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CLIMATE CHANGE AND TOURISM IN TIMOR-LESTE: THE TIME TO ACT IS NOW

A CALL FOR ACTION TO RESPOND TO THE CLIMATE CHANGE CHALLENGE FACING TIMOR-LESTE TOURISM

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CONTENTS

ACRONYMS

ASEAN	Association of Southeast Asian Nations
CFC	Chlorofluorocarbon
CO_2	Carbon Dioxide
CRC	Sustainable Tourism Cooperative Research Centre
GDP	Gross Domestic Product
IPPC	Intergovernmental Panel on Climate Change
PRF	Pacific Resilience Facility
PT-CAP	Pacific Tourism – Climate Adaptation Project
SIDS	Small Island Developing States
SMP	Sustainable Management Plan
UNWTO	World Tourism Organization
WEHAB	Water, Energy Health, Agriculture, Biodiversity
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

Prior to the global COVID-19 pandemic outbreak, tourism was growing steadily across the Southeast Asia region (ASEAN) and the world. Undoubtedly, COVID-19 will affect the volume and profitability of the sector in the short term. The silver lining of this crisis is that the industry has an opportunity to 'build back better' and establish a more sustainable modus operandi.

Given tourism's important role as a creator of jobs, booster of economies and contributor to the fight against global poverty; and in the face of the projected increase in travelers in coming years, there exists a real need for the sector to urgently act to adopt policies which will ensure that the sector is developed responsibly and sustainably, using the 'quadruple bottom line' approach of environmental, social, economic and climate responsiveness. This paper will consider all of these sustainability elements, but specifically focus on how to respond to impending climate change challenge.

Unequivocally, planet earth is warming and as a result, sea levels are rising; sea temperatures are climbing; storm frequencies are becoming more rampant and oceans are becoming more acidic.

> **"We are the first generation to feel the effect of climate change and the last generation who can do something about it."**
>
> **— BARACK OBAMA, FORMER US PRESIDENT**

According to the Intergovernmental Panel on Climate Change (IPPC) human influence has been the dominant cause of this warming since the mid-20th century. It has become evident that humanity is not only feeling the effect of climate change; it is also contributing to it. This leaves the global tourism sector, with its reliance on the world's natural and climatic resources and dependence on the transport industry, facing an uncertain and challenging future.

Tourism is both a vector and a victim of climate change. World Tourism Organization (UNWTO) research shows that tourism accounts for 5% of global CO_2 emissions. Climate is a vital resource for tourism, and the sector's reliance on climate and weather-related factors makes it highly sensitive to any effects of climate change and global warming. In addition to reliable and affordable connectivity; quality accommodation and dining venues; and attractive activities and entertainment - climate is a vital resource for tourism, and the sector relies on climate and weather, particularly in ASEAN destinations. Tourism depends heavily on coastal ecosystems providing tourist features such as clean beaches and clear coastal water for swimming, as well as diverse reef communities for tourists to experience through boating, scuba and snorkeling.

Small Island Developing States (SIDS) such as Timor-Leste are most vulnerable to the extremes caused by climate change. There is an increased likelihood of coastal hazards that may threaten vital infrastructure, settlements and facilities. Local resources will be impacted by beach erosion, coral bleaching and other deterioration

effects of coastal conditions, and increasing temperatures may encourage non-native species to become present where they previously were not. Higher temperatures will also cause an increase in power consumption as a result of higher use of air conditioning. Finally, by the middle of the century, the IPCC predicts that climate change will reduce water resources in many small island states to the point where they become insufficient to meet demand during low-rainfall periods. Acerbated by 'slash and burn' farming techniques being used in places such as Timor-Leste, these effects all have the potential to create a huge impact on the sustained livelihood of small island communities. The impacts of climate change on SIDS may also cause increasing burdens from malnutrition, diarrheal, cardio-respiratory and infectious diseases; increased morbidity and mortality from heat waves, floods and droughts; changed distribution of some disease vectors and increasing burdens on health services.

A 'business-as-usual' scenario cannot be maintained and part of the post-coronavirus tourism reboot in Timor-Leste should embrace a new development paradigm that is low-carbon, resource efficient and socially inclusive. This is an unprecedented opportunity to embrace a truly sustainable tourism ethos to sector development.

> **"Climate change is the pre-eminent geopolitical and economic issue of the 21st century. It rewrites the global equation for development, peace and prosperity".**
>
> **— BAN KI-MOON FORMER SECRETARY-GENERAL OF THE UNITED NATIONS**

However, there must be a clear change in mindset to resist returning to a volume-driven travel and tourism model that many ASEAN countries adopted. Instead, stakeholders will need to rally together to 'build back better' through value creation from sustainable tourism. Because of Timor-Leste's nascent stage in tourism development, this process will be less complicated and onerous.

Prepared by USAID's Tourism For All Project, this report is a compendium of publications related to international good practice in responding to climate change. It is meant to inform Timor-Leste tourism stakeholders of inherent challenges and risks that will emerge in the coming years and provides a variety of examples of adaptive and mitigatory measures that can be implemented by the Government of Timor-Leste in partnership with the private sector. In tandem, the Project is producing a complementary training course to socialize the findings of this report and expand awareness of the threat of climate change.

Section 1 of this report provides a comprehensive overview of the danger of climate change on the global tourism industry and the actions being taken by leading destinations. Section 2 looks at the Timor-Leste situation in relation to climate change and looks at some of the unique challenges that SIDS will face in the future. It also features a collection of case studies highlighting the current situation in Timor-Leste vis-à-vis climate change. And finally, in Section 3 recommendations are provided as to what Timor-Leste can do to prepare for the inevitability of climate change and minimize the associated damage it may cause to the country.

SECTION 1

CLIMATE CHANGE AND TOURISM

This section provides a synopsis of intersecting relationships between tourism and climate change. It explores how tourism contributes to climate change and what can be done to reduce negative impacts on the environment through adaptation and mitigation. Furthermore, good practice examples and global initiatives are highlighted which may provide inspiration and guidance for Timor-Leste as it embarks on its journey to reducing climate change.

Affordable air travel, increased connectivity, new technological advances, new business models and greater visa facilitation around the world have fostered continuous growth of international and domestic tourism in the past decades. International tourist arrivals increased from 770 million in 2005 to 1.2 billion in 2016 and are forecast to reach 1.8 billion in 2030. Domestic tourist arrivals doubled from 4 billion in 2005 to 8 billion in 2016 and are projected to reach 15.6 billion in 2030. Today, tourism is one of the most important economic sectors driving growth and development. It represents 10% of global GDP and 10% of global employment and is forecast to continue growing steadily. While this evolution offers vast opportunities, it also comes with great responsibilities, notably with regards to environmental impacts and climate change.[1]

Direct effects of climate change include the role of climate variables, such as temperature, sunshine hours, precipitation, humidity and storm frequency, and the part they play with respect to tourist decision-making and activities, as well as destination choice. Another effect is the extent to which particular environments, such as tropical resorts, also gain some of their appeal from their climatic variables such as sunshine. Finally, indirect effects of climate change such as heat waves, fires, disease outbreaks, landscape change, and natural resource change - especially with respect to biodiversity - can also have substantial effects on tourism activities, perceptions of a location, and the capacity of firms to do business.[2]

When thinking about vulnerability to current and future changes it is useful to consider the WEHAB+ framework. WEHAB+ is simply an acronym to remind us of six important supports for society, these are:[3]

- **W**ater resources
- **E**nergy supply

[1] UN World Tourism Organisation (2019). Transport-related CO_2 Emissions of the Tourism Sector.
[2] UN Environmental Programme (2008). Climate Change Adaptation and Mitigation in the Tourism Sector: Frameworks, Tools and Practices.
[3] The WEHAB initiative was proposed by UN Secretary-General Kofi Annan as a contribution to the preparations for the World Summit on Sustainable Development. It seeks to provide focus and impetus to action in the five key thematic areas of Water, Energy, Health, Agriculture and Biodiversity and ecosystem management that are integral to a coherent international approach to the implementation of sustainable development

- **H**ealth
- **A**griculture and food supply
- **B**iodiversity, terrestrial and marine ecosystems (incorporating forestry, fisheries, biodiversity, coral reefs, etc.)

+ includes Human settlements and infrastructure (particularly coastal)

The impacts of climate change will affect tourism not only through its influence on destinations - such as disappearing coral reefs, coastal erosion, and flooding and landslides in urban centers - but also because of its capacity to reduce economic growth and per capita income, thereby affecting tourism demand.

The economically important Asian tourism industry is especially vulnerable to climate change and extreme weather events in particular because many local tourism businesses are directly or indirectly dependent on natural tourism resources and demonstrate a substantial lack of adaptive capacity.

