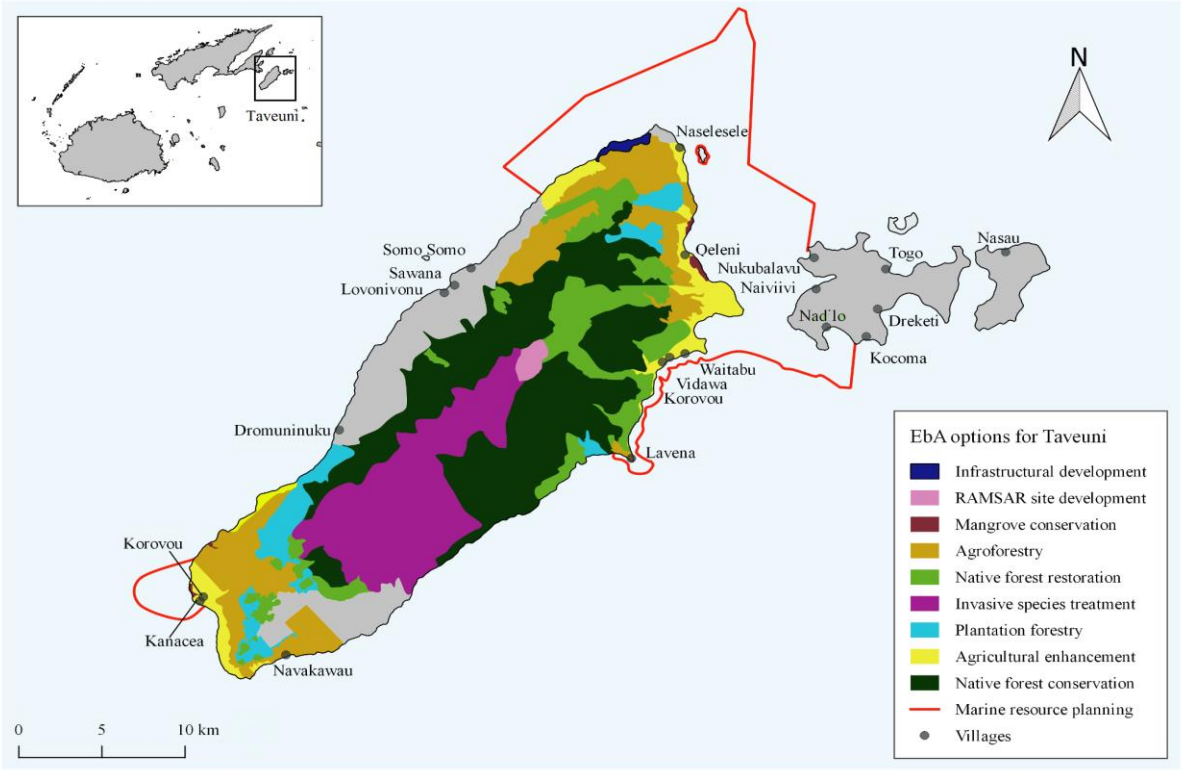

Figure 18 Areas of potential for implementation of EbA options under the PEBACC project on Taveuni (data source: SPREP 2018b)

Table 5 shows the results of the MCA undertaken to assess the potential of the PEBACC interventions selected for Taveuni to be effective under what the conceptual framework recognises as EbA.

Table 5 Multi-criteria analysis (MCA) of the EbA options selected by PEBACC to implement on Taveuni.

EbA Option	1. Potential to make sustainable use of biodiversity and ecosystem services to build resilience.	2. Potential to improve peoples' adaptive capacity to climate change	3. Potential to generate benefits for vulnerable social groups and enhance gender equality	4. Potential to reduce risks associated with current and future climate hazards and changes	5. Potential to build resilience of ecosystems to current and future climate hazards and changes	Total	Rank
1.Taveuni Watershed Coordination Network	Medium (2)	Low (1)	Low (1)	Low (1)	Low (1)	6	7
2. Youth Stewardship Programme With "Living Classrooms"	Low (1)	Medium (2)	High (3)	Low (1)	Medium (2)	9	6
3. Training: Plant Nursery Construction, Operation & Management	High (3)	High (3)	medium (2)	medium (2)	medium (2)	12	3
4. Training: Native Plant Seed Collection to Enhance Biodiversity	High (3)	High (3)	High (3)	medium (2)	medium (2)	13	2
5. Agricultural Improvement & Diversification Trials (With Training)	High (3)	High (3)	Medium (2)	Medium (2)	Medium (2)	12	=3
6. Training: Agroforestry Practices & Management	High (3)	High (3)	Medium (2)	High (3)	High (3)	14	1
7. Training: Plantation Management & Certified Sustainable Products	High (3)	High (3)	Medium (2)	Low (1)	low (1)	10	5

It utilises the 5 effectiveness criteria under the ALivE framework. We can see that the EbA option with most potential to be effective under this MCA is the 'agroforestry practices and management training' (EBA6). It was deemed that the capacity of this EbA option to provide short-term and long-term benefits that diversity income sources, would build resilience of the communities where this option was implemented. Furthermore, it scored highly for building resilience of ecosystems while providing increased biodiversity and thus ecosystem services. These ratings were related that there is a clear reliance on the communities on cash crops (dalo and yaqona), thus agroforestry represents a way to diversify this, while benefitting the local ecosystem through increased biodiversity and thus resilience. It received a slightly lower score for criterion 3 due to the selectivity of who would get to benefit from the implementation of the option in the sense of income generation, although clearly there is the wider ecosystem service benefits that others would receive such as biodiversity related services, water retention and reduction in climatic events such as run-off etc.

Options 4 ranked as the second as potentially the most effective EbA measure. The rational for this being that trainings on seed collections could impact a wide group (easily accessible) and would ensure both biodiversity and ecosystem resilience in the long-term if planted appropriately. The reason it scored lower under the last two criteria (4 and 5) was the fact it would not offer short-term increases in adaptive capacity, thus there would be no change to resilience in the short-term. Furthermore, it is strongly dependant on the success of EbA3. EbA3 faces a similar condition in the sense the nursey provides potential in all areas and offers a sustainable solution going forward but the true benefits may take some time to be felt.

EbA5 ranked joint third, primarily as it would be selective in its application and would benefit a select few to a certain extent with only 2 or 3 people from each watershed being selected to attend training workshops. EbA7 scored low for criteria 4 and 5 primarily due to the long-time lag of tree planting and not meeting the needs of the most vulnerable in the short term in the face of impacts from climate change (even the medium-term early-to-harvest species would take 10-15 years to mature).

EbA2 was ranked 6th and although the community want to see education and this will beneficial in the longer term, it does not provide new livelihood sources, tackle the impacts of climate change short-term or long-term. Although the hope is alongside other measures it would be extremely valuable, but it is difficult to describe this as an

EbA option on individual merits. This is combined with the fact it will only be implemented at one pilot school which would be the beneficiary. It received a high score for criterion 3 as it is hoped it would benefit children to some extent, whom could be seen as a vulnerable group in Taveuni, if it continues on its current path.

Finally, EbA1 may have harshly evaluated as showing little potential effectiveness as an EbA option, as primarily it is representing an organisational role for a select three and does not provide any direct tangible benefits under the criteria. Subsequently, though it could prove invaluable to the potential of the other options and should not be discredited in its importance, but the results would suggest it is merely an action not an option. Furthermore, its ability to benefit a select few means that there is given power to a certain few and as mentioned in the earlier section this power is normally maintained by those already in authority. It will largely come down to who is appointed, but during the fieldwork, it was presented that most of the villagers were not even aware of the job being advertised, as it was only in the local paper and an advertisement in the Provincial office. The post will also be under the employment Cakaudrove Provincial Council, part of the iTaukei administrative system.

8.2.2.1 Other Key themes that impact participatory processes of EbA

Commitment of the people – a key aspect that was brought up a number of times by during interviews was the fact that any EbA option that is implemented needs the commitment of the community behind it. I was given an example by one participant:

"The Ministry of Forestry brought the village seedlings and a nursery for native species Yasi, Vesi etc. but the village got bored and didn't continue"

Another community member said:

"A big problem is that some people don't take it serious, particularly those without children"

In relation to this quote, many people told me that those without a care for the future were less likely to act or change their behaviour.

