

THE LIMITS TO ADAPTATION IN THE CONTEXT OF CLIMATE SECURITY IN THE PACIFIC

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EXECUTIVE SUMMARY

As the speed and magnitude of climate change continues to increase, countries of the Pacific are likely to face a range of barriers and limits to adaptation that undermine efforts to promote security in the face of climate change. This deep dive assessment examines whether there are limits to adaptation by society beyond which politically or socially undesirable outcomes might occur in the overall context of climate security discussions in the Pacific. It seeks to make the connection between climate security and climate change adaptation, and particularly how the barriers and limits to adaptation may contribute to threats to peace and security in the region. This deep dive assessment provides what is perhaps the first attempt to consider barriers and limits to adaptation in the context of climate security in the Pacific.

Barriers refer to restrictions or constraints on adaptive capacity and the range of adaptation options available but are nonetheless resolvable. Limits on the other hand represents thresholds beyond which adaptation is no longer available. A key challenge for the Pacific therefore is whether these barriers can be overcome or if they will at some point become insurmountable limits to adaptation. Barriers and limits to adaptation are highly context specific and the way barriers and limits are framed in the Pacific often leads to an over-emphasis on ecological limits as drivers of vulnerability and adaptation. However, a range of social, economic and political barriers and limits are likely to be more significant in determining vulnerability and adaptation. In particular, barriers related to institutions, governance, finance and knowledge which are underpinned by economic dependencies and path dependencies, are the most crucial challenges for climate security in the Pacific. In this context, the current landscape of institutions and mechanisms that exist to address climate change adaptation are not of the scale to match the magnitude of the threat to the climate security ambitions of Pacific Island Countries (PIC), in particular atoll nations like Tuvalu, Kiribati and the RMI. Furthermore, understanding the drivers of barriers and limits to adaptation is crucial for providing entry points for preventing and addressing them. Key drivers of barriers to adaptation in the Pacific include the distribution and levels of financing for adaptation, inequities in power between PIC and donors, and institutional time and path dependencies.

Where barriers persist over time and/or are resistant to change, then they may lead to politically and socially undesirable outcomes for the Pacific Islands region. While the evidence on barriers and limits continues to grow, there is much less evidence on opportunities and policies for overcoming them. Consistent with the evidence that barriers and limits to adaptation are highly context specific, there is no one-size fits all approach to overcoming barriers and limits. Having explicit, high-level adaptation goals alongside innovate and inspired leadership to address institutional path dependencies are key to overcoming barriers and limits to adaptation. Transformational adaptation is increasingly being called for to not only meet the magnitude of climate change impacts, but also as an approach to effectively address barriers and limits to adaptation.

Based on the assessment and the case studies considered in the report, the following recommendations are made:

1. Given barriers and limits to adaptation are context specific, it is recommended that relevant agencies of the Council of Regional Organizations in the Pacific (CROP) and/or International Organizations undertake further research to systematically identify barriers and limits in the climate security context of the Pacific. In particular, research should seek to identify a range of barriers and limits and options for overcoming barriers to adaptation that relate to explicit climate security goals of the Pacific. Doing so will provide evidence to support national governments to develop appropriate strategies and policies for overcoming barriers and limits, as well as support targeted diplomatic strategies aimed at addressing institutional, governance and financing barriers and limits to adaptation at the global level.

2. The increasing speed and magnitude of climatic change necessitates a shift from incremental approaches to adaptation to transformational adaptation. Evidence indicates that transformational adaptation actions are low in Pacific and that significant challenges exist for countries to reorient planning in such a manner. To help address this challenge, research suggests that engaging in the use of scenarios and foresight approaches can catalyze robust dialogue on transformational adaptation as well as barriers and limits to adaptation (Hadarits et al, 2017; Becker, 2017; Stege 2018). Therefore, it is recommended that relevant CROP agencies and development partners:
 - a) Implement a series of robust, scenario-based dialogues at regional and national levels. Such dialogues should aim “to push the envelope of thinking about adaptation, exploring all ideas and possibilities for innovative and creative solutions and implementing strategies that build on evidence of success and create hope for present and future generations” (Barnett, 2017, p. 11); and,
 - b) Support PIC to identify transformative adaptation pathways, map the transformative potential of adaptation actions, and link their nationally determined contributions with long-term strategies (Dixit et al, 2022). Such efforts should be directly linked to explicit climate security goals and the barriers and limits to adaptation they face, rather than working off generalized climate risks and priorities.
3. Access to financial resources necessary for implementing adaptation strategies at the scale required to meet the magnitude of climate change impacts in the Pacific is a key barrier for PIC. This barrier is likely to worsen with future levels of assistance predicted to decline as the costs of domestic adaptation in donor countries rises (Nunn and Kumar, 2019). It is recommended that Pacific Island Economic Ministers commission the Pacific Islands Forum to undertake urgent research on innovative economic opportunities for supporting the implementation of large-scale transformational adaptation strategies in support of Pacific climate security goals. Potential options for exploration include debt-for-climate swaps (Thomas and Theokritoff, 2021), intermerate accounting based on environmental-credit swaps¹, and the pooling of resources by atoll nations.
4. Atoll nations of the Pacific are most vulnerable to the impacts of climate change. Tuvalu, Kiribati and the RMI have all specified climate security goals related to the protection of sovereignty, habitability and cultural identity. It is recommended that the governments of Kiribati, the RMI and Tuvalu re-institute a regular Pacific atoll nation dialogue with the aim of sharing experiences and exploring opportunities for joint actions in pursuit of shared climate security goals. Where appropriate and agreed to by governments, the dialogue process and any agreed upon actions should be supported by regional organizations and development partners.
5. Theories of climate justice advise that choices made by people and communities impacted by climate change over what to protect and what to let go should be made explicit and should be the subject of deliberation by stakeholders (Gross 2014). Therefore, it is recommended that relevant CROP agencies and/or international organizations, develop guidelines to support PIC governments to undertake inclusive and deliberative dialogue processes with communities impacted by climate changes aimed at identifying potential trade-offs between adaptation goals, the distribution of outcomes and what valued assets will be lost (Barnett et al., 2015).
6. It is recommended that the International Organization for Migration (IOM) endeavor to disseminate the findings of this deep dive assessment to help broaden awareness and discussion of barriers and limits to adaptation across the Pacific region. Dissemination may include shorter and targeted policy briefs as well as dialogues or workshops at regional and national levels.

1 https://issuu.com/wordsbydesign/docs/ecological-economic_accounts_final_version

1. INTRODUCTION

It is increasingly recognized that there may be particular limits beyond which adaptation to climate change will no longer be possible (Adger et al, 2009). Despite COP27 reaffirming commitment to limit global temperature rise to 1.5C, the United Nations Environment Program's Emissions Gap Report (2022) concludes that there is 'no credible pathway to 1.5C in place'. The importance of limiting global temperature rise to 1.5C for the Pacific is well known, with global temperatures above this threshold raising the likelihood of exceeding tipping points which could make many low-lying islands uninhabitable (Pringle, 2018). With emissions gaps persisting (IPCC, 2022) and agreements on mitigation efforts remaining contested, enabling opportunities for adaptation is now more crucial than ever for Pacific Island Countries (PIC) to meet their climate security ambitions.

Yet, some PIC are amongst the most aid dependent and lowest lying countries in the world. Combined with a range of other socio-economic vulnerabilities, these factors create a context within which significant barriers and limits to adaptation can emerge. According to the Intergovernmental Panel on Climate Change's (IPCC) Special Report on the Ocean and Cryosphere in a Changing Climate, limits to adaptation will be reached in small island states and low-lying coastal zones by the end of this century across all emission scenarios (IPCC 2019). Some of these limits may be well known as a result of various scientific predictions made by IPCC reports, such as hard ecological limits associated with loss of coral reefs or the extinction of species. Others are perhaps less well known and are entrenched in social and political processes that can be difficult to untangle. Developing the capacity to understand and proactively address a range of potential barriers and limits will be vital to supporting effective and sustainable adaptation in PIC.

1.1 PURPOSE AND SCOPE

The overarching question driving this deep dive assessment is whether there are limits to adaptation by society beyond which politically or socially undesirable outcomes might occur in the overall context of climate security discussions in the Pacific. While attention to the concept of limits to adaptation has grown in policy and research communities over the past decade or more, it remains a relatively unexplored concept in the context of climate security in the Pacific Islands region. Furthermore, despite ongoing research on limits to adaptation, it remains a conceptually complex issue and its operationalization within policy remains a challenge (Klein, 2014). Therefore, this deep dive assessment seeks to make an initial offering into what should be an ongoing conversation about what limits to adaptation might emerge in the context of climate security in the Pacific, why they emerge, and how they can be addressed. Within this context, the assessment seeks to achieve the following:

- Briefly summarize research on the concepts of barriers and limits to adaptation;
- Analyze how the framing of barriers and limits can influence perceptions of vulnerability and options for adaptation;
- Examine how and why barriers and limits to adaptation emerge, in particular looking at key drivers in the Pacific Islands region;
- Explore options for addressing barriers and limits to adaptation, including the concept of transformational adaptation as a potential approach for overcoming barriers and limits to adaptation; and,
- Through the use of case examples, apply the findings from the points above to the climate security context in the Pacific.

Where possible, research and examples from the Pacific Islands region have been used to reinforce key concepts and help contextualize it to the Pacific context. It should be noted that while barriers and limits can emerge from processes occurring across scales, from communities to global, the current assessment focuses on those operating at regional and global levels. There are several reasons for this. Firstly, there is growing evidence that processes to develop deliberative and inclusive adaptation pathways that are responsive to the diverse values within communities offer a feasible, low cost and effective policy option

for addressing barriers and limits to adaptation at a local level (Barnett et al, 2015; Graham et al, 2014). Secondly, evidence suggests that financial, institutional and governance barriers to adaptation are prominent in the Pacific, which are consistent with barriers operating at a global scale (Thomas et al. 2021). Furthermore, these barriers often arise in the context of attempts at more extensive forms of adaptation, which are becoming increasingly necessary for PIC to consider as the rate and extent of climate change impacts increases.