> **"Climate change is real. It is happening right now, it is the most urgent threat facing our entire species and we need to work collectively together and stop procrastinating."**
>
> **— LEONARDO DI CAPRIO, ACTOR AND ENVIRONMENTALIST**

Transforming tourism for climate action requires embracing a low carbon pathway with awareness and optimization as key elements. Awareness – through measurement and disclosure of the emissions related to tourism activities and the setting of evidence-based targets. Optimization – through instruments and strategies to scale up mitigation and adaptation in the tourism sector with all stakeholders having to play a role.[4]

As with other economic sectors, tourism both contributes to and is affected by climate change. However, tourism is often regarded as being among the more vulnerable sectors because of its dependence on the environment as a factor in the attractiveness of destinations, although the long-term effects of climate change on tourist decision-making are relatively unknown given the adaptive capacity of tourists.

WHAT IS CO_2

The planet's climate has constantly been changing over geological time, with significant fluctuations of global average temperatures. However, this current period of warming is occurring more rapidly than any past events. It has become clear that humanity has caused most of the last century's warming by releasing heat-trapping gases—commonly referred to as greenhouse gases—to power our modern lives. We are doing this through burning fossil fuels, agriculture and land-use and other activities that drive climate change. Greenhouse gases are at the highest levels they

[4] IBID.

have ever been over the last 800,000 years. This rapid rise is a problem because it's changing our climate at a rate that is too fast for living things to adapt to.

One of the biggest drivers by far is our burning of fossil fuels – coal, gas and oil – which has increased the concentration of greenhouse gases – such as carbon dioxide – in our atmosphere. This, coupled with other activities like clearing land for agriculture, is causing the average temperature of our planet to increase. In fact, scientists are as certain of the link between greenhouse gases and global warming as they are of the link between smoking and lung cancer.

Tourism-related emissions include all domestic and international leisure and business travel and the related consumption of goods and services such as: transport to and from the destination, accommodation and activities at destinations; food and beverage consumption, and tourist retail and services. In addition, there are tourism-related emissions from infrastructure construction and maintenance.

The biggest culprit to tourism's contribution to climate change is carbon dioxide or CO_2 emissions produced by airplanes and other transportation modes. CO_2 is an invisible, odorless and colorless gas that is produced by burning carbon and organic compounds and by respiration. It is naturally present in air (about 0.03 per cent) and is absorbed by plants in photosynthesis. The earth requires some CO_2; however excess amounts remain in the atmosphere causing a greenhouse effect. A greenhouse gas is a component of the atmosphere that absorbs heat radiated by the earth and subsequently warms the atmosphere, creating what is commonly known as the greenhouse effect. Common greenhouse gases include carbon dioxide, methane and water vapor. The Asia and the Pacific region will account for 47% of global carbon emissions by 2030. Of course, solid waste produced by tourism activities is also not good for the environment.

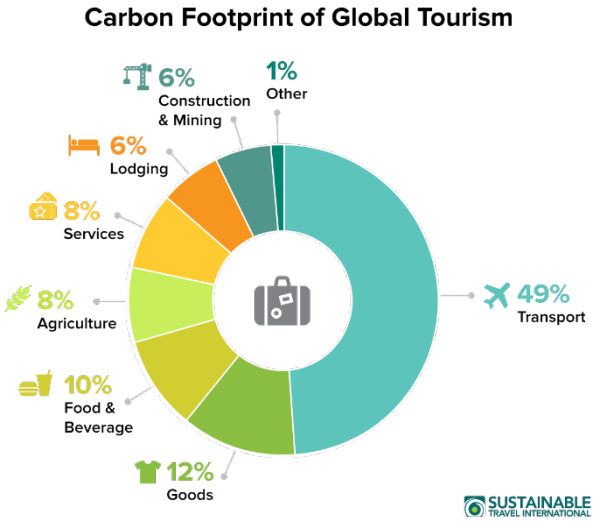
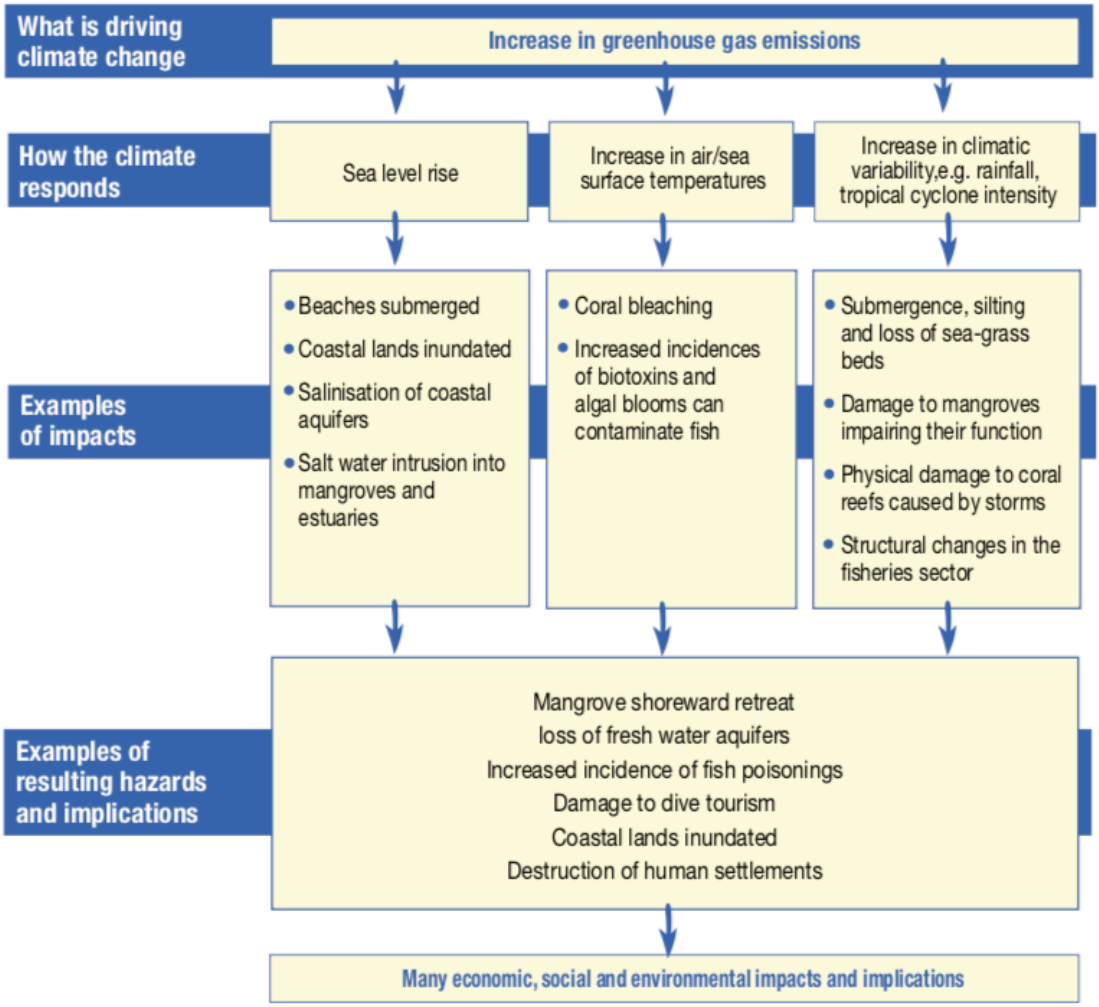


Exhibit 1 provides an illustrative example of how increases in greenhouse gas emissions leads to social, economic and environmental impacts and implications.[5]

[5] **Clarke, J.** (2004) *Potential Climate Change Impacts on the Caribbean Region and Possible Adaptation Responses.* Report prepared during a visiting fellowship in the Tyndall Centre for Climate Change Research, University of East Anglia, Norwich, UK.

EXHIBIT 1. POTENTIAL IMPACTS OF CLIMATE CHANGE ON COASTAL ZONES



The UNWTO and United Nations Environment Programme (UNEP) calculate that CO_2 emissions from tourism may reach 3059 metric tons by 2035 and most of this growth will be associated with air travel. To understand the enormity of this, consider how one ton of CO_2 can be produced in the following examples:

- average emission of one passenger on a flight from Dili to Rome;
- driving with a diesel car from Dili to Kupang and back 22 times (6,000 km);
- electricity consumption of 45 Timorese peoples for one year (4300 kWh)[6].