Behaviour of individuals – although it was found that there is quite a collective mentality in iTaukei communities, which appears to stem from the linkage to vanua and the concept that no one person owns the land. There was a clear blame of individuals that act outside of this basis and are particularly driven by short-term gains and money. Which many of the participants said was not traditional attitudes by iTaukei people. This was summed up by one interviewee:

"Some people only think of money and not the future, this is the problem; they overfish and cut down trees to farm"

Another stated:

"Problem is people want quick money and so plant yaqona and dalo."

This final comment is also important to highlight, as many rely on these two cash crops for income, which is why PEBACC have identified growing practices for both as a major culprit of deforestation. Both are strongly linked to major increases in the recent market values of the crop. Particularly yaqona which has seen a huge price rise since TC Winston, which I was told is because it destroyed so many of the yaqona plants, that it has dramatically reduced supply. This is significant from the perspective of the EbA options as many of them require the communities to wait for potentially 10-25 years before reaping any benefits e.g. reforestation and agroforestry. Furthermore, this desire for money from the villages, led to some people to state that communities are only interested in hosting projects with external donors, as they generally make money from items such as community hall hire and catering.

9. Discussion

9.1 Addressing climate change and climate change adaptation in EbA

When evaluating how the PEBACC project displays the characteristics of an EbA project we must, break EbA down into is core concepts. A key element of EbA, according to the literature and guidance is that by definition it should have a strong emphasis on climate change, its impacts and adaptation to it (CBD 2009; Lo 2016; Munang *et al.* 2013; UNDP 2015). Both ALivE and the quality standards produced by FEBA (2017) state that to be classed as EbA it must 'explicitly address current and future climate change and reduce climate vulnerability'. While climate change was one of the issues addressed, it was not the primary focus of the project. Interviews validated the initial finding from criteria under the conceptual framework, that this project did not target climate change directly. This had knock on impact on how the EbA options were address current and future climate hazards and changes. The MCA demonstrated this by the low scoring values given to many of the EbA options were this was a consideration as part of the ALivE criteria, as they did not tackle current or in some cases 'future climate change hazards and changes' (Terton and Daze 2018). This means that many of the PEBACC EbA options for Taveuni fail to distribute benefits over a short-, medium- and long-term basis in order to support adaptive capacities, which FEBA (2017) describe as a vital aspect of an EbA approach.

If we consider that CCA is the 'process of adjustment to actual or predicted climate change and its effects' (Field *et al.* 2014), then it makes it difficult to see how PEBACC addresses this explicitly and therefore displays this essential aspect of an EbA approach. PEBACC did however address current issues from the perspective of non-climatic stressors (predominantly human induced impacts) on ecosystems and restoring these degraded ecosystems, but lacked the attention to the role of extreme events and potential future changes of these ecosystems due to climate change. This has been determined by some as major flaw in some EbA labelled projects, as money may be wasted if an EbA option doesn't consider the impacts on the option itself in the long-term e.g. planting a species that cannot adapt to increased temperature rise in 50-years' time (Lo *et al.* 2009). However, we must recognise that delineating non-climatic stressors from stressors implicated by climate change is often extremely difficult in the context of adaptation (Adger *et al.* 2005*;* Thomas and Thyman 2005;

Mimura *et al.* 2014). This then challenges how the concept of EbA and the demand to focus on climate change impacts and adaptation can be effectively put into practice, when there is overriding impacts caused by humans. This is similar to case of the former Clean Development Mechanism, which looked to deliver emission reductions under the Kyoto protocol, while also delivering sustainable development benefits and was judged to have failed to deliver on both fronts (Olsen 2007). What EbA requires is that climate change is addressed at sufficient levels alongside non-climatic stressors, to create synergies and reduce trade-offs between interventions that may treat these problems separately.

Assessing the success of CCA is seen to be notoriously difficult, due to the levels of uncertainty over predictions and the timescales on which climate change takes place (Doswald *et al.* 2014; Spearman and McGray 2011). This aligns with the definition of climate change being a 'statistically significant change in the state of the climate that persists for decades or longer' (IPCC 2007a). Clearly then, a valid point relating to EbA addressing climate change, is that in practice we cannot easily say what the future holds regarding climate change impacts without uncertainty (Corfee-Morlot *et al.* 2009). This makes it extremely challenging when creating solutions without in depth scientific data and modelling for specific locations that can give as much certainty as possible to create adequate EbA measures that address expected impacts.

If we return to think about the CBD definition, it highlights that EbA should be part of an 'overall adaptation strategy' (**Error! Reference source not found.**), in PEBACC's case this is particularly hard to identify. When asked about it in interviews, there didn't seem to be any recognition of how this was applied to the project.

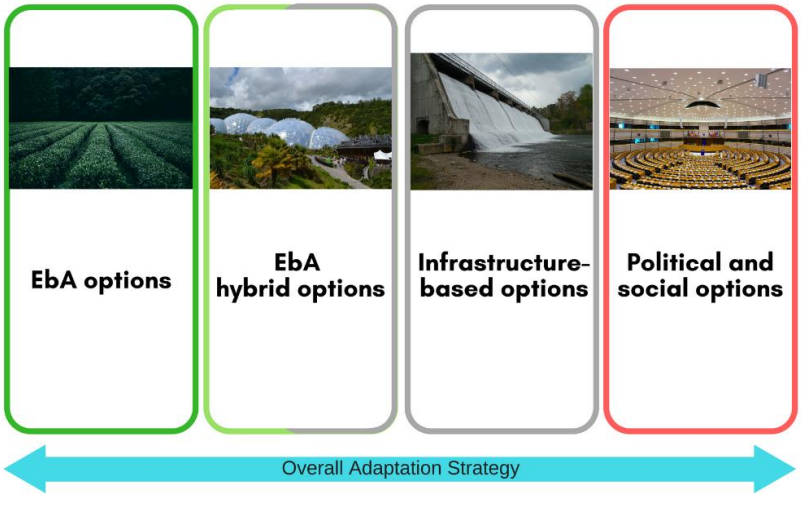

Figure 19 EbA as part of an overall adaptation strategy (adapted from CBD 2018)

When considering the Macuata project site and EbA options or activities should they take place, then there is the potential to class these as part of broader objectives e.g. NRMS and Ramsar Designation & Management Plan, but how much these are related to adaptation, returns us to our earlier points on what is adaptation and more specifically what is successful adaptation. Furthermore, it appears from the literature that many of the case study examples also fail to address this part of the deiftinion when undertaking EbA projects. This may be due to the fact most are standalone projects being implemented by conservation bodies to demonstrate EbA's worth. Either way there is a lack of evidence to show how EbA in practice fulfils this part of the definition both from this study and others, leading to the question of why the CBD includes this in the definition and how should EbA achieve this? It may be that the more common inclusion of EbA in overall adaptation strategies may require more upscaling and mainstreaming prior to meeting this part of the definition. As such it is understandable that at present EbA projects are merely demonstrations of the approach to then convince decision-makers to consider as part of their wider strategy portfolio.

Finally, the lack of scientific data and measurement of a baseline makes evaluating and monitoring of the actual impact of the PEBACC project difficult. The project recognised this as an issue and were keen to undertake measurements in the future. This point seems relevant to how EbA can be put into practice in the sense that even in the literature there appears to be little case study examples where scientific data has been used to justify much of the EbA measures being implemented and allowing for baseline measurement. This also creates future issues in addressing how a project and thus EbA is effective in addressing climate change adaptation.

9.2 Identifying vulnerabilities within the community

A lack of climate change focus also influences PEBACC's ability to identify groups that are most vulnerable to climate change impacts. The reason why so much of the literature suggests that appropriate assessment of human vulnerabilities, through detailed vulnerability assessments (VA), are undertaken in the initial data gathering phase of EbA planning is so that origins of their vulnerabilities in relation to climate change aspects can be traced (Hannah Reid 2016; Newsham et al. 2018; United

Nations Development Programme (UNDP) 2015; Terton and Daze 2018; Sudmeier-rieux 2016).

Vas aim to understand the history of shocks and stressors over a long period of time e.g. extreme climatic events PEBACC did not fully do and would have been beneficial in gaining local knowledge on the vulnerability to climate change impacts. As would have identifying vulnerabilities that happen on shorter timeframes e.g. on a seasonal basis such as how changing climate has disrupted growing seasons or fish spawning periods. Identifying these aspects are a major characteristic of EbA as they provide an understanding of the adaptive capacity of communities to climate change, while also building a picture of current and past climate change. An example of this for PEBACC could be the men who go fishing on the reefs are more likely to be impacted by increases in hurricane frequency and intensity than the women and children who glean on the intertidal zone. An effective VA that focusses on climate change allows for the development of appropriate EbA measures.