Overall, the assessment aims to move beyond simply providing a descriptive account of barriers and limits to adaptation as they apply to the climate security context in the Pacific to challenge our thinking on these issues. Much remains unexplored in this assessment and therefore it is hoped that the report can be used to initiate and guide further discussion, debate and research on barriers and limits to adaptation in the context of climate security the Pacific region and most importantly the strategies and opportunities for overcoming them.

1.2 APPROACH/METHODOLOGY

The data informing the assessment was derived from a review of relevant literature and key informant interviews (see Annex 1 for list of key informants). There is a vast and expansive literature on barriers and limits to adaptation, the complete assessment of which is far beyond the scope of this deep dive assessment. For this assessment, attempts have been made to summarize key concepts, issues and debates deemed relevant for thinking through the issue of barriers and limits to adaptation in the Pacific Islands region. The literature reviewed included academic journal articles; IPCC reports, in particular AR4, AR5, and AR6 as well as special reports on 1.5C and Oceans and Cryosphere; and relevant organizational reports, briefs, speeches, and declarations.

A limit (or perhaps rather a barrier) to the current assessment was that it was undertaken in the weeks leading up to and including COP27. This meant that many of the key actors from Pacific Island Governments and regional organizations were unavailable for consultation during the course of the assessment. Nonetheless a limited number of key informant interviews were undertaken to help expand on the evidence from the review of literature and contextualize it further to the Pacific Islands region.

1.3 AUDIENCES FOR THE REPORT

In the first instance, this deep dive assessment is intended for governments, non-government organizations, regional organizations, and climate change activists from across the Pacific Islands region. It is hoped that the assessment will provide the basis for increasing attention to barriers and limits to climate change adaptation in national and regional plans and strategies. The report also seeks to help inform political positions and advocacy by Pacific governments, regional political groupings, non-government organizations and climate activists with the aim of overcoming key barriers and limits to adaptation and the factors that drive them. More specifically, the outcomes of the deep dive assessment could be used to help inform climate security assessments currently being undertaken in the region, as well as ongoing efforts to revise and develop National Adaptation Plans.

Secondly, the report targets international and regional organizations working with Pacific Island Countries on adaptation to climate change. In this regard, it is hoped the report can inspire self-reflection on the roles that institutions and mechanisms for supporting climate change adaptation may have in perpetuating and/or helping to address certain barriers that constrain the necessary scope and magnitude of adaptation required to meet the climate security goals of Pacific Island Countries. International and regional organizations can also play an important role in disseminating and communicating the findings of the assessment and implementation of its recommendations.

2. BARRIERS AND LIMITS TO ADAPTATION

The aim of this section is to discuss more broadly the different types of barriers and limits to adaptation, why they may emerge, and what can be done about them. In particular, a distinction is made between barriers and limits and how the framing of each impacts on perceptions of vulnerability and possibilities for adaptation. The section seeks to highlight the key barriers and limits for the Pacific. Following a discussion on the types of barriers and limits that might emerge is perhaps a more crucial consideration of the drivers of barriers and limits, or how and why they emerge. Finally, this section concludes with a discussion on transformational adaptation as an approach to overcoming barriers and limits.

2.1 WHAT ARE BARRIERS AND LIMITS TO ADAPTATION?

Research on limits to adaptation has grown since the IPCC first made brief reference to the barriers, limits and costs preventing more extensive adaptation actions, while acknowledging there was no clear understanding of the issue (IPCC, 2014). Since then, evidence on barriers and limits remains somewhat uncertain, and research has tended to focus more on barriers and constraints than on the limits to adaptation (Thomas et al 2021). One issue complicating an understanding of barriers and limits to adaptation is that these concepts have often been used interchangeably and they can also be difficult to distinguish from similar concepts such as constraints, obstacles and loss and damage (see table 1). For example, the IPCC has discussed adaptation constraints, obstacles, barriers and limits, while noting that barriers are synonymous with constraints (Dow et al, 2013). The Small Islands chapter in the IPCC's fifth assessment report briefly examines barriers, constraints and limits in these countries but does not explicitly differentiate between these concepts (Robinson 2018). Barriers and soft limits can appear to be indistinguishable, with both being socially determined and able to be overcome with sufficient willingness and effort.

Therefore some researchers simply distinguish between barriers and limits rather than considering so called hard and soft limits. This approach is used in the Fiji National Action Plan (Government of the Republic of Fiji, 2018) which refers to barriers as restrictions on adaptive capacity and the range of adaptation options available for implementation, but that are nonetheless resolvable; while limits are defined as thresholds which if exceeded result in irreversible changes for which adaptation is no longer an option. Loss and damage is another concept that appears to have become synonymous with limits to adaptation, with both referring to the point at which the things people value most can no longer be secured through adaptive actions (Roberts & Pelling, 2019). This assessment report follows the example set by Fiji in using barriers and limits to distinguish between those constraints which can be overcome (barriers) and those for which options for adaptation no longer exist (limits).

Table 1: Defining key terms

TERM	DEFINITIONS
Limits	The points at which adaptation actions fail to protect things that stakeholders value (Barnett et al 2015). Limits to adaptation emerge when an actor's objectives and the things they value (or the needs of a natural system) cannot be secured from intolerable risks through adaptive actions (Klein et al 2014; Barnett et al 2015).
Barriers	Obstacles or constraints that make it harder to plan and implement adaptation actions or that restrict options but that nonetheless can be overcome with concerted effort, creative management, changed ways of thinking, political will, and re-prioritization of resources, land uses and institutions (IPCC AR5; Barnett et al 2015; Moser & Ekstron 2012).
Soft Limits	Socially determined limits where options for adaptation may exist but are currently not available, and include technological, social and economic limits (IPCC 2022).
Hard Limits	When no adaptive options exist for species, communities or ecosystems to adjust to climate change (e.g. coral reefs affected by ocean warming and acidification).

TERM	DEFINITIONS
Loss and Damage	The economic and/or non-economic consequences of extreme weather events and slow-onset climatic changes that go beyond what people can adapt to, or when options exist but a community does not have the resources to access them (SPREP; Warner et al 2012; IPCC AR6).
Climate security	Climate security refers to the security risks (often defined broadly) induced, directly or indirectly, by climatic changes. In this context, climate-related change amplifies existing risks in society. While climate change is increasingly recognized as a key factor in global insecurity and conflict, the link between climate change and conflict is indirect, non-linear and multi-dimensional (adelphi, 2020).

(a) Types of Barriers

Most research on barriers to adaptation has considered the type of barriers that exist or may potentially arise (Barnett et al 2015; Biesbrock et al 2013). This has led to the development of various typologies of barriers to adaptation. For example, Klein et al (2014) provide a typology of barriers which include knowledge, awareness, technology, the physical environment, economic factors, human resources, socio-cultural factors, and governance and institutional processes. Others have also added the importance of socio-political barriers (Eriksen et al 2015; Bordner, Ferguson & Ortolano 2020). The large majority of evidence on barriers to adaptation emphasise inadequate governance and institutional structures, inequitable distribution and/or lack of access to financial resources, lack of information, and socio-cultural norms that constrain implementation of adaptation options (Miller et al. 2017; Biesbroek et al. 2013). For example, Oberlack and Eisenack (2018) analyzed 26 case studies of collective adaptation actions in river basins and found that problems in collective action arise primarily from particular features of pre-existing institutions, including path dependencies, uncertainty and coordination gaps. However, barriers to adaptation differ across scales and are highly context specific (Biesbroek et al. 2013; Thomas et al. 2021). For example, finance, governance, policy and institutional constraints are more prevalent globally, while households typically face economic, informational and sociocultural constraints (Thomas et al. 2021). The influence of context emphasizes that barriers are “relative to the specified adaptive actions that are considered, to the actors that may exercise them and to the specific situation in which they may be taken” (Eisenack et al 2014: 868).

In Small Island Developing States (SIDS), research indicates that planned adaptation initiatives primarily face institutional and economic barriers to implementation (Robinson 2018). In the Pacific Islands region, prominent barriers include access to finance, institutional and governance factors, and access to knowledge. The economic dependencies of Pacific Island states means that economic barriers to adaptation are an ever present and ongoing issue. For example, Barnett (2008: 45) claims that in Niue international aid is “the most critical factor in the availability of finance for adaptation to climate change, even if it constrains the way the money can be spent”. The Solomon Islands has identified institutional (e.g., staff turnover rates, unclear roles and responsibilities) and knowledge development as two key barriers to adaptation (Solomon Islands 2021). In examining the root causes of issues and concerns relating to the management of climate change risks, the government of Kiribati identified a range of governance, institutional and legislative issues; a lack of data, knowledge and awareness of the science of climate change and vulnerability; and insufficient funding (Government of the Republic of Kiribati 2016). The Fiji National Action Plan includes a section on adaptation barriers which considers governance and institutions; economic barriers; information, knowledge and technology and natural and biological barriers and limits (Government of the Republic of Fiji 2018). Interesting to note here is the term ‘limits’ is used only in the case of natural and biological adaptation, thereby implying that the others are considered to be barriers and therefore mutable.

(b) Types of limits

As with barriers, categories of limits to adaptation have been proposed. These typically include, (1) physical and ecological; (2) technological; (3) social; and (4) economic (see table 2). Types of limits have been further divided into either ‘hard’ or ‘soft’ limits. Soft limits refer to socially determined limits

where options for adaptation may exist but are currently not available, and include technological, social and economic limits (Klein 2014). According to the IPCC (2022), some soft limits to human adaptation have been reached but can be overcome by addressing a range of financial, governance, institutional and policy barriers. Chrichton and Esteban (2018) found evidence of soft limits in Samoa arising from the increasing costs of new defenses and engineering solutions in response to previously failed attempts at coastal adaptation.