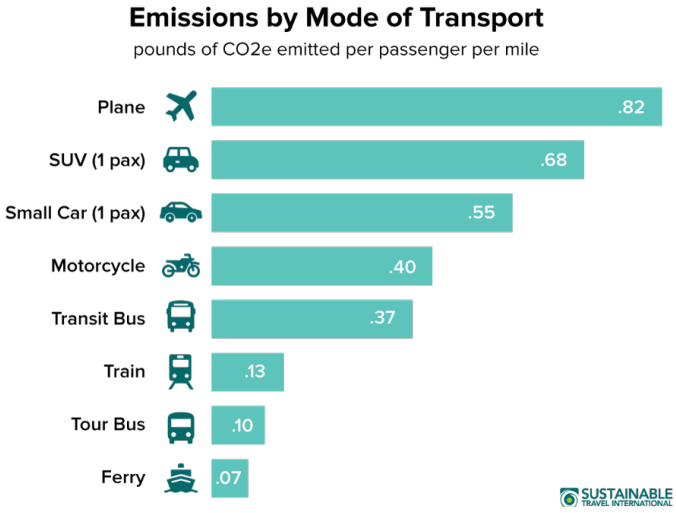
The European Environment Agency provides estimates on the amount of carbon dioxide (kilograms) emitted by various means of transport per 100 kilometers as presented in Exhibit 2.

[6] Timor-Leste's total energy consumption is 125.30 million kWh per year or 95 kWh per capita per year. Source: www.worlddata.info/asia/east-timor/energy-consumption

EXHIBIT 2. CARBON DIOXIDE EMISSIONS

MEANS OF TRANSPORT	KG CO_2 / PASSENGER PER 100 KM
Alone by car	10.4
By plane	28.5
By motorbike	7.2
By bus	6.8
By train	1.4

To gain absolute reductions in CO_2 emissions the tourism industry will need to become far more energy efficient and consumption patterns of tourists will need to change with respect to where and how people travel. This is a tall order that will demand structural changes across the tourism supply chain over the long term.



The challenge of staying within sustainable levels of atmospheric greenhouse gases (i.e. below 450 part per million) remains a formidable one. In the best case, these challenges are met with determination (requiring the world to decisively leave the current business–as-usual pathway).

To act, destinations across the globe, including Timor-Leste, need to embrace a variety of mitigatory and adaptative measures to reduce the associated risks and negative impacts of climate change. These are discussed in the next sub-sections of this report.

MITIGATION OF CLIMATE CHANGE

Mitigation can be achieved by reducing energy use, for instance through changing travel behavior, by improving energy efficiency, increasing the use of renewable energy, carbon offsetting strategies, sustainable destination planning and management, tour operators' choice of destinations and packaging of travel products, as well as other changes in business practices.

The overall objective of climate change mitigation strategies, policies and activities in the tourism sector is to contribute to the achievement of "carbon neutrality". For business and institutions "carbon neutrality" can be defined by the entire set of policies that an institution or business uses when it estimates its known greenhouse

gas emissions, takes measures to reduce them, and purchases carbon offsets to "neutralize" those emissions that remain.

Carbon neutrality for a business or institution signifies an entity (organization) that has a zero-net contribution of greenhouse gases to the atmosphere. This includes all activities directly controlled by the organization, including travel, purchasing of goods and services, and daily behavior of staff. Carbon neutrality can be achieved by improving the way the organization operates (e.g. through modified procurement considerations), by improving efficiency of operations (e.g. communications and meetings) and equipment (e.g. vehicle fleets and building). Carbon neutrality also recognizes offsetting as an option (last resort) to achieve full neutrality.

The UNWTO, UNEP and World Meteorological Organization (WMO) have identified four main strategies for climate change mitigation in tourism as identified below[7]:

- Reduce energy use – including influencing travel patterns through length of journeys, length of stay and mode of transport
- Improve energy efficiency – using new technology and improved practices in aviation, road transport and accommodation design and operations
- Increase the use of renewable energy – such as solar power for tourism enterprises
- Sequester carbon – including use of offsetting, although this should not be as an alternative to reducing emissions.

While some of these mitigation measures should be taken in the destination country, others (such as influence on travel and transport) may be taken in the source market country.

A closer look at mitigation measure that can be taken is presented in Exhibit 3.

EXHIBIT 3. MITIGATION MEASURES

MIGITATION MEASURE	DETAIL
Reduce refrigerant facilities using chlorofluorocarbon (CFC) gas	Tourism services, especially accommodation, use refrigerant facilities (including air-conditioners and refrigerators) which use CFC gas, and which thus contribute significantly to the total levels of CFC gas in the atmosphere. Reducing the number of refrigerant facilities or replacing them with newer, cleaner technology which does not use CFC gas will help in mitigating the effects of climate change.
Develop environmentally friendly tourist products	All tourist products follow environmental standards and focus on saving energy and water and reducing waste. Additionally, the development and promotion of ecotourism products is encouraged as these can directly contribute to environmental and biodiversity conservation.

[7] UNWTO, UNEP WMO (2008) *Climate Change and Tourism – responding to Global Challenges*

MIGITATION MEASURE	DETAIL
Control and/or manage the "carrying capacity" of tourism activity	Tourism activities in which carrying capacities are exceeded have the potential to negatively impact the natural environment.
Plant trees in tourist sites and resorts	Vegetation cover is an important factor in limiting the warming of the earth (which is considered as the main driver of climate change) and thus, the planting of trees in tourist sites and resorts will not only create beautiful landscapes to attract tourists but also actively contribute to limiting the impacts of climate change.
Encourage the use of the "3R" model (Reduce – Reuse – Recycle) in tourism development	This model ensures that waste from tourism activities will be kept to a minimum, thus again helping to limit the negative impacts of tourism on the natural environment.
Encourage the use of renewable energy and to save energy and water in tourism services	Timor-Leste is a tropical coastal country, so it has very high potential for success in using solar and wind energy, which are both considered cleaner and more environmentally friendly. Using renewable and environmentally friendly energy sources in tourism services rather than traditional ones (which are primarily oil or coal dependent) will actively contribute to preserving and maximizing the benefits of the natural environment.

In relation to the carbon neutrality concept, a successful mitigation policy could consider four main steps that any tourism-related business or institution can implement as a practical response to climate change.[8]

- **Eliminate** the emission of greenhouse gases by keeping away from certain activities that can be avoided without a considerable change to the tourism product or service quality.
- **Reduce** the emission of greenhouse gases by focusing on energy efficiency practices in specific activities.
- **Substitute** practices that are responsible for a large amount of greenhouse gas emissions with practices that have a lower carbon footprint.
- **Offset** remaining emissions to achieve full carbon neutrality.

In addition, each business unit or institution of the tourism sector is connected to three distinct but interrelated "activity spaces".[9]

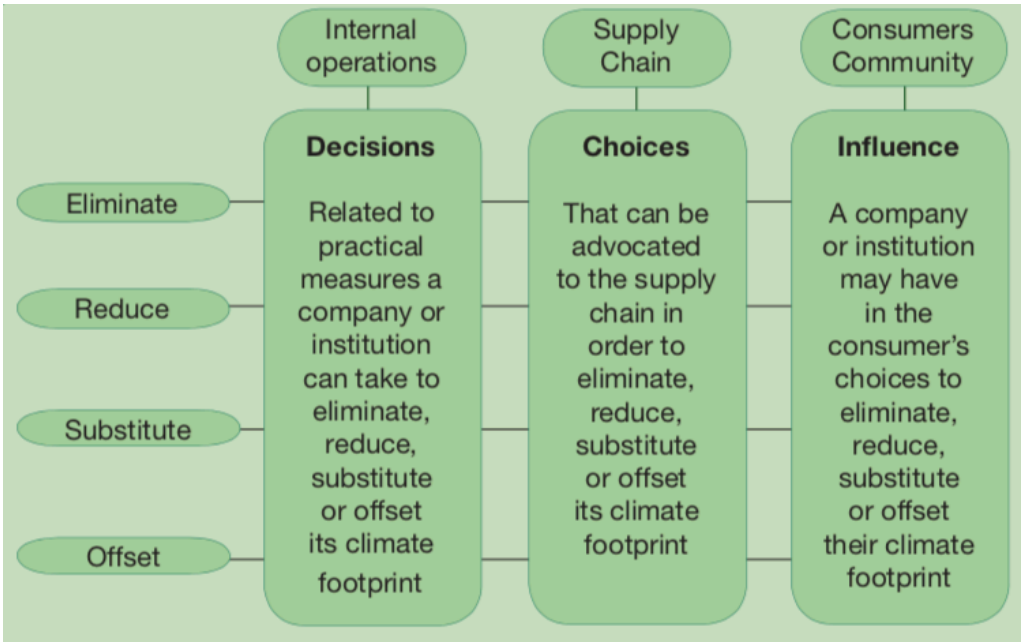
- **Internal operations activity space**: a company or an institution can directly implement practices to achieve carbon neutrality. It is fully the **decision** of the company to implement these practices.
- **Supply chain activity space**: a company or institution could seek to find practices that its supply chain members implement in their internal operations. Although a company cannot decide directly the internal operations of its supply chain partners, it is through the company's choice of partner that the supply chain can be made more sustainable.
- **Community/consumers activity space**: a company can influence the choices of its customers and communities through its own activities and strategies.

[8] Tyndall Centre for Climate Change Research (2005). Surviving climate change in small islands: A guidebook.
[9] IBID.