The results showed that PEBACC did not necessarily focus on climatic vulnerabilities of people in the project sites, instead they focussed on the vulnerabilities of the ecosystems themselves, from a non-climatic perspective. Though this study found that many of the communities spoke of seasonal changes impacting their ability to plan their sowing times on their mataqali land, it was not explicitly and systematically incorporated into PEBACC's findings. They also said they had to now expect strong winds at almost any time of the year, which could wipe out their entire field of yaqona, cassava and Dalo which could cost them an entire year of time and lost income.

Effective vulnerability assessments allow for the identification of groups such as women that are more vulnerable than others which should be part of an EbA approach (Seddon *et al.* 2016; Lo 2016). PEBACC did little to consider how their EbA options could increase gender equality such as equal access to resources (another key aspect from the conceptual framework), while typically the workshops were male dominated which questions whether the EbA options derived from this participation favours a male outlook. This may be a factor of the gender roles in iTaukei communities, but overall there is was no systematic identification of vulnerable groups undertaken by PEBACC, which again fails to meet the criteria of the conceptual framework and what is recognised as an EbA approach. As Gell (2010) notes 'climate change does not choose gender but vulnerability often does', but both the UNDP (2015) and Reid (2016)

clearly state EbA must involve women and vulnerable groups in the planning and selection of EbA options. The target group of the project was quite clearly the iTaukei people, which has limited interaction with other groups and stakeholders who would be part of the 'wider community'. This limits the effectiveness of the EbA options dramatically particularly for PEBACC where they have identified many of those living and working outside of the iTaukei villages as major contributors to the degradation of ecosystems. Furthermore, the lack of recognition and inclusion of the roles of each stakeholders and actors may lead to a trade-off. Erikesen and O'brien (2007) describe EbA situations where one group benefits at another's expense and so without assessing or involving all stakeholder groups fully in the planning and EbA options design there would be concern that the EbA options may benefit the iTaukei communities at the expense of other stakeholders.

9.3 Ensuring EbA is a community centred and driven approach

The PEBACC project clearly demonstrates one of the key aspects of EbA by involving the community at all stages of the planning and design processes. In a sense the community have strongly guided the project towards the key impacts they have decided are most pertinent to them. The reasoning for PEBACC's selections and the problems identified by the communities can be better understood if we recognise the historic changes influencing the current day livelihood schemes. Figure 20 highlights these key events which are strongly related to the agricultural practices that have led to deforestation, which was identified by the community and the project as the key issue to solve.

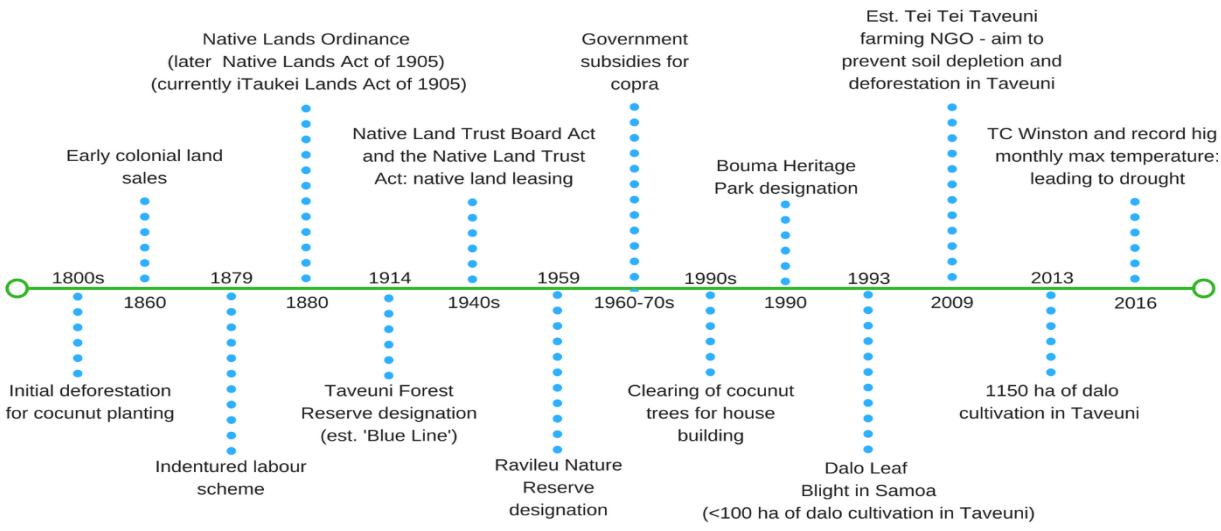

Figure 20 Timeline of key events in Taveuni that have influenced todays livelihood strategies (created from interview data and validation of dates from secondary sources)

As we can see from the figure there has been many events that have influenced the levels of agriculture over time, that have contributed to Taveuni moving away from its virgin landscape to the degraded state that much of the land and ocean finds itself in today. This history is also partly responsible for the variances between land tenure that is relatively unique to Taveuni compared to the rest of Fiji, with large freehold and land leases throughout the island. Many of the participants of this research explained that the government were the ones that had subsidised the cutting of trees for copra in the 1960s and it still the government drives the island to produce more and more dalo, which includes the encouragement of using chemical fertilisers.

There was also an agreement among participants that government ministries commonly conflict with each other's actions and policies. For example, the boundary of the Taveuni Forest Reserve (known as the blue line) is enforced by the Ministry of Forestry who are encouraging reforestation of native forest, but the Ministry of Agriculture (MoA) still pursue high levels of dalo production, which requires the inevitable cutting of trees due to the increasingly degraded and infertile soil, after years of use and chemical spraying. It was further insinuated that the MoA pursue this, as the national government are demanding high yields to support increases in GDP.

In Taveuni PEBACC have involved the community, who have then demanded resolutions to their problems which are not just impacted by current situations, but by residual change and events over time. Which for Taveuni has been a continuum of events that are rooted into land use practice and associated deforestation. This is what the iTaukei communities feel is their greatest vulnerability and it is what they have expressed during the participatory stages of PEBACC. PEBACC have offered solutions to this problem many of which have the potential to be effective EbA options individually (or 'EbA-relevant' as discussed earlier), but even more so as a collective EbA package. This includes the potential to support the communities to adapt to climate change through diversified incomes and increase the resilience of ecosystems at the same time. The challenge for PEBACC is that most of these are solutions that are long-term and won't provide many benefits in the short-term.

Comparatively, if we consider the project in Macuata there was little to no involvement of the community. The significance of this is that PEBACC are trying to implement EbA at a provincial scale, which appears relatively unique compared to the case studies in the literature. There has been claims that EbA is applicable at any scale including

regional and local (Lo 2016). However others have stated that EbA is best implemented at the local or ecosystem level and while CCA itself is seen as location specific requiring local and community level actions (Corfee-Morlot *et al.* 2009). Results from this study show that including the community at larger scales appears to be challenging and certainly questions how many of the characteristics of EbA such as community participation can be appropriately upscaled.

Finally, the results from community interviews and observations show that the attitudes and behaviours of the community are essential for any EbA measure to be effective. There is a real focus at the community level on short-term needs by individuals, who prefer income now over the restoration, conservation or sustainable management of ecosystems over longer-term stability. Any EbA project such as PEBACC clearly must find a way to address this, while they will also have to find a way to buffer the trade-off of the restoration activities (loss of land available for farming) by finding new livelihood strategies, until for example areas of reforestation to offer incomes. This will need a strong commitment by the local community, which again was highlighted throughout the research as incredibly important to any success. A balance between leaders that encourage others and leaders that hold too much control and authority will need to be found, to ensure benefits are shared. Furthermore, to have greater success the project and EbA in general needs to consider how many people are influenced or benefit from the EbA PEBACC's presence e.g. only a select few in each community were aware of the PEBACC project and clearly this will impact the message and the implementation capacity. All these issues, in a sense are related to the need to involve the community at every stage, where this sounds positive and many agree it is essential, in reality time and money mean there is still only a certain section of the community involved.