Table 2: General categories of limits to adaption²

LIMIT	DESCRIPTIONS
Ecological	Natural adaptation limitations, related mainly to the natural environment, ranging from ecosystem thresholds to geographical and geological limitations, include ecological and physical limits. There is growing evidence that the resilience of socio-ecological systems will be influenced by both the rate and magnitude of change and the fact that some systems may not be able to adapt to changing climate conditions without having their functional status and system integrity changed dramatically. Lakes, coral reefs, forests and arid lands, for example, have shown that smooth adaptation to change can be disrupted by unexpected and drastic changes in state, implying that an ecosystem's ability to withstand disturbance has a limit.
Economic	In essence, economic limits to adaptation occur when adaptation costs exceed the costs of the averted impacts. The high costs of protecting cities from sea-level rise against the costs of damage from sea-level rise are examples. In general, implementing adaptation measures entails a significant financial investment. Economic limits may also include a cultural aspect as well as a broader social one. For individuals, communities, groups or society as a whole, adaptation may not be culturally desirable. Costs may include both monetary and non-monetary values and the consideration of benefits associated with non-climate change.
Technological	When the technology to adapt to climate change impacts is available but not on the scale required, or when its application on the required scale is practically unfeasible, technological limits to adaptation will take place. Protecting large-scale spatial areas from rising sea levels is one example. Another example could be hard engineering options such as sea walls and groynes with apparent limitations in technical options. If large-scale transplantation is planned, coral transplantation techniques are undoubtedly limited in technology considerations. The deployment location will determine the suitability of any given technology for adaptation, the degree of climate change and the country's or community's current social, economic and environmental conditions, as well as management practices. If non-climate factors that contribute to climate change vulnerability are not addressed, technological adaptation measures may only be partially effective. For example, improving a water supply system technologically to ensure water availability during dry spells will be of limited benefit to those who do not have access to it.
Social	The individual, social and cultural processes that govern how people react to climate variability and change are social limitations to climate change adaptation. Individuals or groups are prevented from seeking the most appropriate forms of adaptation by social limitations, various processes relating to cognitive and normative restrictions. In this context, the organization and structure of social institutions are among the most important considerations, including belief systems, norms and behavior and organizational structure. Social institutions are diverse and can be seen in local farmers' collectives and indigenous knowledge institutions.

Hard limits on the other hand typically consist of physical and ecological changes beyond which natural systems, communities or species can adapt (e.g., coral reefs affected by ocean warming and acidification). Hard limits are perhaps more widely known as a result of the various IPCC reports and the predictions

² Source: Filho et al, 2021, p. 6-7.

of certain thresholds and limits. For example, evidence from IPCC (2022) claims that above 1.5C global warming level, limited freshwater resources pose potential hard limits for Small Islands. The same report indicates that hard ecological limits of warm water coral reefs and some coastal wetlands may already have been reached or surpassed (IPCC 2022). Furthermore, as global temperatures rise above 1.5C, ecosystem based solutions will begin to lose their effectiveness due to hard ecological limits being reached.

(c) Framing Barriers and Limits

The nature and effectiveness of adaptation, including how we understand barriers and limits, is strongly influenced by framing (Wise et al 2014). Predicted ecological and physical limits typically determined by scientific modelling are often used to make certain claims about inevitable trajectories of climate change and opportunities for adaptation. For example, Storlazzi et al (2017, p. 6, italics added) argue that climate modelling is critical for understanding “how climate change will determine when these islands will no longer be able to support human habitation, resulting in an extensive displacement of human populations”. Such claims about the inevitable impacts of ecological limits raise a critical point of contention in the context of limits to adaptation in the Pacific. For example, based on scientifically predicted ecological limits, the predominant international policy and media discourse on the low lying states is that they will inevitably be submerged due to sea level rise (Barnett, 2017; Farbotko & Lazrus, 2012). Within this discourse, relocation and migration appear as the most, if not only, plausible adaptation response, rather than as a failure of adaptation.

Similar issues arise with regards to scientific modelling of ecological limits and loss and damage. The normalization of loss and damage may have the impact of creating a sense that adaptation cannot work or that at best it is a stop gap measure that can do nothing more than buy more time for atoll nations before the inevitable happens (Barnett 2017)³. Barnett (2017) further claims that this can have disempowering effects on local communities and create a sense of fatalism. In this way, promoting discourses around loss and damage and the inevitability of migration becomes a barrier or limit by undermining support for a range of creative and effective adaptation strategies that can potentially reduce or prevent such outcomes. However, this produces a critical dilemma for the Pacific, given “the scientific evidence, while uncertain, nevertheless does suggest that atolls may cease to be habitable, and this arguably cannot simply be denied lest it lead to poor planning” (Barnett, 2017: 8). As such, the only choices that appear to the Pacific are either accepting the worst and planning for relocation, or hoping for the best and ignoring relocation. In the face of such a dilemma, former Minister of Foreign Affairs for RMI, the late Tony de Brum, called for a ‘duty-bound pragmatism’ - that is, while the idea of relocation is ‘repugnant’, nevertheless it is prudent for leaders to keep it in mind as it is a matter of survival (Bordner, Ferguson & Ortolano, 2020). Other perspectives resolve the dilemma by emphasizing the need to accept a certain degree of fatalism about the future (e.g., that we are already on a path towards loss and damage) in order to prompt action in the present to prevent such outcomes from occurring (Dupuy, 2014; Ruda, 2016; Black, 2022). In a similar manner, Roberts and Pelling (2019, p. 763) ask, “Can liberation in adaptation also be anticipatory and catalyzed not by an event but by risks and the evidence they provide of unsustainable development pathways? If so, climate change with its unique future orientation offers a significant opportunity for social liberation that can also reduce loss and damage by bringing together justice and resilience”.

Another way to respond to the framing of the inevitable determinations of ecological limits impacts is to consider a distinction between ‘limits’ and ‘thresholds’. For example, Adger et al (2009, p. 345) point out “a threshold that is linked to irreversible change in particular, represents an absolute limit to maintenance of the status quo, but only a relative limit to adaptation. This is because adaptation could still be possible when the system in question moves to another state”. Water security is a pertinent example - while sources of fresh water may no longer be available due to drought or contamination of fresh water lenses (a threshold) adaptation can nonetheless support habitability through, for example, desalination or importation of water. Furthermore, while the IPCC recognizes a range of insights regarding global ‘tipping points’, ‘planetary boundaries’ or thresholds for certain species, there nonetheless remains a lack of empirical evidence to quantify magnitudes of climate change that would constitute a future adaptation limit (Klein et al., 2014).

There are two key implications arising from this lack of empirical evidence about limits to adaptation. Firstly, the dynamics of climate systems make precise predictions about limits to adaptation unfeasible and therefore limits to adaptation must necessarily be undertaken in a context of uncertainty (Adger et al., 2009; Rickards, 2013). Rather than being a barrier, uncertainty can be a positive condition for taking climate change adaptation action where degrees of uncertainty open up space for improved and creative approaches to adaptation (Barnett, 2017). Therefore, a lack of knowledge tends to be falsely constructed as a limit to adaptation and climate predictions should not be the main source of information for guiding adaptation actions (Adger et al., 2009). As Adger et al (2009, p. 344) conclude, “An approach focused more on robust decision-making is less likely to be constrained by epistemological limits and therefore more likely to succeed than an approach focused on optimal decision-making predicated on the predictive accuracy of climate models”.

This leads to the second key implication. Some researchers argue that scientifically predicted ecological limits tend to over-emphasize risks at the expense of the adaptive capacities of people and communities (Adger et al., 2009; Filho et al., 2021; Henrique & Tscharket, 2022). For example, Esteban et al (2019) claim that sea level rise does not inevitably lead to coastal areas becoming uninhabitable, and that humans have an innate and often underestimated capacity to adapt to changes in their environment. Therefore, an alternative frame to scientifically determined limits is one that draws attention to social limits to adaptation based on the socially determined nature of limits that emerge at points where adaptation fails to protect the things that stakeholders value most (Adger et al., 2007; Barnett et al., 2015; Henrique & Tscharket, 2022). Lopez-Carr and Marter-Kenyon (2015) argue sociocultural, political and economic concerns, including livelihoods and remaining with friends and family, usually trump environmental pressures when making decisions about adaptation. Research conducted in a coastal town in Victoria, Australia, found that thresholds of change were grounded in socially relevant local experiences rather than those related purely to changes in environmental conditions (Graham et al 2014). Research in the Solomon Islands indicates that while climate driven ecological changes, such as coral bleaching and loss of mangroves, are predicted to lead to declining fish stocks, local fisher people may be more motivated to support adaptive behavioral changes when they experience lower incomes that impact on food and economic security and livelihoods⁴ (Ha’apio et al., 2018). Therefore, although ecological limits will impact on the range and viability of opportunities for adaptation, the prospects for the implementation of adaptation measures for many societies will be determined by a wide range of socio-economic barriers to adaptation (Climate Analytics, 2021). As such, shifts in adaptation strategies tend to shift when social consequences occur and not necessarily when anticipated environmental changes take place (Climate Analytics, 2021).

2.2 HOW AND WHY DO BARRIERS AND LIMITS EMERGE?

While understanding different types of barriers and limits can be helpful for identifying targeted solutions, there are questions about how and why barriers and limits arise (Biesbroek et al., 2013; Oberlack & Eisenack, 2018). Understanding the underlying causes of barriers and limits can provide entry points for addressing them (Eisenack et al, 2014). The IPCC (2022) identifies inequity, poverty, lack of knowledge and financial barriers as being key determinants of limits to adaptation. Financial constraints are important determinants of barriers to adaptation and while global climate financing has tracked upward in the last decade, it remains insufficient for implementation of adaptation options, especially in developing countries (IPCC 2022). Roberts et al (2021) argue that due to a lack of clearly established accounting rules under the UNFCCC, it is impossible to be certain if donor nations have delivered on financing pledges made at the 2009 Copenhagen negotiations. Nonetheless, the authors highlight that even when using the accounting standards of developed countries (which typically produce higher estimates), the pledge of USD100 billion per year by 2020 is unlikely to have been met. Furthermore, of the estimated financial flows to date, only about 20% has targeted adaptation and even where promised levels of financing may have been achieved, the funds are often channeled through private banks, equity funds and corporations, aid agencies and multilateral institutions, few of which are controlled by developing countries⁵ (Roberts et al, 2021).