Exhibit 4 illustrates the combination of the two above-described dimensions and gives a practical framework to propose specific guidelines for each sub-sector of tourism leading to a set of questions as listed below.[10]

- What **decisions** related to practical measures can a company or institution take to eliminate, reduce, substitute or offset its carbon footprint?
- What **choices** can a company or institution advocate with regard to its supply chain members in order to eliminate, reduce, substitute or offset its own, and their carbon footprint?
- What **influence** may a company or institution have with regard to consumer choices, to eliminate, reduce, substitute or offset their carbon footprint?

EXHIBIT 4. FRAMEWORK FOR MITIGATION DECISIONS AND CHOICES



ADAPTATION TO CLIMATE CHANGE

Adaptation to climate change involves adjusting natural or human systems in response to actual or expected climatic changes or their impacts, so as to reduce harm or exploit beneficial opportunities.

Experience has shown that climate change adaptation actions for the tourism sector typically can only be implemented effectively within an integrated policy framework. Actions may be instigated nationally but will often need to be implemented locally. They will vary according to the type of environment and local circumstances, but typically might cover:

- Land use policy and location of buildings, especially required distance from the shoreline.
- Provision of infrastructure, such as sea defenses, flood control, etc.

[10] IBID.

- Product and market adaptation to changing weather patterns.
- Stricter management of resources of all kinds.
- Response strategies for natural disasters such as flooding.
- Adjustment to financial risks, including insurance provision.

According to the Asian Development Bank, Asian tourism is especially vulnerable to climate change, since many tourism businesses and destinations are extremely dependent on natural resources such as coral reefs, forests, alpine areas and beaches. In many cases, tourism businesses and destinations also demonstrate a relative lack of adaptive capacity.[11]

The Sustainable Tourism Cooperative Research Centre (CRC) in Australia conducted research on the impacts of climate change on tourism and proposed a number of destination-based adaptive strategies. The research investigated climate change in five popular tourism destinations across the continent. Key recommendations from the study, which may be informative to a destination such as Timor-Leste, include[12]:

Actions Government May Lead

- Conduct climate change risk assessments of natural assets and develop strategies to minimize risk, including emergency evacuation policies.
- Promote integrated regional planning approaches across the areas of tourism, climate, agriculture, natural resources, energy, water, infrastructure and health. Resource local governments to deliver regional development coordination.
- Support research to improve the accuracy of climate models and reduce the uncertainties in climate projection at the local level. Assist in funding this research and develop long term monitoring.
- Organize workshops to identify high priority adaptation strategies that can be implemented.
- Develop and implement policy for land planning, building codes and infrastructure development informed by good research. Clear actions, timelines and targets need to be identified, monitored and reported to the community.
- Provide appropriate funding for low carbon emission infrastructure development (e.g. roads, telecommunications, wharves, airports, etc.) that support tourism. Use this as a marketing opportunity.
- Involve tourism operators and representative bodies in the development of 'water policy'.
- Develop appropriate conflict resolution processes in anticipation of conflicts between competing users of water resources within the region.
- Make a concerted effort to plan for water use for 2030, 2050 and 2070 (e.g. water recycling, changed irrigation techniques).
- Provide information about the new carbon economy to enable tourism operators to assess the impact on their business; standardize a system of calculating emissions; develop a 'carbon' audit for the sector.

[11] Cruz, R. V. et al. (2007); Simpson, M. C. et al. (2008); Asian Development Bank (2012).
[12] Sustainable Tourism Cooperative Research Centre (2009). The Impacts of Climate Change on Australian Tourism Destinations.

- Provide incentives for best practice management to assist operators to reduce their environmental impact, through rebates, tax benefits, etc.
- Develop incentive schemes to support innovation and promote 'model' tourism businesses and organizations wanting to adapt to climate change.
- Reduce carbon footprint across the sector—hotels and restaurants required to purchase locally or pay surcharge on products sourced elsewhere.
- Adaptation and mitigation strategies need to be simple, cheap and effective with clearly identified needs and benefits.

Actions Businesses May Lead

- Keep up-to-date with the latest research and adapt accordingly.
- Consider how the new carbon market could impact business practices.
- Reduce environmental impact by moving to more efficient use of water, means of transport, taking up renewable energy sources, reducing energy consumption, improving waste management practices and keeping informed of future climate projections.
- Obtain environmental accreditation—assistance needs to be provided for operators including auditing, education and certification.
- Diversify products to cope with future environmental and market changes.
- Develop resource sharing among operators.
- Build accommodation and transport needs for visitors in the next 10, 40, 60 years.
- Price products so they are competitive and affordable to attract visitors.

Actions Industry May Lead

- Provide a tourism 'voice' for government planning and resourcing.
- Develop stakeholder networks across the region through which climate change threats and opportunities can be identified, ideas can be generated and disseminated, resources can be pooled, and priority actions can be implemented, monitored, evaluated and communicated back to stakeholders.
- Lobby governments to provide better incentives for operators to shift to 'greener' business practices.
- Communicate relevant policy changes to operators.
- Produce information and guides to assist small tourism operators and organizations to develop and undertake adaptation strategies as a means of supporting the regional economy.
- Develop new tourism products/experiences that have low carbon footprints—improve existing products/experiences to offset climate change impacts.
- Develop and implement offsets or more efficient means of transport.
- Develop and market destinations as 'cleangreen'—particularly targeting international markets sensitive to the carbon costs of travel such as Australia and Europe.
- Work with marketers, agencies and tourism operators to coordinate the response to climate change.
- Undertake research into the expected and actual changes in visitor behavior (e.g. visitation behavior and intentions) in key markets and in response to changing weather conditions and proposed adaptation plans.

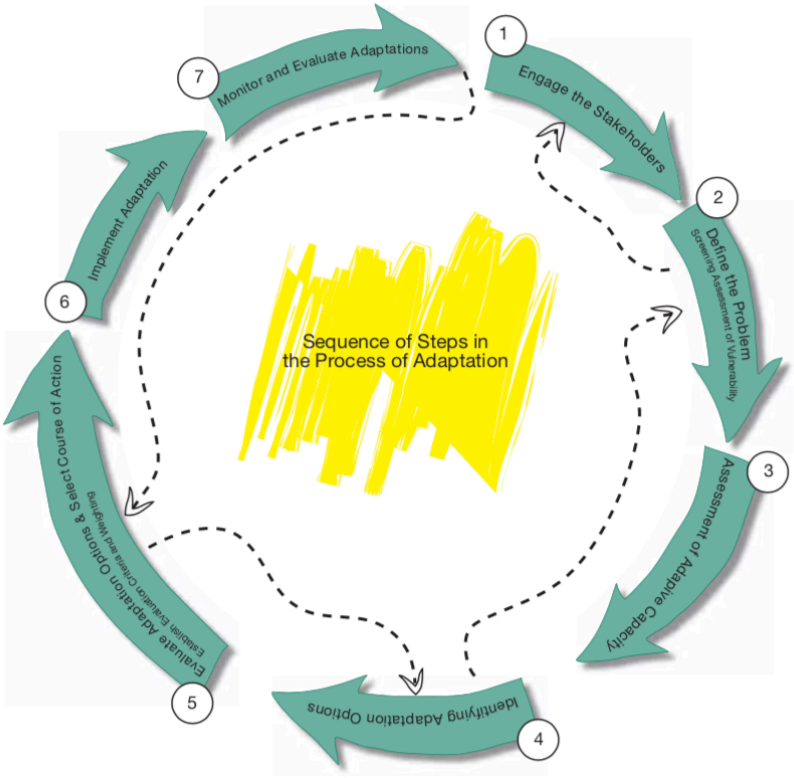
- Develop and deliver visitor information outlining how a region is tackling climate change including the promotion of operators engaging in good business practice.
- Explore opportunities where operators can work with the local community on specific adaptation projects as a means of building relationships and support for tourism.
- Conduct workshops and seminars to update the tourism operators and representative organizations on the likely impacts of climate change and adaptation strategies. Use these to demonstrate new technologies for adaptation.
- Provide training for the tourism workforce and recognize (value) the training so it is retained in the community.

Actions Communities May Lead

- Continue to lobby the government for support in tackling climate change.
- Continue to monitor environmental changes, disseminate findings and encourage further research.
- Understand the beliefs and values of local residents with the view to building support for adaptation in the tourism sector.
- Reduce energy use, water use and carbon footprint.
- Provide greater education of, and communication with, the public, tourism operators and service providers.
- Understand the impact of adaptive responses on the social, economic and biophysical processes.
- Become involved in social mapping exercises to determine community impacts from climate change.
- Continue to build resilience through strategic management of weeds, pests and fire.

In the guidebook titled *Surviving climate change in small islands: A guidebook* produced by Tyndall Centre for Climate Change Research a framework for the process of adaptation is proposed as depicted in Exhibit 5.