9.4 How does the PEBACC project differ from other non EbA approaches?

The evidence from this research suggests that it is difficult to differentiate between many of the EbA activities that PEBACC is attempting to implement in Macuata and Taveuni from other more traditional strategies such as EBM, CBNRM, CBA, EBM, ICDP, CLICS etc. In Macuata the focus on supporting an NRMS at the provincial scale does not appear to realistically address the direct impacts of future climate change impacts on ecosystems and many of the elements of EbA defined in the conceptual framework. Even the current NRMS itself states it follows 'an EBM and CBNRM

approach' (Macuata Provincial Office 2014). Reid (2016) identified this as a common occurrence, that historically organisations have attempted to rebrand or refocus environmental efforts by including climate change in their labels, to secure greater levels of funding, that comes with climate change projects. So this begs the question is EbA just a new label or can we actually find projects that fulfil the concepts of EbA. Certainly the point made by Newsham et al. (2018) that EbA is not quite the win-win solution it is claimed to be, may be true here. These authors also highlight the ICDPs, which could be adjudged to very similar to EbA and some parts of PEBACCs aspects too, in the sense both aim to improve livelihoods and conservation at the same time, in fact the use of the RAMSAR designation as an EbA option in Macuata is very similar in characteristics as ICDPs, which in turn could also be called CBNRM.

In Taveuni many of those interviewed have stated that PEBACC are primarily restoring ecosystems so that they provide the natural resources they once did for communities and the increase levels of biodiversity. So, without a direct focus on climate change these EbA options under the conceptual framework would very be like these other strategies. The issue is though, what if these other strategies tackle climate change indirectly by conserving, restoring or sustainably managing ecosystems while increasing socio-economic benefits. Do we class them as EbA or does it then become about if it was intended to support CCA (i.e. part of an overall adaptation strategy)?

Overall, it is difficult to say if PEBACC is EbA, if we follow the conceptual framework and the lens of ALivE and other guidelines mentioned in the literature, then it is likely that much of what PEBACC does display the expected attributes and characteristics of EbA to the full extent. What is worth considering though is whether PEBACC and EbA itself needs to address demonstrate all of these attributes if outcomes are the same, even if the route to get there was different, e.g. focus on non-climatic stressors versus focus on climate change impacts, both will likely create resilience of communities if addressed. Colls *et al.* (2009) detailed that if ecosystem services are made stronger through ecosystem restoration then it is likely that there will be greater livelihood options to that community and as such increase their adaptive capacity to deal with climate change impacts. Furthermore, if an intervention diversifies livelihoods it is likely to move people away from unsustainable resource use, increasing resilience of both ecosystems and communities. This then presents the question of how EbA differs from the many other integrative strategies (EBM, CBNRM, CBA, EBM, ICDP,

CLICS etc.) that have been mentioned in this study and the literature? Furthermore, the real question is whether the extra benefits believed to be associated with EbA are realised?

If we consider though what Doria et al. (2009) consider as successful CCA ('any adjustment that reduces risks associated with climate change impacts') then surely the PEBACC project has the potential to contribute to this, even if for some elements it does not show all the characteristics of EbA detailed by the conceptual framework. Does this mean that the PEBACC project is not EbA? Maybe the PEBACC project as it appears to address climate variability and ecosystem vulnerabilities, such as heavy rain falling on forested areas compared to areas of drought where there is deforestation could be termed under what Doswald et al. (2014) calls EbA-relevant. In relation to the role that non-climatic stressors have in Taveuni, that may not be considered, is that Taveuni might need transformational adaptation to move away from many of the causes of these non-climatic stressors, particularly as these are said to become worse with climate change in the future. Meaning a total shift away from their current status-qou of livelihoods based on fishing and agriculture if a tipping point in the SES (e.g. soil degradation levels) on Taveuni has already been passed or if climate change will leads to its passing, which would require this type of transformational adaptation.

9.5 Limitations

The nature of the research entails there are several limitations to the study. Methodologically speaking there are a few interviewer biases to consider. Firstly, there was the potential to be associated with the PEBACC project due to attendance alongside the project and the PPOA project. This was combatted by ensuring that the participants were aware of non-affiliation with the SPREP, but there is the potential for this to remain to an extent outside of the interviewers control. Secondly, due to the location and rural location of some of the interviews, there was the potential for participants to treat the researcher differently due to his background and difference in culture. As such the research aimed to ensure that participants were not removed from their natural settings. Another issue arises concerning language, although English is defined as an official language and all interviews were conducted in English to high standard, for many of the participants this was not their direct mother tongue, so issues of misinterpretation on either part could be possible. An example of such language barrier could be that in the iTaukei language, there is no such word for ecosystem, so

if the participant does not understand the English concept, it would provide difficulties, but it did not appear to become an issue.

Access provided some issues in the sense that many of those from government were not present or available during the possible fieldwork schedule, which means some interviews did not take, place. Though it was felt that the sampling size of the research was adequate and robust.

As analysis was primarily done using coding, it is clear this process can be subjective to the mindset of the person coding. To prevent this another person was asked to sample code a selection to see if similar codes were produced, this produced no indication of subjective bias.

Finally, mother nature, during the fieldwork Fiji was hit by two sperate tropical cyclones, which fortunately did not incur any injury, but did cause a loss of days in the field and for access to people who became otherwise pre-occupied with these events.

10. Conclusions

In conclusion this study has demonstrated using the case of the PEBACC project in Fiji that in practice under the basis of the conceptual framework using the lens of the ALivE criteria and the conceptual boundaries of the CBD definition of EbA, that the EbA in this case study does not display the full characteristics it is claimed to show. The key characteristic that the PEBACC project appears to lack is a clear focus on current and future climate hazards and changes. This prevents it from addressing the multiple outcomes expected of an EbA approach according to the conceptual framework of this research. This challenges whether EbA can actually produce all the outcomes it claims to for; climate change adaptation; conservation and biodiversity protection; and sustainable development. Although the research does recognise that the PEBACC EbA options for the Taveuni field site, if implemented appropriately, are likely to increase adaptive capacity, build resilience and subsequently reduce vulnerability to climate change. However, due to the long-term aspect and uncertainty of climate change it will be difficult for any EbA defined project to prove that it can effectively achieve the things it so claims to do and display all the attributes that guidelines of what an EbA approach is state.

It shows there are still some key issues to understand when EbA as concept is translated in practice. The concept may be being used inconsistently and there is the potential that many traditional conservation or development organisations are misusing the label to ensure the capture of climate change funding for more traditional strategies or EbA is just a new lens that captures the climate change adaptation element for familiar project topics such as sustainable development and conservation and biodiversity protection. EbA as a concept seems logical, it ticks all the boxes for so many different sectors, but as the past has shown, these approaches often show to be to incur trade-offs or achieve one outcome at the expense of the other

In the case of Fiji and SIDS much of their underlying vulnerabilities can be associated with colonists. Typically, these islands have strong cultural networks which allowed for historically high adaptive capacities. This was further increased by a history of adapting and learning to live with the extremes of island life such as isolation and climatic events, which in turn increased resilience. What is becoming clearer is that the unsustainable resource use which will be exasperated by climate change impacts, can be to some

extent attributed to the historic interaction with “more developed” sovereign states and the dependency on one or two resources. This brings up point that neoliberal capitalism appears to not go in tandem with climate change adaptation and that in fact transformational adaptation is what is required.

In the case of Fiji and the island of Taveuni, historically there was not such a short-term vision and use of cash-crops, while there were little commodities than what was grown on the island. Now though many desire short-term increases of wealth over the long-term protection and spirit of the *vanua*. The PEBACC project as such attempts to alleviate a small portion of these problems for a select number community by aiming to return Taveuni to a state where it can provide many of those ecosystem services that are on the trajectory of being lost. As climate change continues to unfold, then Taveuni will be in better place from a socio-ecological perspective to deal with the subsequent impacts, with these measures in place.

We must consider though, what is the aim of EbA in the first place. Many point to EbA as a win-win solution, but it is clear this is context dependent. Further, we must consider the vulnerabilities that EbA aims to resolve, for example diversifying livelihoods can be strongly equated back to development and poverty, which are intrinsically linked to resilience of SES. These issues can also be strongly tied to ecosystem services and subsequently the health of ecosystems. As one participant of this research said, if the premise of EbA is that healthy ecosystems provide more ecosystem services and support increased resilience. Then we know that greater resilience affords for better climate change adaptation, then why do we not just focus on ensuring our ecosystems are healthy and providing the maximum level of ecosystem services possible and providing the livelihoods people need.