4 Key Informant Interview

5 Key informant interview

Such relations of unequal power and the economic dependencies arising from them can limit decision making power regarding adaptation planning and financing (Roberts et al, 2021). For example, at COP27, Nauru's Minister of Climate Change and National Resilience, Rennier Stanislaus Gadabu, emphasized the failure of "people with real power" to avert the climate crisis (Islands Business, 2022). Research undertaken in the Republic of the Marshall Islands (RMI) concluded that power differences create a disconnect between local adaptation goals and the priorities of donors that impede Marshallese from pursuing the transformative adaptation required to achieve their goals (Bordner, Ferguson & Ortolano, 2020). Therefore, political-economy factors, including historical political and economic processes that shape vulnerability, uneven distribution of power and resources, are key drivers of barriers and limits (Barnett, 2020; Bordner, Ferguson & Ortolano, 2020; Eriksen et al., 2015). These issues are further compounded by the fact that mitigation pathways pursued by developed countries will also determine the magnitude of change required by human systems including the substantial social, cultural and economic costs of adaptation. The key sticking points over mitigation and financing at the recent COP27 meeting highlight the presence of such barriers and limits to adaptation within global climate negotiations.

Another driver of barriers and limits to adaptation are time and path dependence, which manifest as resistance to changing the way things have typically been done and/or resistance to new and untried ideas, even when the status quo is maladaptive (Barnett et al, 2015; Wise et al, 2014). This resistance, which may already underpin barriers, can become a limit when it appears likely that the barrier will not be overcome. As raised earlier, such barriers are more likely to arise where larger, more transformative scales of adaptation are necessary. Indeed, the existing landscape of global and regional institutions and mechanisms supporting development, climate change adaptation and financing are not at the scale to address adaptation at the magnitude required. As will be seen later on in this report, the RMI and Tuvalu both face significant institutional and financing barriers to implementation of large scale adaptation initiatives. Over time, where donors remain reluctant and/or the availability of foreign aid diminishes, or where institutions and mechanisms are unable or unwilling to shift, such barriers may become limits. Given such resistance is entrenched in social systems and structures built overtime and include the development of laws and institutions, shifting path dependence will likely take considerable time. Therefore barriers to adaptation may also become limits when the change required is slower than the rate of the climate change (Barnett et al., 2015).

2.3 OVERCOMING BARRIERS AND LIMITS TO ADAPTATION

While knowledge of barriers and limits to adaptation is growing, there are few studies providing systematic evidence on opportunities for addressing barriers and limits, particularly at a scale required to address the increasing rate and magnitude of climate change (Klein et al, 2014; Eisenack et al, 2014). The evidence that does exist indicates there is no one-size fits all approach, which is consistent with the highly contextual nature of barriers and limits (Eisenack et al, 2014). For example, a study on identifying and overcoming barriers to adaptation in the San Francisco Bay Area found the use of a wide range of strategies to overcome barriers were both context and barrier specific and therefore fine-tuned to the specific situation (Ekstrom & Moser, 2014). Nonetheless, there can be lessons drawn from existing research and efforts to address barriers and limits. The CASCADE project in the European Union provides guidelines on overcoming barriers to adaptation, including a survey to help local authorities identify and rank the main current or expected barriers to adaptation⁶. Evidence from case studies in Australia indicate that processes to develop deliberative and inclusive adaptation pathways that are responsive to the diverse values within communities offer a feasible, low cost and effective policy option for addressing barriers and limits to adaptation at a local level (Barnett et al, 2015; Graham et al, 2014). At a larger scale, research in British Columbia, Canada, found that addressing barriers and limits requires explicitly articulated high-level directives, inspired leadership that supports innovation and collaboration, and institutionalizing climate change actions into standard operating procedures (Burch, 2010). Further, the study emphasized that facilitating the mobilization of existing resources was crucial and required addressing institutional path dependencies, organizational cultures and policy making processes that have historically underpinned failed patterns of climate change policy development (Burch, 2010).

6 https://www.cascade-bsr.eu/sites/cascade-bsr/files/outputs/overcoming_barriers_to_climate_adaptation_0.pdf

This last point supports growing calls for transformational adaptation. Currently, the majority of climate adaptation initiatives are ‘first frontier’ (see figure 1), consisting of incremental, fragmented, and small scale changes that prioritize immediate and near-term climate risk reduction. However, as the pace and magnitude of climate change continues to increase, incremental adaptation may not be sufficient and ‘second frontier’ initiatives will be necessary to avoid intolerable risks from climate change (IPCC, 2022; Berrange-Ford et al, 2021). New et al (2022: 2580) highlight that the IPCC’s AR6 special reports reinforce and build on previous evidence that “radical shifts in governance, knowledge development, technology application, finance and economics, and social norms” would be required to enable climate resilient development. However, evidence suggests countries are finding it difficult to shift planning and development process to focus more on transformational adaptation. For example, research found only 11 current NDCs explicitly mention the term transformative adaptation, while also finding no evidence of long term, systemic change (Fransen et al 2022; Dixit et al 2022). Furthermore, Holler et al (2020) reviewed 50 National Adaptation Programmes of Action (NAPA) in the world’s poorest nations and found that key aspects of the NAPA actually worked against transformational adaptation by emphasizing cost-effectiveness, aligning with existing development and environmental policies to determine adaptation actions, and emphasizing risk exposure over adaptive capacity. Berrange-Ford et al (2021) analyzed adaptation responses against four transformational dimensions: depth (novelty), scope (geographical or sectoral breadth), speed (of implementation) and limits (the extent to which adaptation actions approach or overcome barriers or limits). High transformational adaptation consists of novel adaptations implemented quickly and at large scales that overcome or reduce barriers or limits to adaptation, while low transformational adaptation involves largely localized and slow actions that involve incremental or small adjustments to business as usual and that remain constrained by barriers or limits (Berrange-Ford et al, 2022). For Small Island States, transformational adaptation is low, indicating a lack of evidence of actions seeking to challenge or overcome barriers or limits (Berragne-Ford et al, 2022).

Figure 1: Adaptation Dimensions and Frontiers

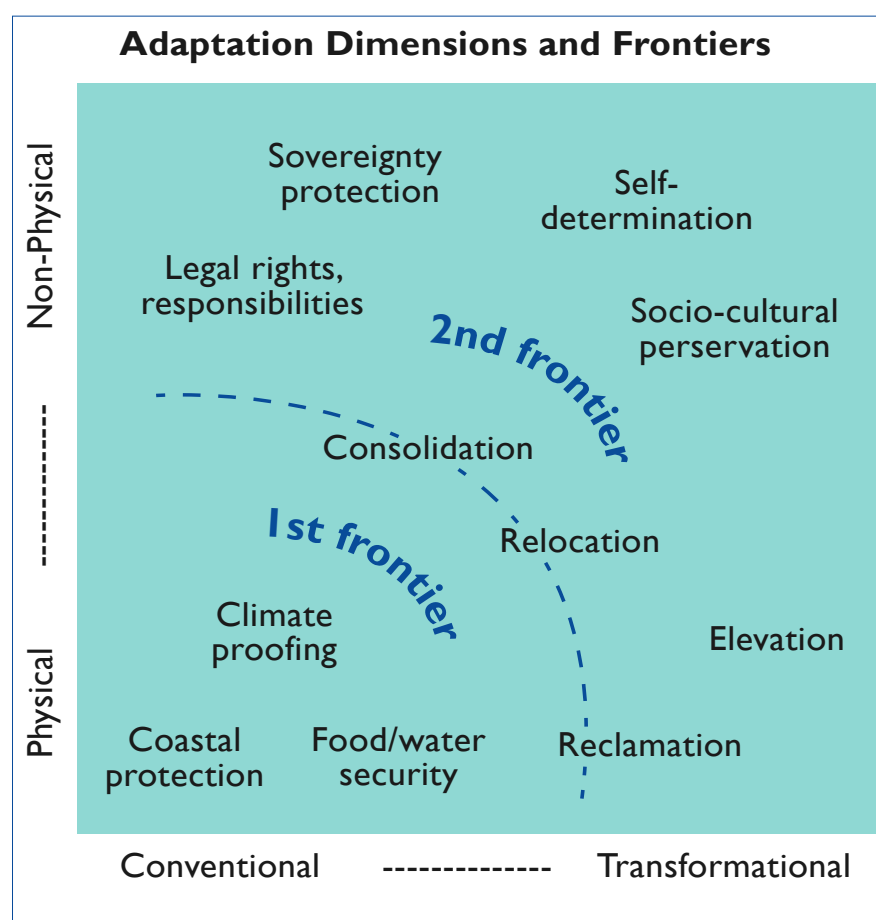


Table 4: Elements of transformational adaptation

Source	Elements of transformational adaptation
Berrange-Ford et al (2021)	<ul style="list-style-type: none"> i. Depth (novelty) ii. Scope (geographical or sectoral breadth) iii. Speed of implementation iv. The extent to which adaptation actions approach or overcome barriers or limits.
Source	Elements of transformational adaptation
Filho et al (2022)	<ul style="list-style-type: none"> i. Engagement of stakeholders ii. Societal impact iii. Sustainable trajectories iv. Participation v. Long-term benefits vi. Vulnerability reduction
Hadarits et al (2017)	<ul style="list-style-type: none"> i. Challenge the status quo ii. Attempt to move a system into a fundamentally different state iii. A discrete process that fundamentally results in change in the biophysical, social or economic components of a system from one form, function, or location to another.
Fransen et al (2022)	<ul style="list-style-type: none"> i. Expansion - adaptation actions that increase in geographical coverage and/or the number of people impacted; ii. Expansion with system change - an expansion that requires change in the overall system that goes beyond incremental adaptation or business as usual approaches; iii. Innovation - adaptation actions that include new approaches, methodologies and technologies in a particular region or resource system; and, iv. Shift in location - a change in location for the adaptation activity being implemented, such as relocating climate vulnerable communities or shifting from farming to non-farming livelihoods.