EXHIBIT 5. STEPS FOR CLIMATE CHANGE ADAPTATION



Step 1: The purpose of multi-stakeholder processes is to promote better decision making through an inclusive and transparent process that creates trust and a sense of buy-in or ownership among stakeholders. It also recognizes the substantial gaps in awareness and understanding of climate hazards and climate change among many key stakeholders.

Step 2: Understand how climate change may affect your region and what risks this would pose for the tourism sector. Understanding climate impacts is an essential early step and the assessment should include examination of physical risks to tourism resources (e.g., biodiversity, water supply) and infrastructure (e.g., coastal resorts), business and regulatory risks (e.g., changes in insurance coverage), or market risks (e.g., changes in international competitiveness through transportation costs).

Step 3: Assess the adaptive capacity[13] of communities to understand the inter-relationships between communities and their infrastructure, ecosystems and physical changes, social features such as availability of social networks and institutional features such as decision-making processes and policy/regulatory interventions. The IPCC (2001) identifies eight determinants of adaptive capacity, namely:

i. available technological options
ii. resources
iii. the structure of critical institution and decision-making authorities
iv. the stock of human capital
v. the stock of social capital including the definition of property rights

[13] Adaptive capacity is the potential or capability of a system to adjust its characteristics or behaviour to cope better with climate variability and change.

vi. the system's access to risk-spreading processes
vii. information management and the credibility of information supplied by decision makers
viii. the public's perceptions of risks and exposure

Step 4: Work with tourism stakeholders to compile a list of alternative technologies, management practices or policies that may enable them to better cope with the anticipated impacts of climate change. There are many good practice examples at the national and regional level to glean from.

Step 5: Conduct a second round of stakeholder consultation to present the full initial list of stakeholders identified adaptations (from Step 1), and determine criteria by which to evaluate adaptations and refine the portfolio of adaptations to be considered for implementation. USAID suggests a number of potential evaluation criteria for adaptation options.[14]

Step 6: Implementation of the adaptation options selected in step 5 requires that the roles of implementing stakeholders, resource requirements, and timelines be specifically defined. The following components of the implementation plan should be considered: strategic plan outlining actions and timelines of involved stakeholders; capacity building needs assessment and training plan; financial/business plan covering expenditure needs and revenue sources; outreach/communication plan; sustainability plan; and plan for monitoring the performance of adaptations.

Step 7: To ensure the optimal realization of this ongoing investment, the final step in this process is to continuously evaluate the effectiveness of the implemented adaptations.

Many of the ideas and concepts provided in the mitigation and adaptation sections of this paper will be useful to guide Timor-Leste in addressing climate change.
However, it should be noted that climate change studies conducted in other tourism destinations typically lead to a number of often-articulated barriers to implementing the suggested adaptation and mitigation strategies including:

- the scale and uncertainty surrounding climate change projections
- communication within and between regional and national bodies
- concerns regarding the capacity of small to medium tourism enterprises to adapt, relative to governments and larger operators
- there was enough skepticism in the community to prohibit rapid uptake of adaptation and mitigation strategies.
- if adaptation and mitigation strategies are to be implemented successfully, they need to be simple, cheap and effective
- there are significant knowledge gaps around climate change resulting in a level of uncertainty about adaptation and mitigation.

[14] US Agency for International Development (2007). Adapting to Climate Variability and Change: A Guidance Manual for Development Planning.

INTERNATIONAL GOOD PRACTICE IN CLIMATE CHANGE AND SUSTAINABILITY

There are a number of examples of companies and institutional models that demonstrate how mitigatory and adaptative measures can be practically implemented. This sub-section provides some examples that Timor-Leste can consider.

Intrepid Travel Decarbonization Guide

In 2020, a leading tour operator with 40 offices around the world and operations in some 130 countries created a 10-step guide to provide an easy-to- follow action plan for other tourism businesses to get started on their journey, and to encourage our industry to rebuild more sustainably. It is intended to help businesses start on their carbon journey. It is not a one-size fits all solution and everyone is at a different stage. However, climate change is a collective responsibility of every government, organization and individual.[15]

The 10-steps include:

1. *Understand how climate change is impacting your business* by engaging with your stakeholders, customers, employees and investors — through a variety of mechanisms, including direct dialogue, surveys and engagement at professional and industry forums to understand how climate change is impacting your business and value chain. Take time to learn what the latest science says, and how your company's operations might be impacting that.
2. *Build internal support* and gain buy-in by engaging employees in the climate journey.
3. *Define your project team* to work on decarbonization and reduction strategies as well as environmental data collection and capacity building.
4. *Declare a climate emergency* with Tourism Declares, a global collective of tourism businesses, organizations and individuals who have pledged urgent action on climate change.
5. *Develop a carbon management strategy* that focuses on measuring your company's emissions annually, identifying emission reduction opportunities and offsetting the unavoidable emissions.
6. *Measure your emissions* from transport, to waste, to energy use so that you know where your emissions are coming from and can understand how to limit them.
7. *Reduce your carbon emissions* to identify opportunities to reduce emissions by changing tour itineraries, finding economies of scale in emissions (e.g. filling vehicles, etc.).
8. *Offset your carbon emissions* by purchasing carbon offset to take responsibility for your unavoidable emissions and become carbon neutral.
9. *Report your emissions* by communicating externally as part of your company's performance.
10. *Set emission reduction targets* that align with the best-available climate science in order to transform your company for a low-carbon future.

[15] Intrepid Travel (2020). A 10-Step Quick Start Guide to Decarbonise your Travel Business.

Tourism Declares Climate Change Emergency

Tourism Declares supports tourism businesses, organizations and individuals in declaring a climate emergency and acting to reduce their carbon emissions. The website[16] highlights the complex nature of the tourism industry; its climate impacts (especially through aviation); and its potential for positive influence and transformative change. All of which necessitate the creation of an industry-specific initiative to network, support and advocate for climate change action by governments and industry. This call to action has become even more urgent as the tourism industry looks to recover, reimagine and renew from the COVID-19 crisis. The initiative is building a global community of industry leaders, united in their public declaration of a climate emergency, and committed to aligning networks inside and outside the tourism sector. Resources are being developed to help converts create their own climate emergency plans. The initiative is also amplifying achievements of individual signatories' calls to action, positioning the group as an advocate for the urgent changes needed to accelerate a just transition towards carbon-free tourism. Tourism stakeholders in Timor-Leste have an opportunity to express their commitment to mitigating and adapting to climate change by becoming a signatory to the initiative and producing their own climate emergency plans.

TOURISM DECLARES
CLIMATE EMERGENCY

Euromonitor International Sustainable Travel Index

The Sustainable Travel Index helps destinations and travel businesses shift to more sustainable and purpose-driven tourism models by benchmarking performance against the 99 countries included in the index. Unfortunately, Timor-Leste is not included at this time.

Each country was analyzed across seven key pillars which make up sustainable tourism. These pillars look through the lens of environmental, social and economic sustainability, country risk as well as sustainable tourism demand, transport and lodging as depicted in Exhibit 6. [17]

EXHIBIT 6. SUSTAINABLE TOURISM PILLARS

[16] www.tourismdeclares.com
[17] Euromonitor International (2021). Top Countries for Sustainable Tourism – Embracing a Green Transformation for Travel Recovery.

Environmental Sustainability

A thriving natural environment is one of the main prerequisites for a successful and sustainable tourism offer. The environmental sustainability pillar contains five categories: climate, natural assets, pollution, energy and water. This pillar addresses the overall health of a country in terms of the environment, biodiversity and natural resources under threat due to climate emergency.

Social Sustainability

Pre-pandemic, social sustainability came second to the environment. However, governments, consumers and businesses have now shifted their focus to people and communities. The social sustainability pillar has since become an important component in determining a countries' ability to have fair and equitable societies. For the index, social sustainability encompasses access to resources, food security, poverty, happiness, freedom, equality and education.

Economic Sustainability

One area often overlooked is whether a country is overly dependent on tourism which makes it vulnerable to external threats such as natural disasters, terrorism or pandemics which can put jobs and communities at risk. The economic sustainability pillar therefore considers a country's relative economic performance based on its tourism dependency, debt levels, hospitality employment and business readiness to gauge strengths and weaknesses.

Risk

The travel and tourism industry is particularly susceptible to external risks like geopolitics, natural disasters, man-made catastrophes and diseases. The risk pillar has three main areas: safety, healthcare and endangered cultural sites and species.

Sustainable Tourism Demand

The demand for sustainable tourism is a complex balancing act. Each destination faces its own set of challenges in order not to overwhelm communities or damage nature and the environment. The level of resilience, value creation and amount of over tourism determines how sustainable a country's tourism demand is.

Sustainable Transport

Connectivity and mobility are key factors in enabling sustainable travel and tourism, especially where transport accounts for a significant share of the industry's carbon emissions. The sustainable transport pillar takes into account a country's dependency on air travel compared to rail and other modes. The higher the dependency on air, the more negative a weighting has been given, where CO_2 emissions per passenger are higher than other modes of transport.