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Appendices

Appendix A Examples from the literature of EbA measures, the impacts they address and their benefits.

Measures	Impacts	Benefits	Paper
Mangrove reforestation and restoration	Extreme weather events (cyclones, flooding, storm surges), sea-level rise	Protect the coast from erosion, inundation and saline intrusion, conservation of carbon stocks, conservation of habitats for species, raw materials, provision of employment opportunities and income generation for local communities, contribution to food security	UNFCCC 2013, Munang 2013, Alongi DM: Mangrove forests: resilience, protection from tsunamis and responses to global climate change. Estuar Coast Shelf Sci 2008, 76:1-13., CBD 2009, Jonkman *et al.*, 2013
Beach nourishment	Extreme weather events (cyclones, flooding, storm surges), sea-level rise	Prevent flooding, reduce coastal erosion	
Artificial sand dunes and rehabilitation	Extreme weather events (cyclones, flooding, storm surges), sea-level rise	Reduce flooding and coastal erosion	Huq et al 2017
Wetland restoration	Water scarcity, water quality	Reduce coastal flooding and erosion, provide water sources, prevent saline intrusion, act as floodwater reservoirs, enhance grazing potential, conservation of wetland biodiversity, maintenance of breeding grounds and stopover sites	Reid 2011, Jonkman *et al.*, 2013), UNDP 2015, Reid 2016, UNFCCC 2013

		for migratory species, reduced emissions from soil carbon mineralization	
Coastal setbacks/buffers	Development	Adaptation to coastal erosion and flooding	**Doswald *et al.* 2014**
Coral reef rehabilitation and restoration		Coral reef ecosystem structural or provisional recovery	Ojea, 2015
Marine protected areas	Human activity	Conserve marine biodiversity and ecological processes, provide space for sustainable use and public appreciation/ education	
Sustainable management of fisheries	Consumption	Reduce of by-catch and destructive fishing practices, ensure future production and food security	Chong 2014
Sustainable forest management and forest conservation	Extreme weather events, soil quality, productivity loss	Climate regulation, buffering of extreme events, maintenance of genetic diversity, recreation, provision of medicinal resources, food, water, raw materials and habitat for species, reduce risks from erosion, landslides and downstream flooding, conservation of carbon stocks, reduce emissions from deforestation	UNDP 2015, Reid 2016, Chong 2014, **Doswald *et al.* 2014, UNFCCC 2013**

		and forest degradation	
Use of indigenous knowledge	Forest management/ crop	Empowerment of IPLCs, potential source of income for IPLCs, reduced emissions from deforestation and forest degradation, conservation of genetic diversity, diversification of food products	UNFCCC 2013, IPCC 2014
Participatory and community-based forestry		Increased livelihood generation and potential revenue from recreational activities	UNFCCC 2013
Sustainable management of grasslands and rangelands	Extreme weather events (drought, heavy rain?)	Enhance pastoral livelihoods, increase resilience to climate-induced drought and flooding, reduce soil erosion, prevent desertification	UNPD 2015, CBD 2016, Chong 2014
Soil and water conservation (SWC) technologies	Soil and water	Prevent erosion, provision of water, food and raw materials, maintenance of genetic diversity	**Doswald *et al.* 2014**
Conservation tillage	Crops	Slow down the water movement, reduce erosion	
Restoration of water sources	Extreme weather events (high temperature, heavy rainfall, drought)	Enhance water provision, recharge ground water, increase soil moisture, increase vegetation, increase agricultural and livestock production, through increased water	Barrow *et al.* (2015); Khanal *et al.* (2014).

		provision, channeling excess water, reduce the impact of landslides by capturing silt	
Integrated nutrient management	Productivity loss	Increase crop productivity, preserve soil productivity	
Crop diversification	Productivity loss	Improve plant productivity, health and nutrient value	IPCC 2014
Conservation agriculture	Productivity loss	Provide specific gene pools for crop and livestock adaptation to climate change	**Doswald *et al.* 2014**
Ecological pest management	Natural systems	Reinforce natural processes of pest regulation, improve of agricultural production	
Agro-forestry	Land use	Increase resilience of agricultural production to climate change, ensure food security	CBD 2009, UNDP 2015, Ojea, 2015
Vegetative erosion control for river banks	Extreme weather events	Prevent/reduce erosion Provide buffer against weather events, provide habitats for species and fresh water, , improve river bank ecosystem function/structure, improve water quality	Huq et al 2017
Rainwater collection from ground surfaces (small reservoirs and micro-catchments)	Extreme weather events (drought??)	Divert or slow down the runoff, store water for use or to improve soil moisture for agriculture	
Alpine ecosystem restoration		Prevent erosion and habitat loss, provision of food,	

		water, medicinal resources, support to agricultural productivity and economic diversification	
Ecosystem restoration		Enhance critical ecosystem services,	(Munang *et al.*, 2013)
Sustainable management of upland wetlands and floodplains		Maintenance of water flow and quality	CBD 2009
Management of fire-prone ecosystems	Extreme weather events (high temperatures??)	safer fire regimes while ensuring the maintenance of natural processes.	IPCC 2014
'Soft' approaches		Improved policies, capacity building, institutional governance, enhanced knowledge	Huq 2017, CBD 2016
Greening of cities	Extreme weather events (high temperatures)	counter the heat island effect	CBD 2016
Protected areas		enhance ecosystem resilience, ensure continued provision of ecosystem services, conservation of habitats	CBD 2016
Payment for Ecosystem Services (PES) schemes		improve livelihood strategies via partnerships and interactions with national agencies, offer alternative income streams, reduce seasonal migration contribute to conservation objectives	Wertz-Kanounnikoff *et al.* (2011), Newsham 2018

Appendix B. Key Concepts

Adaptation: The adjustments of natural or human systems in response to actual or expected stimuli, or its effects to moderate the harm or exploit beneficial opportunities (IPCC 2007a; Ángela Andrade Pérez 2010).

Adaptive capacity: The ability of a system to adjust (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (IPCC 2007a; Ángela Andrade Pérez 2010).

Climate Change Adaptation (CCA): The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or to exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects (Doswald and Estrella 2015; Mimura *et al.* 2014).

Climate change: A statistically significant change in the state of the climate that persists for decades or longer. It can be a change in the mean, extremes or frequencies of climate parameters. Climate change may be due to natural internal processes or external forcings or to persistent anthropogenic changes in the composition of the atmosphere and land use (IPCC 2007a).

Climate hazards: Potentially damaging hydro-meteorological events or phenomena; they can be events that have an identifiable onset and termination, such as a storm, flood or drought, as well as more permanent changes, such as shift from one climatic state to another (UNDP, 2005).

Climate impacts: The effects of climate hazards and climate change on natural and human systems (IPCC 2012; Terton and Daze 2018).

Climate risks: The probability of harmful consequences or expected loss (e.g. death, injury, loss of livelihoods, reduced economic productivity, environmental damage) resulting from interactions between climate hazards, exposure to these hazards and vulnerable conditions (Terton and Daze 2018).

Climate variability: Variations in climatic conditions from long-term means on time scales beyond that of individual weather events. Variability may result from natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external forcing (external variability) (Terton and Daze 2018).

Climate: “Average weather” or long-term averages of climate variables such as temperature, precipitation and wind across decades (usually 30 years) (IPCC 2007a; Terton and Daze 2018).

Ecosystem services: Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fibre; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling (Millennium Ecosystem Assessment 2005).

Ecosystem: A dynamic complex of plant, animal, and microorganism communities and the non-living environment interacting as a functional unit. Humans are an integral part of ecosystems (Millennium Ecosystem Assessment 2005)

Ecosystem-based adaptation (EbA): is an approach that builds resilience and reduces the vulnerability of local communities to climate change. Through considering the ecosystem services on which people depend to adapt to climate change, EbA integrates sustainable use of biodiversity and ecosystem services in a comprehensive adaptation strategy (CBD 2009),

Exposure: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected (Mimura *et al.* 2014).