Table 4 summarizes some of different elements of transformational adaptation from the literature. As the table shows, there is no single, clear definition of the concept. Indeed, the ambiguity of the concept of transformational adaptation is one factor constraining its effective operationalization in policy environments (Klein et al, 2014). Another challenge to the operationalization of transformational adaptation within global and national policy is the limited number of practical examples of transformative adaptation in the literature (Klein et al 2014). The majority of case studies of transformational adaptation are from the agricultural sector where transformation is typically identified as actions aimed at changing crop type, seeking alternative livelihood options, and relocation (Hadarits et al, 2017; Vermeulen et al, 2018). For example, in Nepal, farmers switched from buckwheat and barley to vegetables and fruit trees (Konchar et al, 2015), while in Australia a large peanut-growing company relocated its production site as a result of rainfall variabilities (Jakku et al, 2016). Fiji's relocation policy has been cited a number of times as an example of transformative adaptation (Fransen et al., 2022; Barnett & McMichael, 2018; Martin et al., 2018), although some commentators argue that the inclusion of migration as a transformative option seems to undermine the intent of the concept (Roberts & Pelling, 2019).

Transformational adaptation actions have been shown to be important for protecting loss and damage from climate change. For example, typical household-level efforts at adapting to the impacts of coastal erosion in Kosrae were found to be insufficient to avoid both economic and non-economic loss and damage due to limits in adaptive capacity (Monnereau & Abraham, 2013). Rather, in order to minimize loss and damage, adaptation strategies require changes in institutional, political, social and financial systems and existing values and norms need to be thoroughly re-evaluated (Monnereau & Abraham, 2013; Rickards, 2013). Chrichton and Esteban (2018) argue that transformational adaptation is important to address adaptation needs for countries like Samoa where the significant influence of culture, livelihoods and popular behavior need to be incorporated into adaptation strategies. Transformative adaptation therefore requires a careful examination of the interactions between different activity spheres, such as politics and power, knowledge and science to be applied to adaptation (Chrichton & Esteban, 2018). While transformational adaptation may help to address certain barriers and limits to adaptation, it can also lead to other barriers and limits. Therefore, on the one hand incremental adaptation may face fewer barriers to implementation, but it is increasingly seen to be insufficient in the face of the increasing pace and magnitude of climate change. On the other hand, transformational adaptation is deemed necessary to address the limitations of incremental adaptation in terms of scale and speed to address ecological changes, yet is likely to be faced with greater barriers and limits to adaptation due to its challenge to the status quo and requirements for greater financial investments (Filho et al 2022).

3. BARRIERS AND LIMITS TO ADAPTATION IN THE CONTEXT OF CLIMATE SECURITY

As emphasized earlier, barriers and limits to adaptation are context specific and are dependent upon the goals and values of the actors who are impacted. Therefore, this section seeks to apply the concepts of barriers and limits to the climate security context of the Pacific Islands. This section begins with a brief outline of the climate security context in the Pacific Islands with the aim of identifying what might be some of the key climate security goals for the region. It will then seek to apply the analysis of barriers and limits from section two to this context through the use of case examples from the RMI, Tuvalu, and the region's tuna industry.

3.1 THE CLIMATE SECURITY CONTEXT

There are a range of changes to climatic conditions that will impact on the Pacific Islands region, including sea level rise, ocean acidification, rising global temperatures, changing rainfall patterns, and increased intensity of disasters. The severity of the threats posed by these changes has led the governments of the Pacific to declare on numerous occasions that climate change is the greatest security threat facing the region. To reiterate the well-known statement from the Boe Declaration on Regional Security (Pacific Islands Forum 2018):

We reaffirm that climate change remains the single greatest threat to the livelihoods, security and well-being of the peoples of the Pacific and our commitment to progress the implementation of the Paris Agreement.

Furthermore, under the Pacific Islands Forum's (2022) Declaration on Preserving Maritime Zones in the Face of Climate Change related Sea-Level Rise, the Leaders of the Pacific affirm "threats of climate change and sea-level rise as the defining issue that imperils the livelihoods and wellbeing of our peoples and undermines the full realization of a peaceful, secure and sustainable future for our region". Within this broader emphasis on climate security are a range of non-traditional security threats that are anticipated from a changing climate, including impacts on health, energy, and national economies through impacts on tourism and the region's tuna fisheries (Pasisi. 2019; Bell et al, 2021). Pasisi (2019) identifies five key climate risks facing the Pacific from climate change as (1) displacement and forced migration; (2) blue economy (oceans, coasts, fisheries, tourism); (3) health, food and water security; (4) coping capacity and natural disasters; and (5) impacts of sea-level rise on maritime zones and boundaries. Crichton and Esteban (2018) report that under the United Nations Development Program's (UNDP) Pacific Adaptation to Climate Change project, the priority adaptation issues identified by Pacific Island countries included coastal adaptation, food security, and water security. Hauger (2015) identifies the major and direct threats to human and non-traditional security in the Pacific as access to fresh water (due to changes in rainfall patterns and salt water intrusion); local food supply (damage to coral reefs, declining fisheries, and impacts on agriculture); and infrastructure damage (through rising sea levels, other flooding and storm damage). He further identifies a range of what he calls 'second order consequences' arising from these direct impacts, including economic loss, declining revenues from tourism, relocation, and the existential threat of climate change. Table 3 below lists some of the climate security priorities identified in National Action Plans (NAP), Nationally Determined Contributions (NDC) and National Communications by Pacific Island countries under the UNFCCC.

The draft 'Pacific Climate Security Regional Assessment Guide' (Adelphi 2022) also outlines a number of key security risks arising from climate change:

- Threats to the territorial integrity of Pacific Island Countries and regional stability;
- Livelihoods and the Blue Economy;
- Land availability and pressures on food, water and health security;
- Climate risks exacerbating disasters and eroding the resilience of the vulnerable populations and government; and,
- Security consequences of increased human mobility resulting from climate change.

A key feature of the draft Assessment Guide is its development of climate security pathways which depict step changes in the climate, the impacts stemming from these changes, and the potential security implications arising from the impacts. There are opportunities to build on these pathways by overlaying them with information adaptation capacities and pathways that can significantly halt or alter the cascading effects of the climate security pathways.

While the discussion above identifies key risks and priorities, relatively few references are made to explicit climate security goals. Under Strategic Focus Area 1 (Climate Security) the Boe Declaration Action Plan lists seven 'proposed actions'. While actions 1(iii) to 1(vii) can perhaps be considered process goals, the other two actions are more outcome focused and imply the protection of certain values: Action 1(i) Securing our sovereignty and territorial integrity in the face of the impacts of climate change; and, Action 1(ii) Maintaining the dignity and well-being of our communities in the face of the impacts of climate change (Pacific Islands Forum, 2019: 10). During his opening remarks at the Pacific Climate Security Dialogue held in Suva on August 2022, PIF Secretary General Henry Puna reinforced these goals when he stated, "In adopting the Boe Declaration on Regional Security, Leaders asked that we unify our efforts behind one priority cause: securing our sovereignty and territorial integrity in the face of the impacts of climate change" (Puna, 2022). At a national level, the security goal of RMI is to mitigate climate change and adapt to its impacts in order to sustain a livable territory. At the heart of this security goal the RMI recognizes "the security of our people, the respect for their rights, and the protection of the territory we rely on" (Government of the Republic of the Marshall Islands, 2020: 26). Tuvalu's Long Term Adaptation Plan (L-TAP) seeks to safely accommodate the National population beyond 2100, even in the face of the worst case climate change scenarios. Kiribati also has a goal to maintain the sovereignty and unique identity of Kiribati. Tonga's NDC includes prevention of the permanent loss of land to rising sea levels and maintaining existing stocks of fish and other marine species as two climate security goals, while Nauru seeks the relocation of homes and critical infrastructure. As discussed earlier, having an explicitly articulated high-level directive or goal has been shown to be critical in overcoming barriers and limits to adaptation. Annex 2 attempts to summarize potential barriers and limits to adaptation that may emerge for three climate security goals in the Pacific and demonstrates one way of thinking through key elements of adaptation as well as barriers and limits, as they relate to climate security goals.

3.2 CASE STUDIES

As highlighted numerous times in this assessment, barriers and limits to adaptation are context specific. The case examples below seek to further contextualize the assessment of limits to adaptation in the context of climate security in the Pacific. They aim to provide examples where clear climate security goals have been articulated in order to consider more specifically what potential barriers and limits might emerge to prevent the realization of those goals. The case detailed in Annex 3 are the RMI, Tuvalu and the regional tuna fisheries. Tuvalu and the RMI are both atoll nations at frontlines of climate change and both have clearly articulated climate security goals. Both countries have also explored transformative adaptation options at a scale necessary to meet the magnitude of the threat posed to their climate security goals.

In RMI, the ambitious goal of protecting and sustaining sovereignty, self-determination and identity through 'reclamation, elevation, consolidation' already recognizes the hard ecological limits that exist on the not-too-distant horizon. But it also refuses to cede to inevitable loss and damage and to see migration and relocation as the only viable response. While the development of pathways for reclamation, elevation and consolidation were funded under the GCF, the major barrier to achieving the RMI's security goal is the costs of implementation. However, the cost barrier is more than simply access to finance but is underpinned by the unequal relations of wealth and power between donors and the RMI that often lead to divergence between the adaptation goals of the country and the priorities of the donors and development partners. Building consensus on adaptation pathways and timelines, including with the leaders in the RMI, remains an ongoing and crucial challenge. Such a challenge may become a barrier or limit should the speed of decision making fail to keep up with the rate of climate change.

Tuvalu's Long-Term Adaptation (L-TAP) contains an important level of flexibility regarding adaptation options that helps to address potential social barriers and limits to adaptation associated with different goals and values of actors. For example, following comprehensive dialogue, it acknowledges that younger generations may have different aspirations than older people: the latter may prefer to stay on their home islands and be more open to maintaining traditional aspects of living, while younger people may well want secure housing with access to modern technology, while maintaining the possibility of migration for work and education. Both sets of goals and values are valid, and the L-TAP enables a range of options to be realized based on the different goals of different stakeholders. Nonetheless, even with a well-planned and consulted transformational approach to adaptation, the economic dependencies of Tuvalu mean that financing the implementation of the L-TAP remains a barrier that, in time, may become a limit. Indeed, the current landscape of institutions and mechanisms providing support for both development and climate change adaptation operate at a level inappropriate to match the scale and magnitude of support required to enable adaptation strategies such as the Tuvalu L-TAP. Where institutional change is not forthcoming, overcoming these barriers will require the Government of Tuvalu to think outside the box and seek innovative means of support to realize their climate security ambitions. The implications of this for climate security is that if these efforts ultimately fail and financing the L-TAP becomes a limit, then relocation may be the most viable alternative.