Sustainable Lodging

The sustainable lodging pillar includes resource usage by hotels in terms of energy, water and carbon footprint. Hotel and short-term rental dependency was used to assess how diverse and balanced hotel supply is in each country. The greater the diversification of lodging formats, the more resilient the sector is in a crisis.

Pacific Tourism Climate Adaptation Project

In 2012, the AusAID-funded *Pacific Tourism – Climate Adaptation Project* (PT-CAP) applied innovative sustainability science to develop effective climate change adaptation policies and strategies for the South Pacific Island. The research project developed a tourism adaptation toolkit framework to assist tourism destinations in the Pacific to adapt to climate change risks.

The tourism adaptation toolkit framework provides a number of benefits to the various stakeholders, but first and foremost it offers a four-step guide for building the resilience of the tourism destination to the effects of climate change now and in the future. It provides ways to both identify the different stakeholders and elements that make up the tourism destination's supply and demand system, and ways to identify risks, and it also provides an overview of how the vulnerability of the tourism destination can be assessed. Taking all these steps into consideration, a range of options for the development and implementation of adaptation can be provided.

Step 1: *Identifying the tourism system.*

Climate change risks contribute to the overall vulnerability level of a destination, and it is important to identify the key players of the tourism system in the destination who will potentially be exposed to these risks, as their understanding of and perceptions about climate change can have an impact on the destination's overall response to climate change related threats. The identification of the tourism system components also helps to scope out the stakeholders that are potentially responsible for, and able to take adaptation actions. The toolkit framework provides a tourism system model including tourism destination region, tourism generating region, and transit route.

Step 2: *Identifying the risks.*

There are two types of risks: shocks and stressors. Shocks are rapid and immediate events while stressors are slow-onset ones that affect the tourism system. This differentiation is important when resources for adaptation are limited and decisions have to be made to prioritize the responses to the most relevant risks in the destination. An open-ended list of potential risks can be scoped out through desktop literature analysis and further added by incorporating local stakeholders' feedback. A ranking practice is recommended to engage local stakeholders, as these are the people who are exposed to the risks and who will be affected by future adaptation policies.

Step 3: *Assessing vulnerability and resilience.*

Three components of vulnerability, namely exposure, sensitivity, and system adaptiveness have to be fully understood to inform the development of adaptation strategies. Exposure presents an inventory of the destination's defining physical characteristics, and an understanding of how these are exposed to certain shocks and stressors identified in the previous step. Sensitivity captures the pre-existing economic, social, political and environmental conditions that shape how the destination is affected by the risks. System adaptiveness emphasizes how the system and its people respond to the risks and the consequences of these responses.

Step 4: *Developing and implementing adaptation.*

The climate adaptation portfolio for the tourism-recreation sector established by Scott et al. is utilized in this step to categorize the types of adaptation responses for tourism: technical and structural, behavioral and social, business management, governance and policy, and research and education. The categorization of adaptation options provides a systematic approach to identifying adaptation gaps in the existing system and incorporating adaptation into policy and business.

SECTION 2

CLIMATE CHANGE IN TIMOR-LESTE

There is little doubt that Timor-Leste, like most island nations in the Pacific and Coral Triangle will be affected by climate change in the future. SIDS in the Pacific, of which Timor-Leste can be considered a member, face a range of development challenges and are subject to continual environmental change and multiple risks to their livelihoods. As the largest export sector, a major job creator and a key contributor of GDP for most Pacific Island countries, tourism makes a crucial contribution to human development, economic growth and foreign exchange earnings in the region.

It is an established scientific fact that rapid emissions reduction is required to restore Earth's energy balance and avoid ocean heat uptake that would practically guarantee irreversible effects. Continuation of high fossil fuel emissions, given current knowledge of the consequences, would be an act of extraordinary intergenerational injustice, particularly for SIDS like Timor-Leste.

The unfortunate irony for Timor-Leste is that the country currently depends on revenues from fossil fuel extraction to fund the Petroleum Fund, which in turn supports national economic growth activities. By not exploiting available gas and oil reserves, Timor-Leste will have limited revenue sources. By ignoring the country's vulnerabilities to climate change, the safety, security and livelihoods of future generations of Timorese will be jeopardized. This dilemma further supports the need for economic diversification to non-extractive industries such as tourism and agriculture to help mitigate the risks of climate change to the Timorese people.

PACIFIC ISLANDS AND CLIMATE CHANGE

Pacific tourism is considered to be highly vulnerable to climate change impacts due to its climate sensitive nature as well as the characteristics of SIDS, ranging from limited natural resources to limited funds and human resources. Sea level rise, storm surges, more frequent and/or intense tropical cyclones, warming sea temperatures and changes in rainfall patterns affect the physical attributes of destinations and tourism infrastructure in the Pacific. This has consequent influences on destination attractiveness and tourists' patterns of travel. It is imperative for the tourism sector in the Pacific to adapt to climate change impacts which local communities are on the front line to face.

It is critical for SIDS, like Timor-Leste, to start building resilience to counter the impacts of climate change. In the South Pacific there is a Pacific Resilience Facility (PRF) that has been established "to build Pacific resilience in the face of more frequent and severe disasters and ongoing climate change threats". The PRF is a Pacific-owned, Pacific-led solution, answering a clear need for island nations. In support of the PRF, the Pacific Islands Forum has established a regional financing facility with a goal of US$1.5 billion. The PRF will help vulnerable Pacific people

exposed to climate change and disaster risks, particularly women and girls, children, the elderly and people with disabilities. It will also build the resilience, preparedness and adaptive capacity of poor communities before disasters strike; and invest in small grant based but high-impact projects to make communities disaster-ready. The PRF provides predictable and ongoing support so the Pacific nations can prepare themselves for disasters and long-term climate change risks, rather than waiting for the next catastrophe.[18] Timor-Leste can garner good practice and partnerships to counter climate change from the PRF example.

THE CORAL TRIANGLE AND CLIMATE CHANGE

Even more relevant to the Timor-Leste situation are predictions for the Coral Triangle, which stretches across six countries in Southeast Asia and the Pacific (Indonesia, Philippines, Malaysia, Papua New Guinea, Solomon Islands and Timor Leste) and is the richest place on earth in terms of biodiversity. In no more than 1% of the Earth's surface, evolution has produced species and ecosystems that are unrivalled in number, color and diversity. Within its seas, lie the richest marine communities and ecosystems found anywhere on planet Earth. With over 30% of the world's coral reefs, including 76% of the world's reef building corals and over 35% of the world's coral reef fish species, the Coral Triangle is remarkable and invaluable.

> **"The Coral Triangle is defined by marine zones containing at least 500 species of reef-building coral. The Coral Triangle supports livelihoods and provides income and food security, particularly for coastal communities. Resources from the area directly sustain more than 100 million people living there."**
>
> **— WORLD WILDLIFE FUND REPORT**

A 2009 report published by World Wildlife Australia in 2009, highlights the full extent of the threats and proposed solutions to the challenges facing the Coral Triangle and its people. Based on a thorough consideration of the climate, biology, economics and social characteristics of the region, it shows why these challenges are increasing, and how unchecked climate change will ultimately undermine and destroy ecosystems and livelihoods in the Coral Triangle.[19]

This report investigated the conclusions of over 300 published studies and consulted over 20 experts on different aspects of the future of the Coral Triangle. This information was used to explore how this region might change based on the decisions that are taken today.

There appears to be little doubt in the minds of hundreds of scientists that a failure to act on climate change will lead to regrettable and potentially catastrophic consequences for the world. These looming changes will also be amplified by the

[18] Pacific Islands Forum. www.forumsec.org/pacific-resilience-facility
[19] World Wildlife Fund Australia (2009). The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.

impact of many other environmental threats to coastal ecosystems that arise from declining water quality, destructive activities, over-exploitation and pollution. Failure to act to reduce these threats will ultimately spell out a gloomy economic and social future for the Coral Triangle and its people.

Unfortunately, the coastal ecosystems of Coral Triangle are deteriorating rapidly and 40% of coral reefs and mangroves have already been lost over the past 40 years. Coastal deforestation, coastal reclamation, declining water quality, pollution, sewage, destructive fishing and over-exploitation of marine life have had a severe impact on these essential ecosystems. This is placing many communities and businesses within the Coral Triangle at risk. The relationship between people and coastal ecosystems is now under extreme threat from climate change, as well as escalating local and regional environmental pressures. Regional and international action is urgently needed to avoid an ecological and human catastrophe.

The report offers two possible scenarios for the future. In one world, the international community continues down a track towards catastrophic climate change and the Coral Triangle countries do little to protect coastal ecosystems from the onslaught of local threats. In this world, the biological treasures of the region are destroyed by rapid increases in ocean temperature, acidity and sea level, while the resilience of coastal ecosystems deteriorates under ineffective coastal management. Poverty increases, food security plummets, economies suffer and coastal people migrate increasingly to urban centers.