Livelihoods: The combination of resources (natural, human, physical, financial, social, and political), activities, and access to these that together determine how an individual or a household makes a living. Here we understand livelihoods as the productive activities (livelihood strategies) being undertaken in a particular location including farming, livestock rearing, tourism, etc. (Terton and Daze 2018)

Resilience and resilience thinking: There have been many definitions of resilience used by different authors but the key principles can be linked back to Buzz Holling's description of ecological resilience; 'the ability of systems to absorb change. And still persist' (Holling 1973). Combined with the concept of socio-ecological systems, we see this concept transform to involve the 'capacity for linked social-ecological systems to handle disturbances, while also being able to maintain adaptation, learning and transforming capacities to deal with change and continue to develop' (Folke *et al.* 2011). Resilience thinking and approach utilises this concept by considering these aspects to learn how resilience can be achieved for all, within the planetary boundaries (Rockström *et al.* 2009).

Risk: The potential for consequences where something of value is at stake and where the outcome is uncertain, recognising the diversity of values (Mimura *et al.* 2014).

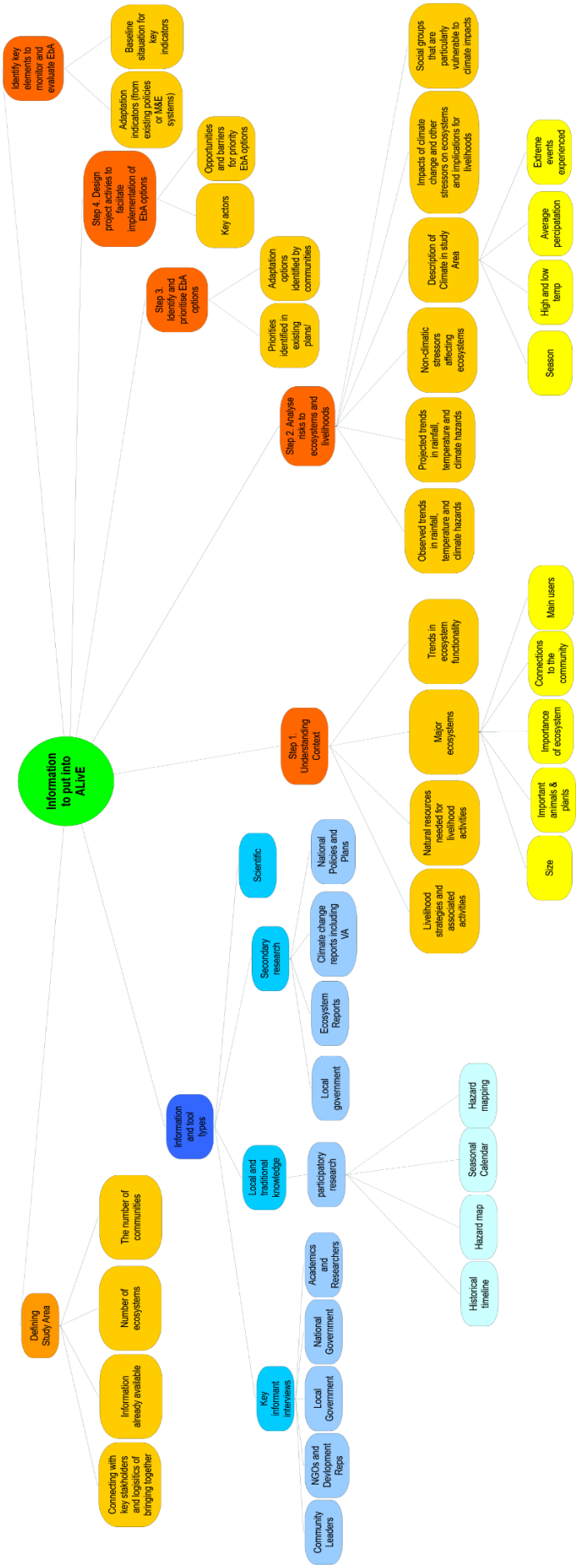
Sensitivity: The degree to which people and assets are affected, either adversely or beneficially, by climate variability or change (IPCC 2007a).

Socio-ecological systems: Social-ecological systems are linked systems of people and nature, emphasising that humans must be seen as a part of, not apart from, nature (Berkes and Folke 1998).

The National Adaptation Plan (NAP) process: emerged from the 16th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Cancun in 2010, where Parties affirmed that "adaptation must be addressed with the same priority as mitigation" (UNFCCC 2010)

Vulnerability: Degree to which a system is susceptible to, or unable to cope with, adverse effects, including climate variability and extremes (IPCC 2007a; Ángela Andrade Pérez 2010).

Appendix C Analysis Criteria



deliver something tangible and visible and your constituents and communities are happier because thats what they also want to see. They feel safe beyond a physical barrier. Whereas EbA approaches are a lot less tangible, long term in nature, and from a political point of view. It's not that attractive.

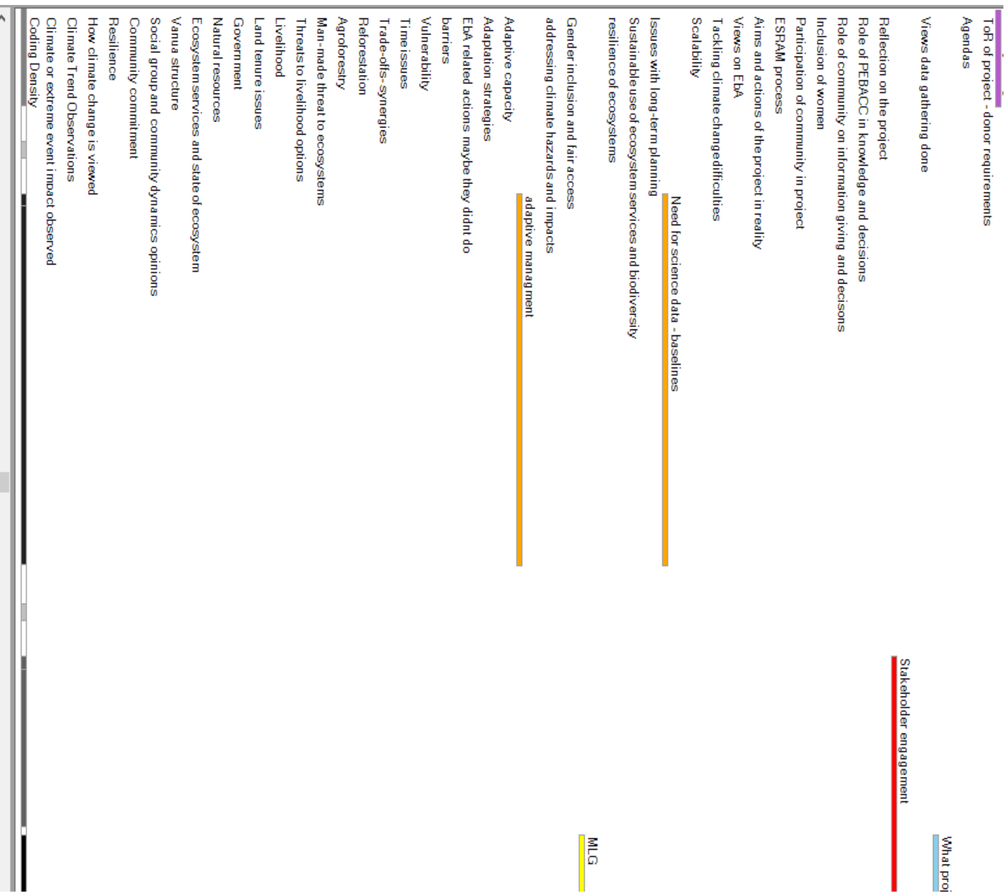
How does the project incorporate adaptive management principles?

[redacted]

implementation will be monitoring of the natural resources. I've mentioned the water monitoring, [redacted] including this monitoring of River Biota as a way of monitoring stream health. [redacted] build the community based monitoring systems. [redacted] project will be going that route to training these youngsters have shown a lot of interests to do the monitoring, giving them the tools and the knowledge to do that and creating a system and I think monitoring is imperative. If you want to have adaptive management, you need to know what's going on so you need to monitor so that will be the first step to get those systems in place and that in itself is a quite a big thing to achieve. set those systems up so that that they are sustainable. communities do them on their own over their own time and use the results to inform the decision making. [redacted] As I said, to inform decision making and data management means taking decisions based on the current information of what's going on and being tuned into the process of deciding in relation to that information.

So how does the project and the EbA options promote multilevel governance?