Tuna fisheries is one of the most important sources of national income in the Pacific Islands region. The goal of Pacific Island governments is to maintain the economic benefits arising from tuna fisheries in the face of the impacts of climate change. The sustainable management of tuna stocks in the Pacific region remains the most important factor determining the viability and economic success of the region's tuna fisheries. In any climate scenario, management strategies will remain the key mediating factor. Nonetheless, climate change is anticipated to drive the main tuna stocks in the Pacific region to migrate away from the jurisdictions of Pacific Island countries and territories and into the high seas or other jurisdictions in the Eastern Pacific. For PIC, fisheries management will remain the key driver of tuna populations until at least 2050 and keeping global temperature rise and greenhouse gas emissions to a minimum is crucial for minimizing the impacts of climate change on tuna fisheries. In addition, there exist other adaptation pathways that can help sustain the economic benefits for PIC arising from tuna fisheries. Hard ecological limits are likely to play an important role in determining the success of adaptation efforts. Achieving the necessary consensus at the Western and Central Pacific Fisheries Commission (WCPFC) on agreements to retain economic benefits for the Pacific Islands will likely be a significant barrier, driven by diverging interests between coastal states and the tuna industry. Changing tuna stocks may also undermine the leverage that Pacific Island countries have in such negotiations, which may provide another political barrier to adaptation.

4. SUMMARY AND RECOMMENDATIONS

The key question driving this assessment was whether there are limits to climate change adaptation by society beyond which politically or socially undesirable outcomes might occur in the Pacific Islands region. To explore this question, the assessment examined what types of barriers and limits to adaptation exist, how and why they exist, and how they can be overcome. Barriers refer to restrictions or constraints on adaptive capacity and the range of adaptation options available, but are nonetheless resolvable. Limits on the other hand represents thresholds beyond which adaptation is no longer available. In general, the large majority of research has focused on barriers rather than limits, and there is a small but growing evidence base on barriers and limits in the Pacific region.

The findings of the assessment indicate that while there are ecological limits that may pose a threat to the climate security goals of PIC, there are a range of institutional, governance, and political-economic barriers that are likely to determine the capacity of Pacific governments to adapt to these limits. In particular, the current landscape of institutions and mechanisms that exist to address climate change adaptation are not of the scale to match the magnitude of the threat to the climate security ambitions of PIC, in particular atoll nations like Tuvalu, Kiribati and the RMI. Furthermore, understanding the drivers of barriers and limits to adaptation is crucial for providing entry points for preventing and addressing them. Key drivers of barriers to adaptation in the Pacific include the distribution and levels of financing for adaptation, inequities in power between PIC and donors, and institutional time and path dependencies.

A key challenge for the Pacific therefore is whether these barriers can be overcome or if they will at some point become insurmountable limits to adaptation. Where these barriers persist over time and/or are resistant to change, then they may become barriers that lead to politically and socially undesirable outcomes for the Pacific Islands region. While the evidence on barriers and limits continues to grow, there is much less evidence on opportunities and policies for overcoming them. Consistent with the evidence that barriers and limits to adaptation are highly context specific, there is no one-size fits all approach to overcoming barriers and limits. Some research suggests that having explicit, high-level adaptation goals alongside innovative and inspired leadership to address institutional path dependencies are key to overcoming barriers and limits to adaptation. Transformational adaptation has also been suggested as necessary for addressing barriers and limits. However, many countries, including those in the Pacific, are finding it challenging to shift planning and development processes to focus more on transformational adaptation. Few practical examples of transformational adaptation exist outside the agricultural sector. While transformational adaptation is deemed necessary to address the speed and scale of climatic changes, it can also lead to barriers and limits to adaptation due to its challenge to status quo and requirements for greater financial investments.

This last point has practical implications for the three case examples considered in this assessment. For both Tuvalu and the RMI who seek to secure territorial integrity for future generations through ambitious reclamation strategies, institutional path dependencies and access to financing to match the scale of adaptation required are significant barriers. Achieving the protection of economic benefits from the region's tuna fishery will be challenged as much by tuna management strategies and political agreements as it is by the impacts of climate change. Therefore, while ecological limits are driving adaptation efforts, socio-political and economic barriers, including access to financing and institutional and governance factors, are key challenges that must be overcome for the Pacific to realize their climate security goals.

This deep dive assessment provides what is perhaps the first attempt to consider barriers and limits to adaptation in the context of climate security in the Pacific. The scope of the material covered in the assessment was limited by both time and the availability of key informants from within the region. Therefore, much remains unexplored in the assessment. The recommendations below provide a number of options for building on the outcomes of this report and to support a deeper level of understanding and action on barriers and limits to adaptation in the Pacific region.

4.1 RECOMMENDATIONS

Based on the assessment and the case studies considered in the report, the following recommendations are made:

1. Given barriers and limits to adaptation are context specific, it is recommended that relevant agencies of the Council of Regional Organizations in the Pacific (CROP) and/or International Organizations undertake further research to systematically identify barriers and limits in the climate security context of the Pacific. In particular, research should seek to identify a range of barriers and limits and options for overcoming barriers to adaptation that relate to explicit climate security goals of the Pacific. Doing so will provide evidence to support national governments to develop appropriate strategies and policies for overcoming barriers and limits, as well as support targeted diplomatic strategies aimed at addressing institutional, governance and financing barriers and limits to adaptation at the global level.
2. The increasing speed and magnitude of climatic changes necessitates a shift from incremental approaches to adaptation to transformational adaptation. Evidence indicates that transformational adaptation actions are low in Pacific and that significant challenges exist for countries to reorient planning in such a manner. To help address this challenge, research suggests that engaging in the use of scenarios and foresight approaches can catalyze robust dialogue on transformational adaptation as well as barriers and limits to adaptation (Hadarits et al, 2017; Becker, 2017; Stege 2018). Therefore, it is recommended that relevant CROP agencies and development partners:
 - a) Implement a series of robust, scenario-based dialogues at regional and national levels. Such dialogues should aim “to push the envelope of thinking about adaptation, exploring all ideas and possibilities for innovative and creative solutions and implementing strategies that build on evidence of success and create hope for present and future generations” (Barnett, 2017, p. 11); and,
 - b) Support PIC to identify transformative adaptation pathways, map the transformative potential of adaptation actions, and link their NDC with long-term strategies (Dixit et al, 2022). Such efforts should be directly linked to explicit climate security goals and the barriers and limits to adaptation they face, rather than working off generalized climate risks and priorities.
3. Access to financial resources necessary for implementing adaptation strategies at the scale required to meet the magnitude of climate change impacts in the Pacific is a key barrier for PIC. This barrier is likely to worsen with future levels of assistance predicted to decline as the costs of domestic adaptation in donor countries rises (Nunn and Kumar, 2019). It is recommended that Pacific Island Economic Ministers commission the Pacific Islands Forum to undertake urgent research on innovative economic opportunities for supporting the implementation of large-scale transformational adaptation strategies in support of Pacific climate security goals. Potential options for exploration include debt-for-climate swaps (Thomas & Theokritoff, 2021), intermerate accounting based on environmental-credit swaps⁷, and the pooling of resources by atoll nations.

7 https://issuu.com/wordsbydesign/docs/ecological-economic_accounts_final_version

4. Atoll nations of the Pacific are most vulnerable to the impacts of climate change. Tuvalu, Kiribati and the RMI have all specified climate security goals related to the protection of sovereignty, habitability and cultural identity. It is recommended that the governments of Kiribati, the RMI and Tuvalu re-institute a regular Pacific atoll nation dialogue with the aim of sharing experiences and exploring opportunities for joint actions in pursuit of shared climate security goals. Where appropriate and agreed to by governments, the dialogue process and any agreed upon actions should be supported by regional organizations and development partners.
5. Theories of climate justice advise that choices made by people and communities impacted by climate change over what to protect and what to let go should be made explicit and should be the subject of deliberation by stakeholders (Gross 2014). Therefore, it is recommended that relevant CROP agencies and/or international organizations, develop guidelines to support PIC governments to undertake inclusive and deliberative dialogue processes with communities impacted by climate changes aimed at identifying potential trade-offs between adaptation goals, the distribution of outcomes and what valued assets will be lost (Barnett et al., 2015).
6. It is recommended that the IOM and its partners endeavor to disseminate the findings of this assessment to help broaden awareness and discussion of barriers and limits to adaptation across the Pacific region. Dissemination may include shorter and targeted policy briefs as well as dialogues or workshops at regional and national levels.