> **"Within the Coral Triangle, the Solomon Islands, Papua New Guinea and Timor-Leste are in the most vulnerable category, especially as these countries will experience serious impacts as global temperatures rise beyond 3^0C."**
>
> **— WORLD WILDLIFE FUND REPORT**

The threats to healthy coral reefs, mangrove forests and seagrass beds within the Coral Triangle can be divided into two broad categories. The first set contains 'local' threats, which originate directly from activities within the region. Deforestation of mangroves, destruction of seagrass beds, declining water quality, pollution, over-exploitation of marine species, sewage discharge, and destructive fishing practices are some of the many direct impacts that humans have inflicted on the ecosystems of the Coral Triangle. The second category includes global threats from climate change, which have already been addressed.

If nothing is done about climate change, these are the predicted consequences:

Downward Spiral in Coastal Ecosystem Health and Biodiversity: There will be few coral reefs, mangroves and seagrass beds that survive given the high sea temperatures, low pH, suboptimal carbonate ion concentrations, and rapidly rising sea levels. The loss of these important habitats will see approximately 40-50% of

marine species decrease to very low abundance, and many will be driven to extinction.

Increasing Vulnerability of Coastal Communities: Rapidly rising sea levels will lead to the steady loss of coastal land and the inundation of coastal freshwater supplies. Together with increasing storm intensity, some parts of the Coral Triangle will experience reduced protection from ocean waves, leading to an increasing frequency and scale of damage to coastal communities and infrastructure. Increases in sea level of one meter or more will put tens of millions of people and their communities under extreme pressure. Many millions will have to move from coastal areas under these scenarios, with serious consequences for inland agriculture and other land use.

Reduced Food Security: The decreased productivity of coastal ecosystems will reduce the food resources and income available to coastal communities in the Coral Triangle. By 2050, coastal ecosystems will only be able to provide 50% of the fish protein that they do today, leading to increasing pressure on coastal agriculture and aquaculture. Access to water for coastal agriculture is likely to decrease sharply due to saltwater inundation of coastal groundwater as sea levels rise, while aquaculture is likely to suffer from the impact of reduced water quality caused by the loss of mangrove systems and other coastal ecosystems. The reduced availability of food in addition to the deterioration of water supplies is likely to cause increased health problems and rising infant mortality.

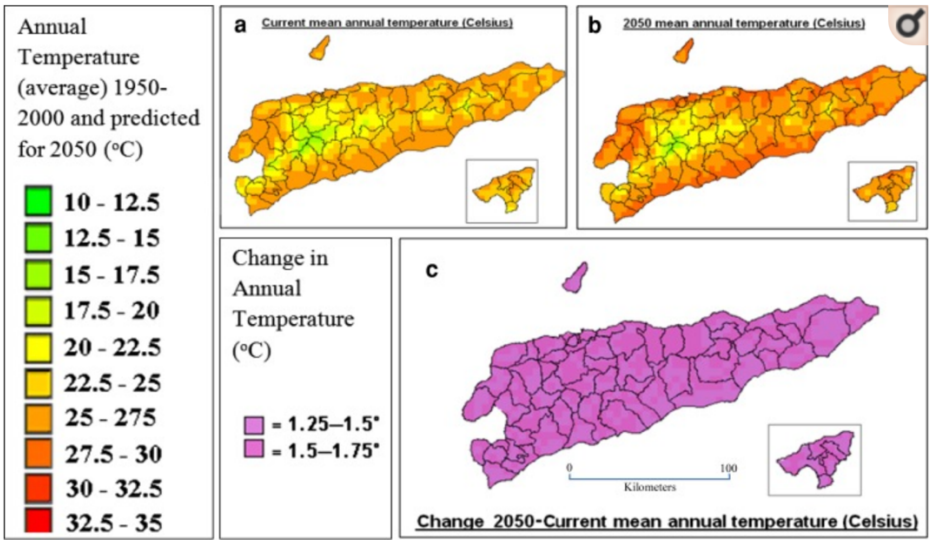
Social Disruption: The movement of people from communities in search of food and income will lead to the breakdown of traditional societies, and increase social disruption. The pressure on coastal infrastructure from sea level rise together with reduced food availability is likely to cause social disruption on large scales. Traditional fishing communities increasingly migrate to cities and towns. As a result of the desperate conditions within crowded urban environments, traditional, family and cultural integrity are lost.

Deteriorating Regional Security: While understanding and projecting how regional security will change is a complex task, reduced food and water security and the resulting social disruption represents a potent threat to regional security. Radicalization of some sectors of the community may follow, increasing tensions and civil unrest within the Coral Triangle region.

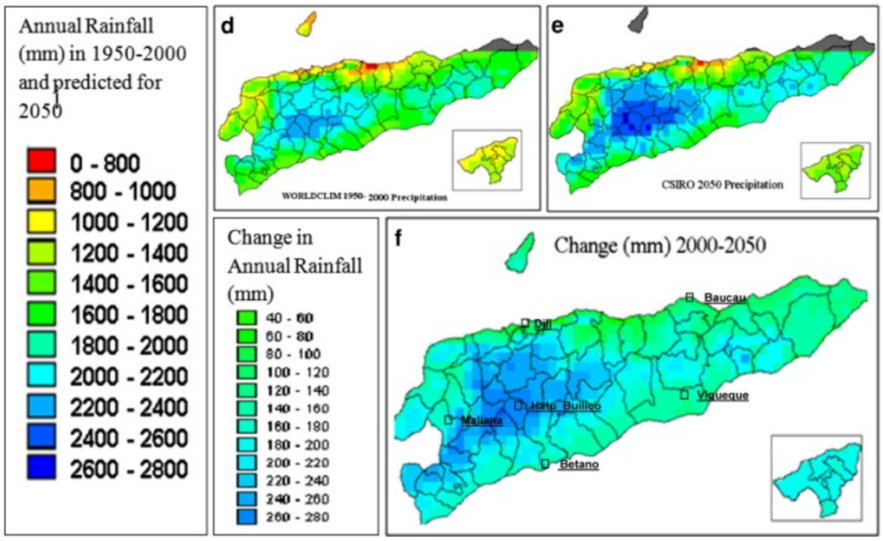
To avoid this disturbing storyline, governments, businesses, the media, and the public should pay increased attention to the environmental and social aspects of development. Countries like Timor-Leste will need to invest a large part of their economic development gains in improved efficiency of resource use, equity, social institutions and environmental protection.

CLIMATE CHANGE PREDICTIONS FOR TIMOR-LESTE

According to the WorldClim database, climate in Timor-Leste is predicted to become about 1.5°C warmer and about 10% wetter on average by 2050 as shown in the two below graphics.[20] [21] As a result of this increase in temperature climate-related risks to human health, livelihoods, food security, human security, water supply and economic growth are all likely to increase. There are also associated risks including sea level rise, leading to coastal flooding and erosion; changes to the salinity of coastal groundwater supplies, resulting in freshwater stress; risks to marine ecosystems, such as mass coral bleaching and die-offs; and more intense tropical cyclones.



Albeit increased rain will be good for crops, there will be the likelihood of higher incidence of flooding resulting in damage to homes, roads and other infrastructure.



[20] The current values were obtained from the WORLDCLIM database and 2050 predicted values were for the A2A scenario of the CSIRO model in the WORLDCLIM database (www.worldclim.org/futdown.htm).
[21] The current (~1950–2000) (**a**, **d**), predicted for 2050 (**b**, **e**) and the difference between 2050 and current (**c**, **f**) mean annual temperatures (**a**–**c**) and rainfall (**d**–**f**) for Timor Leste.

Changes in climate (temperature and rainfall) will affect the distribution and spread of pathogens. Timor-Leste is particularly vulnerable to mosquito-borne diseases such as malaria and dengue fever and avian influenza. An increase in mosquitoes, accompanied by a change in distribution of mosquito vectors carrying disease will increase health risks for both visitors and residents.

The contamination of food and water supplies from flooding and cyclones will also increase the risk of spread of some infectious diseases such as gastroenteritis and melioidosis. An increased incidence of water-borne disease associated with contaminated water caused by extreme rainfall events is also likely.

Higher temperatures will also cause an increase in power consumption as a result of higher use of air conditioning. Given that an average of 50% of energy consumption in hotels is attributable to air conditioning, this is likely to result in a significant increase in operation costs. An increase in power outages as existing infrastructure struggles to fulfil demand would also inconvenience visitors and add to business costs.[45]

More intense high rainfall events will increase the severity and inundation time of severe floods, resulting in a greater risk of damage to infrastructure including roads, bridges, accommodation facilities.

According to the Pacific-Australia Climate Change Science and Adaptation Planning Program, satellite data indicate the sea level has risen near Timor-Leste by about 9 mm per year since 1993. This is larger than the global average of 2.8-3.6 mm per year.[22] This trend in rising sea level is expected to continue with the following scenarios depending on levels of emissions.