Um, well. the governance systems are already there in terms of the line departments like fisheries, forestry, agriculture, they have offices in the ground that have their programs and they link to the northern division which then links to the national for them. Um, so those are already there. It's a question of linking in with those to what [redacted] at the community level. The provincial offices already there, they have their role. They have their program they have their conservation officer, um, those again to the provincial office links from the village to the district to the province to the national. [redacted] challenge is to develop and maybe strengthen, I'm hesitant to use the word formalized, but [redacted] may need to formalize to a certain degree these watershed management groups that we're trying to promote, um, and have these link more



Appendix D. The Traditional Tua

Ecosystem functions and services from ridge to reef

Stakeholders identified 12 ecosystems corresponding to traditional Tua, which are based upon social, ecological, elevational, and topographic features. Working in watershed groups, stakeholders identified and defined ecosystem functions and services provided by each of the traditional Tuas below:

VEIKAULALAI | CLOUD FOREST
Cloud-water interception, source of water, chiefly location

VEIKAULOA | DEEP FOREST
Rain interception, tourism (hiking, bird watching)

QAKILO | INTER-VALLEYS
Protection from landslides, wind, hunting, erosion protection, water infiltration, spring water

TOKAITUA | INTERMEDIATE RIDGE TOPS
Hunting (pigs, chickens)

TEITEI + VOAVOA | FARMS + FALLOW AREAS
Food for village and commerce, sustainability

SAURUSA | EMPTY SPACE
Burial areas, expansion, food and nourishment, firewood, construction material, light timber production, material for thatching

KORO | VILLAGES
House and home, dwellings, community, schools, church, commerce, rest and relaxation

MATAVURA | COASTAL STRAND & MANGROVES
Protection, filtration (protects reef), buffers reef from runoff, access to the sea, gateway to the sea, tourism, family area

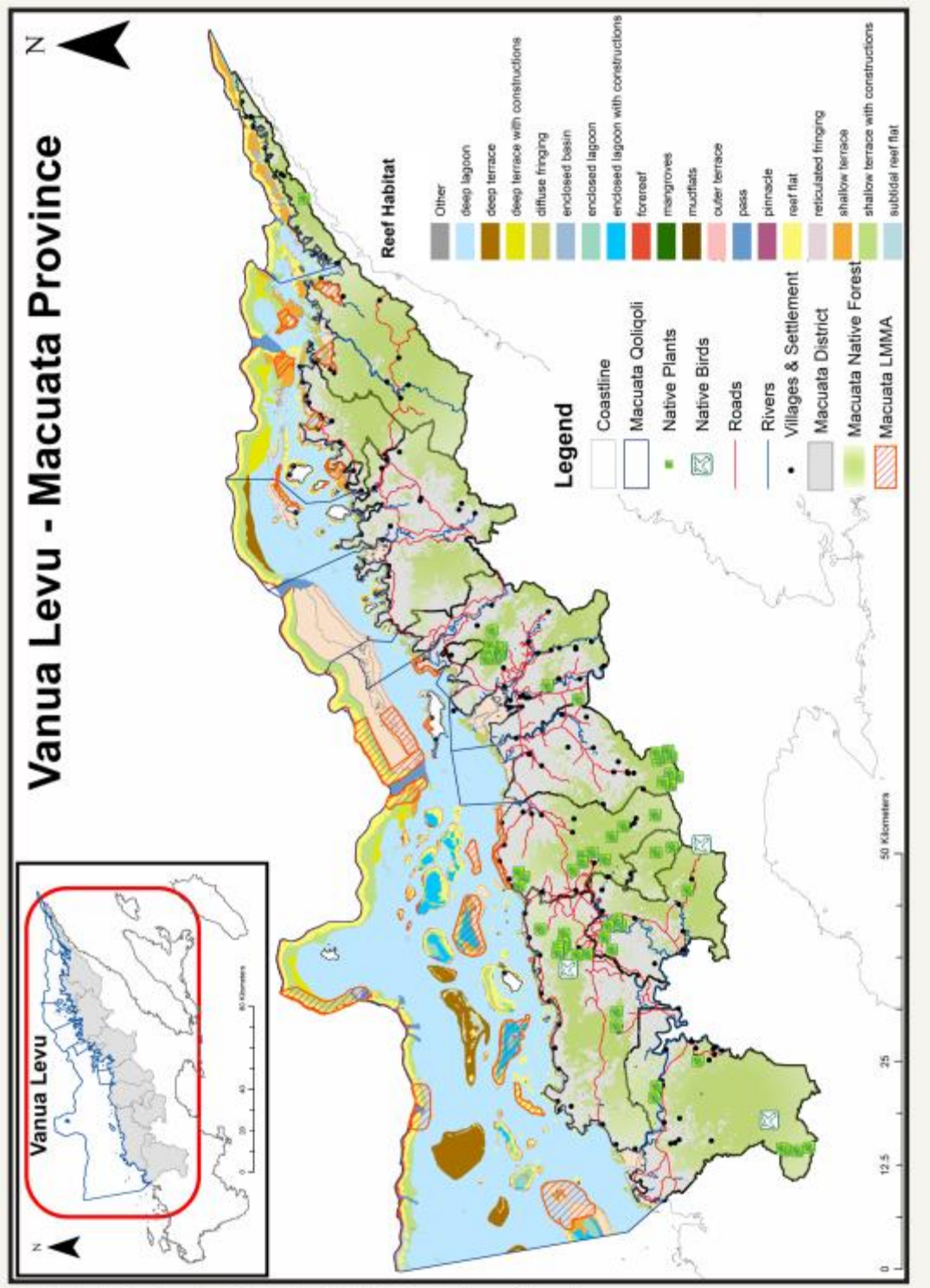
SAWANA | INTERTIDAL AREA
Food, fishing grounds

CAKAU | CORAL REEF
Food, fish, protection from storms, nursery area, tourism (diving) income

WAITUI | DEEP SEA
Food, income, air, wind, storms

(Secretariat of the Pacific Regional Environment Programme (SPREP) 2018b)

Appendix E. Map of Macuata Ecosystems



Map illustrating the important biodiversity habitats for the Province of Macuata
Source: Wildlife Conservation Society Fiji, 2013.

Appendix F. Macuata EbA Options Details

EbA option 1: Integrated Natural Resource Management Strategy: Update Toward Resilience

1. Identify consultant or partner organization for contract.
2. Form a Multidisciplinary Task Force (MTF).
3. Conduct capacity building and technical workshops for the MTF and key stakeholders to define the scope of the review.
4. Identify a Plan of Action (PoA) that develops the NRMS.
5. Conduct “Pilot” of the NRMS for the Qoliqoli Cokovata Strategy.
6. Implement the PoA for the remainder of Macuata Province.
7. Seek Government endorsement of the updated Macuata Province NRMS and determine long-term role and funding of the MTF.
8. Outline strategy for expansion of NRMS to the whole of Vanua Levu at the Divisional level, as “next steps”.

EbA option 2: Ramsar Designation & Management Plan: Qoliqoli Cokovata, Great Sea Reef

1. PEBACC coordination of linkages with the NRMS EbA (option 1).
2. PEBACC Coordination with Qoliqoli Cokovata Management Committee to bring forth support where it is most needed, identify matching funds, and gaps in information, logistics, or other needs. Implementation of the GSR PoA.
3. Support designation of Qoliqoli Cokovata as a Ramsar site through PEBACC coordination of logistics, political assistance and communications. This includes engagement and support by PEBACC and SPREP to facilitate the National Cabinet endorsement process. Draft GSR Management Strategy.
4. Support the development of a Plan of Action to develop a management strategy for the Great Sea Reef (GSR).
5. Support the development of the Qoliqoli Cokovata Management Strategy as a Pilot strategy through technical support, stakeholder engagement, logistics, political assistance and communications.
6. PEBACC support with the National Committee and Cabinet to monitor, implement and evaluate the overall strategy through communications and logistical support.