ANNEX 1: EXAMPLES OF PIC CLIMATE SECURITY PRIORITIES

PIC	CLIMATE SECURITY PRIORITIES	SOURCE
Cook Islands	Food Security	3rd National Communication under the UNFCCC DECEMBER 2019
	Water Security	
Fiji	Food and Nutrition Security	Fiji NAP 2018 and NDC
	Infrastructure	
	Human Settlement	
FSM	Food Security	2nd National Communication under the UNFCCC
	Water Security	
	Energy Security	
Kiribati	Water security	NDC Report
	Food security	
	Maintain the sovereignty and unique identity of Kiribati	
Nauru	Water Security	2nd National Communication under the UNFCCC December 2014 and NDC report
	Food Security	
	Energy Security	
	Reduce coastal erosion	
	Relocation of homes and critical infrastructure	
Niue	Food Security	2nd National Communication under the UNFCCC
Marshall Islands	Habitability	Adaptation Communication
	Land tenure rights	
	Infrastructure	
	Social Wellbeing	
	Economic development	

PIC	CLIMATE SECURITY PRIORITIES	SOURCE
Palau	A resilient, sustainable and food secured Palau	National Climate Policy (2015)
	To conserve and protect the island nation and its communities from climate change and disaster impacts.	
PNG	Enhanced food and water security	2nd National Communication under the UNFCCC 2014 and NDC report
	Improved access to health measures	
	Resilient infrastructure	
Solomon Islands	Food Security	2nd National Communication under the UNFCCC 2017
	Infrastructure	
	Human Settlements	
Tonga	Food Security	3rd National Communication under the UNFCCC 2019
	Infrastructure	
	Energy Security	
	Water security	NDC
	Prevent permanent loss of land to rising sea levels	
	Maintain existing stocks of fish and other marine species	
Tuvalu	To accommodate the National population safely beyond 2100.	Tuvalu Long-Term Adaptation Plan (2022)
	Improved food and water security	
Vanuatu	Food Security	3rd National Communication under the UNFCCC 2020
	Water Security	
	Infrastructure	

ANNEX 2: SUMMARY OF PACIFIC CLIMATE SECURITY GOALS AND BARRIERS AND LIMITS TO ADAPTATION

PACIFIC SECURITY (ADAPTATION) GOAL	ECOLOGICAL DRIVERS OF INSECURITY	IMPACTS OF FUTURE CLIMATE CHANGE	POTENTIAL ADAPTATION STRATEGIES	POTENTIAL BARRIERS AND LIMITS TO ADAPTATION
1. Maintain liveable territory (habitability) for future generations.	Sea level rise. Wave driven flooding. Changing rainfall patterns.	<ul style="list-style-type: none"> Coastal erosion; Damage to infrastructure; Loss of land and inhabitability; Increased coral mortality and effects on fisheries resources impacting on food security. Impacts on water security through drought and contamination of water lens. 	Protection via seawalls, revetments. Elevation of land and buildings. Reclamation to create new land. Importation of food and water. Desalination. Relocation of communities and key infrastructure.	Ecological and Physical: <ul style="list-style-type: none"> The inability of coral reefs to adapt. Lack of land for relocation. Environmental damage from maladaptation. Social and Political: <ul style="list-style-type: none"> Path dependency Disconnect between donors and proposed adaptation strategies. Lack of action on appropriate mitigation at the global level. Social and cultural barriers to relocation. Economic: <ul style="list-style-type: none"> Dependency on foreign aid. Costs of transformational adaptation.

PACIFIC SECURITY (ADAPTATION) GOAL	ECOLOGICAL DRIVERS OF INSECURITY	IMPACTS OF FUTURE CLIMATE CHANGE	POTENTIAL ADAPTATION STRATEGIES	POTENTIAL BARRIERS AND LIMITS TO ADAPTATION
2. Maintain economic benefits from tuna fisheries.	<p>Sea temperature rise.</p> <p>Changes in velocity of major currents.</p> <p>Reduced ocean oxygen.</p> <p>Ocean acidification.</p> <p>Less productive food webs.</p>	<ul style="list-style-type: none"> • Eastward migration of tuna outside of Pacific EEZ leading to decreased revenue from tuna fisheries by up to 15%; • Shifting responsibilities and management arrangements. 	<ul style="list-style-type: none"> • PNA VDS; • Relocation of canneries to countries in the Western Pacific; • Reduce the number of foreign flagged vessels (FFV); • Establish agreements on allocation of long-term rights. • Adaptive fisheries management regimes. 	<p>Ecological and Physical:</p> <ul style="list-style-type: none"> • Migration of tuna out of Pacific EEZ. <p>Social and Political:</p> <ul style="list-style-type: none"> • Agreement (negotiations) on retaining benefits. • Lack of action on appropriate mitigation at the global level. • Unsustainable tuna management strategies. • Uncertainty of modelling data. <p>Economic:</p> <ul style="list-style-type: none"> • Losses resulting from reductions to FFV.
3. Enhance Food Security.	<p>Changing rainfall patterns.</p> <p>Ocean warming and acidification.</p> <p>Sea level rise and salt water inundation.</p>	<ul style="list-style-type: none"> • Changes in temperature and rainfall reducing agricultural yields; • Ocean warming and acidification impacting coral reefs, mangroves and coastal fisheries; • Loss of arable land; • Loss of gross domestic product. 	<ul style="list-style-type: none"> • Food importation. • Climate resistant crops • Increased irrigation and use of fertilisers. 	<p>Ecological and Physical:</p> <ul style="list-style-type: none"> • Hard ecological limits undermining ecosystems. • Unavailability of arable land. <p>Socio-Political:</p> <ul style="list-style-type: none"> • Population growth • Unsustainable fishing practices. <p>Economic:</p> <ul style="list-style-type: none"> • Global food and fuel prices.

ANNEX 3: CASE STUDIES

(A) SELF-DETERMINATION AND SOVEREIGNTY IN THE MARSHALL ISLANDS

The Republic of the Marshall Islands recognises climate change as the pre-eminent security threat facing the nation and its people. The climate security goals of the Marshall Islands are to sustain the habitability of its territory to ensure future generations can live and thrive on their ancestral atolls and to protect the rights of its citizens in all climate scenarios including those where habitability is compromised. These goals are grounded in the inalienable right for people to remain on their islands as well as the principles of self-determination and sovereignty. The Marshall Islands explicitly refers to these issues as security concerns, stating “As we develop a plan for our future survival, we will continue to put the security of our people, the respect for their rights, and the protection of the territory we rely on, at the heart of our security policy”.

Beyond 2050, for all but the very lowest emission scenarios, communities in the RMI will need to adapt to coastal hazard events well beyond the current planning time ranges. The Marshall Islands’ goal of maintaining sovereignty and habitability for its citizens is under threat from sea level rise, extreme tidal events, coastal erosion, and changes in rainfall patterns, including droughts and contamination of freshwater lenses (Government of the Republic of the Marshall Islands, 2020). These climate pressures interact with existing economic and social conditions that further determine the capacity for Marshall Islanders to take appropriate adaptation in order to meet its climate security goals. For example, the RMI economy is fragile and largely dependent on financial payments under the Compact for Free Association with the United States of America⁸. This economic context means that the RMI is heavily dependent on foreign aid to support the implementation of adaptation strategies. The National Strategic Plan 2020-2030 acknowledges the need to consider tipping points for habitability and multiple frontiers of adaptation and resilience building against coastal erosion and more frequent and extended droughts and contamination of fresh water lenses.

The government of the RMI has previously stated that it does not have the luxury to pick and choose from a wide range of options and adaptation pathways, and therefore at times, presents its adaptation options as a stark choice between relocation or finding other options to respond to the impacts of long-term sea-level rise. The RMI’s National Communication under the UNFCCC states that in response to this dilemma, “The RMI is considering whether to relocate all 55,000 citizens” (Government of the Republic of the Marshall Islands, 2020: 26). At other times it has made clear its ambition to avoid this situation altogether. As former Minister of Foreign Affairs Tony de Brum (2013) stated, “the prospect of displacement of communities and peoples is repugnant...an admittance of defeat before we are actually defeated”. Furthermore, research in the RMI found that local respondents believed migration to be inappropriate as it would lead to the loss of sovereignty and identity (Border, Ferguson & Ortolano, 2020).

Figure 1 below depicts an example of a relocation pathway developed in the RMI. The aim of this pathway is to ensure properties are not located in the most highly exposed locations and it reflects the potential ability to relocate notwithstanding the complexities of socio-cultural barriers associated with landownership and occupation rights (Government of the Republic of the Marshall Islands, 2020). A second, more ambitious pathway is what former Chief Secretary Ben Graham describes as ‘reclamation, elevation, consolidation’. The project⁹ has been developed in consultation with the World Bank under its Building Resilience in Pacific Atoll Island Countries work. It expands on the first pathway by outlining four potential adaptation responses: (1) protect and raise; (2) protect and reclaim; (3) protect and relocate; and (4) protect and migrate (see figure 2 below). While the pathways seem to present a somewhat linear and progressive sequence of adaptation options, the increased speed and magnitude of climate change and its impacts means the RMI may no longer have the luxury of time to sequentially implement actions

8 The Compacts of Free Association are a series of treaties between the United States, the Federated States of Micronesia (FSM), the Republic of Palau, and the Republic of the Marshall Islands (RMI) which provide direct U.S. economic assistance and extends U.S. domestic programs and federal services to these Pacific Island nations.

9 See: <https://storymaps.arcgis.com/stories/8c715dcc5781421ebff46f35ef34a04d>

as particular adaptation options become more urgent. Indeed, a strategy that combines reclamation and raising is considered to be the only pathway that enable the Marshallese stay on the atolls (World Bank 2022). At the same time as seeking to implement such ambitious adaptation strategies, the RMI is able to keep migration as an open strategy due to the arrangements under Compact for Free Association with the United States of America.

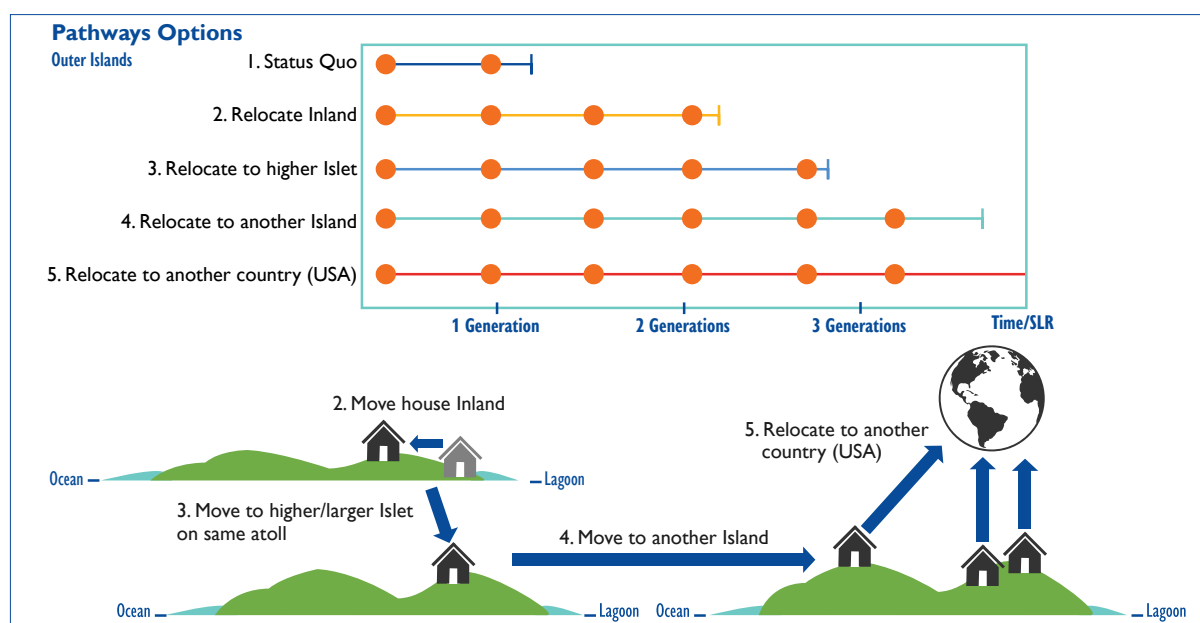


Figure 2: Potential Adaptation Pathways for RMI (outer islands and rural areas).

Source: RMI Adaptation Communication 2020.

The ambitious goal of protecting and sustaining Marshallese sovereignty, self-determination and identity through ‘reclamation, elevation, consolidation’ already recognises the hard ecological limits that exist on the not too distant horizon. But it also refuses to cede to inevitable loss and damage and to see migration and relocation as the only viable response. While the development of pathways for reclamation, elevation and consolidation were funded under the GCF, the major barrier to achieving the RMI’s security goal is the costs of implementation. However, the cost barrier is more than simply access to finance, but is underpinned by the unequal relations of wealth and power between donors and the RMI that often lead to divergence between the adaptation goals of the country and the priorities of the donor entities that they rely on (Bordner, Ferguson and Ortolano, 2020). One government official interviewed by Bordner, Ferguson and Ortolano (2020) observed that donors come with their own agendas and objectives, thereby not listening to the what the people of RMI want. While much work has been undertaken with the support of the World Bank to produce the adaptation pathways for ‘reclamation, elevation and consolidation’, to date, comprehensive consultation of the ‘reclamation, elevation, consolidation’ strategy has not been undertaken. Furthermore, building consensus on adaptation pathways and timelines, including with the leaders in the RMI, remains an ongoing and crucial challenge. Such a challenge may become a barrier or limit should the speed of decision making fail to keep up with the rate of climate change.

(B) THE COSTS OF STAYING IN TUVALU - FROM MILLIONS TO BILLIONS

Tuvalu is one of the most vulnerable countries in the world to the impacts of climate change. By 2050, it is estimated that half the land area of the capital will become flooded by tidal waters and by 2100, 95% of land will be flooded by routine high tides. Furthermore, climate change poses extreme risk to drinking water, food security, and energy supply. Loss and damage and relocation have typically been at the forefront of considerations of adaptation to climate change in Tuvalu. Tuvalu’s Long-Term Adaptation (L-TAP) plan seeks an alternative future for Tuvalu, one where the entire population can remain safely in Tuvalu, even in the worse-case sea level rise scenario beyond 2100 (Government of Tuvalu, 2022).



Figure 3: Pathways for 'Reclamation, Elevation, Consolidation' in the RMI. Source: World Bank

Tuvalu's L-TAP, which was officially launched by the Government of Tuvalu at COP27 in Egypt, is an exemplary case of using anticipated loss and damage as an opportunity to both address the root causes of vulnerability and pre-empt a range of possible barriers and limits. Developed by the Government of Tuvalu with the support of UNDP Tuvalu's Long-Term Adaptation Plan (L-TAP), 'Te Lafiga o Tuvalu' (Tuvalu's Refuge), presents a new approach to adaptation, designed to provide comprehensive solutions beyond 2100 (Government of Tuvalu, 2022). While UNDP continues to provide a range of technical support to develop L-TAP, perhaps the most crucial intervention was the flexibility and willingness of UNDP to re-orient from the initial Tuvalu Climate Adaptation Project (TCAP) to the L-TAP, or, 'from project scale of 10's of millions to billions'. That is, building on the conversations taking place under the TCAP within Tuvalu, the UNDP supported local understandings of the temporal scales of sea level rise impact which led to local urgency to investigate far more ambitious and challenging plans (L-TAP) of the magnitude required to meet Tuvalu's climate security ambitions. While acknowledging the extensive time and effort required to achieve this outcome, the flexibility of UNDP in this situation provides an example of how potential institutional barriers and path dependencies can be overcome in order to support the climate security goals of particular countries.

The L-TAP itself also contains an important level of flexibility regarding adaptation options that helps to address potential social barriers and limits to adaptation associated with different goals and values of actors. For example, following comprehensive dialogue, it acknowledges that younger generations may have different aspirations than older people: the latter may prefer to stay on their home islands and

be more open to maintaining traditional aspects of living, while younger people may well want secure housing with access to modern technology, while maintaining the possibility of migration for work and education. Both sets of goals and values are valid, and the L-TAP enables a range of options to be realized based on the different goals of different stakeholders.

Nonetheless, even with a well-planned and consulted transformational approach to adaptation, the economic dependencies of Tuvalu mean that financing the implementation of the L-TAP remains a barrier that, in time, may become a limit. Indeed, the current landscape of institutions and mechanisms providing support for both development and climate change adaptation operate at a level inappropriate to match the scale and magnitude of support required to enable adaptation strategies such as the Tuvalu L-TAP. Where institutional change is not forthcoming, overcoming these barriers will require the Government of Tuvalu to think outside the box and seek innovative means of support in order to realize their climate security ambitions. Should these efforts ultimately fail, and financing the L-TAP becomes a limit, then relocation may be the most viable option.

(C) PROTECTING ECONOMIC BENEFITS FROM THE REGION'S TUNA FISHERY

Tuna fisheries is one of the most important sources of national income in the Pacific Islands region. On average, government revenue across the region from tuna accounts for 34% of GDP (Bell et al 2021). The goal of Pacific Island governments is to maintain the economic benefits arising from tuna fisheries in the face of the impacts of climate change. The sustainable management of tuna stocks in the Pacific region remains the most important factor determining the viability and economic success of the region's tuna fisheries (Pacific Islands Ocean Fisheries Management Project, 2018). Indeed, recent research contends that any data on the impacts of climate change should be treated with caution as such estimates do not account for management responses (Bell et al, 2021). Therefore in any climate scenario, management strategies will remain the key mediating factor.

Nonetheless, climate change is anticipated to impact on the region's tuna stocks through warming ocean temperatures, changes in velocity of major currents, reduced oxygen, ocean acidification, and less productive food webs. Such changes are anticipated to drive the main tuna stocks in the Pacific region to migrate away from the jurisdictions of Pacific Island countries and territories and into the high seas or other jurisdictions in the Eastern Pacific. The shift of tuna into high seas areas beyond national jurisdictions would likely result in weaker regulation and monitoring (Bell et al, 2021).

A number of options for adaptation tailored to the fisheries sector have been identified in the literature, conservation through catch and effort limitation; flexible, precautionary and multi-jurisdictional management systems; and schemes for capacity adjustment and development of alternative livelihoods for fishers (Miller et al. 2017). For PIC, fisheries management will remain the key driver of tuna populations until at least 2050 (Pacific Islands Ocean Fisheries Management Project, 2018) and keeping global temperature rise and greenhouse gas emissions to a minimum is crucial for minimizing the impacts of climate change on tuna fisheries. In addition, there exist other adaptation pathways that can help sustain the economic benefits for PIC arising from tuna fisheries. The first is to negotiate through the Western and Central Pacific Fisheries Commission (WCPFC) for PIC to retain the economic benefits they currently receive from tuna, regardless of changes to tuna stock resulting from climate change¹⁰. The Parties to the Nauru Agreement (PNA) Vessel Day Scheme also has within it components that enable negotiations over maintaining the economic rights of PIC to tuna. Furthermore, South Korea, a member of the WCPFC, has already suggested exploring the possibility of making PNA vessel days transferable to the high seas areas (Bell et al, 2021). Table 5 below outlines other possible adaptation options for retaining the economic benefits from tuna for the Pacific.

10 See Bell et al 2021 for a comprehensive discussion on the mechanisms through which negotiations could take place.

Table 5: Win-Win options for adapting to threats from climate change to economic benefits from tuna.
Source: Pacific Islands Ocean Fisheries Management Project.

ADAPTATION OPTIONS	SUPPORTING POLICIES
Implement fully the Vessel Day Scheme to control fishing efforts by the PNA	Strengthen national capacity to administer the VDS.
Diversify sources of fish for canneries and maintain trade agreements	Make national tuna management plans and marketing strategies more flexible for buying and selling tuna.
Identify ways to add more value to skipjack tuna	Promote partnerships to process and market skipjack tuna in new ways
Continue conservation and management measures for all species to maintain healthy populations resilient to climate change	Address climate change in the WCPFC's management objectives.
Promote energy efficient programs to assist fleets to minimise their greenhouse gas emissions and cope with rising oil prices and the costs of fishing further afield as tuna populations move east	Develop national means of managing tuna populations outside the WCPFC mandate at a subregional level.
Promote environmentally-friendly fishing operations	Require all commercial tuna vessels to provide catch and effort data to improve modelling of the effects of climate change.

Hard ecological limits are likely to play an important role in determining the success of adaptation efforts. Bell et al (2021) combined estimates based on RCP8.5 and RCP 4.5. and the results indicated that while there will be losses under both scenarios, losses are expected to be far less under RCP4.5. Achieving the necessary consensus at the WCPFC on agreements to retain economic benefits for the Pacific Islands will likely be a significant barrier, driven by diverging interests between coastal states and the tuna industry. Changing tuna stocks may also undermine the leverage that Pacific Island countries have in such negotiations, which may provide another political barrier to adaptation.

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