Appendix G Taveuni EbA options as selected by the PEBACC project

Name	Description	Delivered Activities	Benefits with Action
TAVEUNI WATERSHED COORDINATION NETWORK	A coordination effort to a provide a structure for Taveuni watershed groups to accomplish two major goals: (1) support a coordinator to work with their community to be the point of contact and liaison officer for their watershed group, and (2) attend quarterly meetings to further adaptation Taveuni-wide, report progress and challenges with implementation, and have a nexus for centralizing the distributed EbA participation island-wide.	• 10 Watershed coordinator positions • Quarterly meeting support • Coordination logistics	• Supports engagement of coordinators to overall Taveuni EbA goals • Allows for watershed groups to work together to achieve similar goals • New projects can be vetted with Taveuni watershed groups in open forum
YOUTH STEWARDSHIP PROGRAMME WITH "LIVING CLASSROOMS"	This EbA meets a national need for improving knowledge and the human connection with Fiji's ecosystems, particularly youth. The main goal is to initiate a multi-year curriculum in schools to build institutional capacity in awareness and stewardship of ecosystem and ecosystem services. This project seeks to initiate and build a programme that involves an active and rich learning atmosphere that spans all ages with a pedagogy that incorporates a range of science,	• Travel & logistics support for workshop • Develop school curriculum with materials • Establish plant nursery in a school • Purchase of measuring equipment, computer • Purchase of ~200 trees to plant and care for	• Building institutional capacity for stewardship and sustainability • Active learning with highly visible demonstration projects at local schools

	traditional and community-based practices to foster ecosystem stewardship. This programme is designed to be integral to the implementation of PEBACC activities. Students are encouraged to participate in ground-based activities to learn from their communities' efforts to implement EbA activities. Similarly, students will be engaged to create a "living classroom" at their school to become caretakers of native plants from seed to garden. Older students will have the opportunity to teach younger students to build strong capacity in information and exchange. Students will have exposure in data gathering during PEBACC monitoring of ground-based implementations in their communities, by assisting PEBACC in the inventory of plantings, seedlings, and seed collections to measure progress.		
TRAINING: PLANT NURSERY CONSTRUCTION, OPERATION & MANAGEMENT	The distribution of low-cost and low technology nurseries is a principal dependency to implement the PEBACC watershed-level EbA activities. Guided training is needed to assist watershed groups with the best option(s) to suit their needs and	• Conduct training to build low-cost nurseries with experts • Identify appropriate locations and needed resources for communities	• Local capacity to grow trees to provide nursery stock for communities • Lower barriers to implementing tree-planting EbA activities • Will ease pressures and costs for

	to train in the construction and management of the nursery process, as well as nursery-related issues associated with virus, disease, and maintaining nursery health. Focused training should be on the successful seed and germplasm sources and propagation of plants that meet the EbA prescriptions to be implemented by the watershed groups (agroforestry species, native trees, commercial hardwoods, agricultural enhancement crops). This provision for training & guidance will require an outside specialist and additional involvement from Taveuni-based nurserymen to work with representatives from watershed groups, in skill building and "tricks of the trade". Guidance and site criteria will need to be identified for the construction of nurseries across the island by watershed groups (13 in total). Nursery design is budgeted to build small-scale nurseries that are of durable construction, approximately 2x10 m in size or cost appropriate, to accommodate a targeted ~600 finished trees per year. Nursery deployment be done in 12 locations to support watershed activities, and	• Construct 12 nurseries in communities & 1 at school • Identify propagation and nursery techniques	sourcing plant material Provides means for local watershed groups to implement locally

	an additional to service the Youth Stewardship Programme "Living Classroom".		
TRAINING: NATIVE PLANT SEED COLLECTION TO ENHANCE BIODIVERSITY	The EbA implementation portfolio presented as this document relies heavily on communities to collect seed, grow and plant trees and alternative plants to conventional agriculture to favour other ecosystem services. As such, there is a critical need to source plant germplasm that represents the genetic and species diversity of Taveuni Island, especially to capture ranges in the timing and tolerances of plants to adapt to climate change. There is opportunity with the PEBACC project to support a unified system of plant germplasm collection that is incorporated into the EbA projects. This can serve as quality assurance to ensure that the genetic and species diversity of Taveuni is represented, and that future "bottlenecks" arising from environmental conditions (e.g. climate change and extremes) or	• Training to gather seed stock from local native forests as module to other workshops • Create network on Taveuni to distribute seeds and plants to aid reforestation • Record keeping system to catalog biodiversity	• Collection of germplasm used for reforestation actions • Increases value of native forest areas as sources of seeds • Provide a steady supply of seed stock • Conservation of biodiversity

	loss of resistance to pest and diseases are minimized. The objectives of this EbA are to convey and reinforce the importance of species and genetic diversity in seed and plant collection, to form a method of recordkeeping to document source material, and to provide a method for watershed groups to trade germplasm stock to best accomplish island-wide objectives.		
AGRICULTURAL IMPROVEMENT & DIVERSIFICATION TRIALS (WITH TRAINING)	This project aims to build upon the body of work and support on-going collaborative efforts on Taveuni conducted to address soil fertility, resource intensive agriculture, gaps in income generation, and diversity of crops to improve sustainability goals. A key goal of this project is to increase crop diversity and timing to test replicated, repeatable and realistic treatments. Funding for this project is currently allocated toward facilitating organizational tasks, with half of the funds to support on-the-ground implementation. Coupling treatments to include Agroforestry	• Conduct field trials for different cropping systems, including agroforest options • Build on body of work with experts in workshop • Support local NGO or graduate student • Materials & supplies for implementation for ~25 ha	• Alternatives to intensive dalo farming with indiscriminate fertilizer use • Slow current trajectory of soil degradation • Guide future treatments • Off-season farming options

	options, would create natural synergies to minimize organizational costs. Goals for the design would be to generate measurable data over a 2.5-year period as to the costs and benefits associated with different treatment designs across Taveuni. Some support is provided for a graduate student or local NGO to help guide this project, conduct soil measurements, and other necessary information relevant to the project design. This project does not fully fund a coordinator support mechanism, rather a means to provide a pulse of funds to address agricultural enhancement issues among the community of farmers, but careful consideration of funds can leverage other on-going projects and programmes to feed into meeting shared goals.		
TRAINING: AGROFORESTRY PRACTICES & MANAGEMENT	Agroforestry options are generally prescribed in lower and mid-elevation deforested areas to serve an overall function of providing diversified and high-value income streams, improve soil health, increase biodiversity and watershed	• Workshop and expert support on food-based tree crops and mixed applications • Finalization of community site treatments • Tree and materials	• Tangible training and on-the-ground support to implement pilot projects • New market exploration • Slow deforestation and degradation of forestlands and soil resources

	function, and assist as a precursor to native forest regeneration or plantation management activities. Training and assistance is needed to provide watershed groups with selecting and implementing useful strategies on the landscape to meet landowner objectives, as well as identifying potential markets for the different products. A consulting expert is required to initiate trials and provide guidance to landowners. This project can also be coupled with the agricultural enhancement project outlined in to maximize efficiencies with travel, workshop timing, materials presented and experts attending.	purchase for 9-10 ha	
TRAINING: PLANTATION MANAGEMENT & CERTIFIED SUSTAINABLE PRODUCTS	The purpose of this project is to provide technical expertise, training and opportunity for communities to implement plantation management prescribed projects within their watersheds. This project is concurrent with seed collection and agroforestry project trainings (Sections 3.4 and 3.6), and is dependent upon the establishment of nurseries (Section 0). Careful management of this project with the	• Training on mixed species and native hardwood plantations • Expansion of existing forest fragments to obtain many ecosystem benefits • Development of sustainably certified wood products	• Long-term increase in forest cover and functions • High-value investment for communities through time • Aides in restoring native forest through out-planting and creating shade • Sustained income

	implementation of the above will capitalize on synergies in both time and cost, and should be considered carefully by PEBACC during implementation. Plantation management training is required to implement mixed and native species plantations with access to markets and expertise. An industry expert consultant with strong ecological background will be required to spearhead this initiative. Inclusion of certified sustainable practices through internationally-recognized programmes (Smartwood/ Forest Stewardship Council) will increase the ecological benefit to Taveuni as well as open wood products to high-value markets. Training in different techniques including ground preparation, species selections, early cultivation (tipping, weed control, thinning), harvest methods, certification, and markets should be explored in this project, providing capacity to watershed group participants across Taveuni. Ecological applications of plantation management to enhance and enlarge native forest fragments (e.g. "outplanting" and fertilizer enhancement), while gaining some	• Higher-value product production beyond sale of whole logs	

	economic value, are also techniques that should be considered in this training. Enhancement of biodiversity, increased forest cover, and improved watershed function (e.g. water cycling) are the desired outcomes along with long-term sustained income sources for the community. Value-added products including crafted items, oils, and non-timber forest products are all considerations for long-term and sustainable income streams. National policies in place, such as the Ministry of Forestry REDD+ programme, and a robust timber industry are natural synergies where PEBACC can obtain expertise and support ongoing efforts by including watershed-level activities on Taveuni.		