	2030 (cm)	2050 (cm)	2070 (cm)	2090 (cm)
Very low emissions scenario	8–17	15–30	21–45	26–59
Low emissions scenario	9–17	16–31	24–48	32–67
Medium emissions scenario	8–17	15–30	23–47	33–68
Very high emissions scenario	9–18	18–34	30–58	43–88

Under all four emissions scenarios the acidity level of sea waters in the Timor-Leste region will continue to increase over the 21st century, with the greatest change under the very high emissions scenario. The impact of increased acidification on the health of reef ecosystems is likely to be compounded by other stressors including coral bleaching, storm damage and fishing pressure.

That means that significant sections of Timor-Leste's coastline will deteriorate due to changes in ocean levels. The sections in red in the below map indicate areas that could be underwater as soon as 2030 due to climate change. The south coast of the country appears to be more vulnerable to these changes.[23]

[22] Current and future climate of Timor-Leste (2011), Australian Government. www.pacificclimatechangescience.org/wp-content/uploads/2013/06/5_PACCSAP-Timor-Leste-9pp_WEB.pdf
[23] Scenario mapping available at: https://sealevel.climatecentral.org/maps/

CLIMATE CHANGE CASE STUDIES IN TIMOR-LESTE

It is clear from the analysis provided in this report that climate change is more than likely to affect the tourism industry in Timor-Leste. In fact, there is already evidence of this happening in some parts of the country. The Caimeo Beach Resort Case Study is a case in point of how the powers of mother nature are influencing the fortunes of tourism enterprises through changing ocean cycles caused by climate change. On Ataúro Island, a survey was conducted to better understand the perceptions and awareness of climate change by local entrepreneurs and tourism operators. The catastrophic floods of April 4th, 2021 not only caused multiple fatalities but destroyed many homes and some essential state infrastructure, affecting all of the municipalities in the country. These case studies provide a first hand evidence that climate change is here now and not a distant cause for concern.

CASE STUDY 1: CAIMEO BEACH RESORT DESTROYED BY IMPACTS OF CLIMATE CHANGE

CAIMEO BEACH RESORT

BLACK ROCK RESTAURANT

Introduction

In 2010, the owners of Caimeo Beach Resort and Black Rock Restaurant developed an upscale camping site and restaurant to cater to locals and expatriates desiring a weekend escape from Timor-Leste's capital city. A pleasant and picturesque 40-minute drive (30-kilometers) west of Dili, the resort is located in the town of Liquica along a beautiful coconut fringed pebble beach with crystal clear waters. The resort's website enticed guests by stating "You can swim all year round and the weather is always warm. Black Rock Restaurant will serve you a delicious combination of international and local food, accompanied by a cold beer, wine or fresh juice." Truly a perfect oasis for those wishing to relax and unwind from the busy streets of Dili.

Initially, the property consisted of glamping tents and modern bathroom blocks. Recognizing a demand for more luxury accommodation, in 2019 the owners decided to expand the facilities and constructed six spacious villas set amongst the trees right on the edge of the ocean, with views to Alor Island in Indonesia and spectacular sunsets in the evening. The website described the villas as having "spacious interiors with high ceilings, louvered windows back and front for capturing the sea breezes and air con for those who want to sleep in late in the morning with the block-out curtains drawn".

In early 2020, with the completion of the new villas and backed by an ambitious marketing campaign, the future was looking bright for the Caimeo Beach Resort. Content on digital marketing channels, including the www.caimeobeach.com, Booking.com and TripAdviser was updated; retail agents across Australia were actively promoting; and there were serious inquiries for bookings, such as a group of 20 amateur (or ham) radio operators from Germany intending to stay for ten nights.

And then the forces of nature changed the fortunes of Caimeo Beach Resort. Rising sea levels and increasingly turbulent wave action due to climate change caused severe damage to the property forcing the owners to close indefinitely.

Caimeo Beach Resort
is now CLOSED

Due to unforeseen circumstances, the Caimeo Beach Resort is no longer operating.
We would like to thank all of our supporters and wish you well for the future.

Climate Change and the Caimeo Beach Resort

Any developer wishing to build a resort near the ocean must consider adaptive measures to prevent damage from wave action and shifts in sea level, and the owners of Caimeo Beach Resort were no exception. As shown in the below photos, from the onset of the resort development, a protective wall was built, which over eight years shielded the property from the ocean.

In 2020, the owner noticed a change in the predictability of the ocean and waves. What were previously smooth seas changed to consistently large waves regardless of tide and weather. As a result, the configuration of the beach area rapidly changed. Within a matter of months, the resort and the new villas would be taken by the sea, causing irreparable damage to the property and the community.

The Caimeo Beach Resort owners prided themselves on the employment and economic opportunities created by the hotel and restaurant. At its peak, 23 people

were employed full time and local community entrepreneurs supplied everything from building supplies, fish, vegetables, fruits and furniture to the resort, generating significant opportunity along the tourism value chain. These jobs are all gone and the owner estimates that over US$1,000,000 of damage has been inflicted upon the property. There are no plans to rebuild.

Mitigatory and Adaptive Measures Taken by Caimeo Beach Resort

In terms of climate change adaption, the Caimeo Beach Resort was protected by a substantial retaining wall which was continually maintained and upgraded. This was often at great cost to the owners, particularly as the sea level crisis became more acute. In addition, the villas were supported by strong foundations. Unfortunately, these mitigatory measures could not defend against the climate change phenomenon. The Caimeo Beach Resort was also designed to be eco-friendly to reduce water and electric consumption.

In relation to mitigatory measures to climate change, Caimeo Beach Resort's environmentally responsible ethos included a long list of activities as listed by the business below:

Saving trees on the beach
Our coastline is changing and we are devoted to saving as much of it as we can. Due to unusually large waves we lost 5 trees and a large part of our retaining wall. We are continually working on the front wall to ensure the remaining trees and land remain.

Preserving the foreshore
We are building a retaining wall the length of our site. We work with nature and where too much of our soil was removed by the ocean we have made a private beach area. We use local beach rocks to build our retaining wall so that it blends with the surrounding stony beach.

Building with natural materials
We build with local stone, local timber, sand from the river and bamboo products. Our doors, windows and most of our furniture we have made ourselves from local renewable timber.

Supporting local community
We buy local vegetables, building and furniture products, hand woven material (Tais), and everything we can locally. We sponsor sports clubs and events and donate to local community functions.

Educating local community in sustainability and environmental responsibility
We have school visits to our site to see what we do, we have work experience students from colleges and universities working with us and we do staff talks and practical lessons. Our lessons are done in the local language to make sure everyone understands.

Working outside our boundaries
We do beach clean ups, road repairs and picking up rubbish in the surrounding area.

Providing local employment
Caimeo Beach Resort is one of the largest employers in the area. We also employ casuals for small projects. We use unskilled labor and are constantly teaching new skills to our workers.

Economic improvements to the country
Timor Leste is an impoverished country. We are helping the fledgling tourist industry by encouraging tourists and travelers through social media, participating in tourist associations and privately organizing for visitors to Timor Leste.

Saving energy
All our villas are built with louvered windows and high ceilings allowing cross ventilation so the sea breezes can flow through the room. Overhead fans assist when additional air flow is needed. Air-conditioning is available for customers who need it as sometimes it is necessary for comfort, however it is only available in bedrooms and is operated by the guest. Our restaurant is open air with no power needed. Our kitchen uses a minimal amount of gas burners and refrigerators. We don't run a cool room and refrigerators are switched off if not needed. All our lights are operated manually by our staff. Our kitchen does not have a dish washing machine or coffee making machine, all products are cut by hand. Washing of linen is by request from guests, we don't have a clothes dryer: our laundry is dried in the sun.

World responsibility
We minimize the use of plastic straws, takeaway containers and water bottles are discouraged. We have a very small energy usage. We drive small economic cars or motor bikes.

Saving water
Our gardens are watered by hand during the evening and night when it is cool. We don't have any sprinklers or irrigation; the grey water (from showers) is used to water gardens. Our water comes from our own bore and is filtered for drinking. The water is pumped into tanks where it is stored for use. The pump only works when needed. Our kitchen minimizes water use, all washing up is done by hand.

Wildlife
We encourage local wildlife and have an interesting range of lizards including the large pink spotted gecko and flying lizard, we also have many birds and our front stone retaining wall is home for many crabs and other sea life.

Food sustainability
We only buy fresh fish from the local fishermen who fish in the bay in front of the restaurant. The fishermen only catch what can be used daily. We don't buy young fish or endangered species.
We buy fresh fruit and vegetables from our neighbors, we don't use mass produced catering products. All our pizza bases, cakes, wrap bread, sauces, stocks, dried fruit and more are made in our kitchen.

Preserving culture
Our restaurant serves a variety of local food and we have "Specials" featuring traditional dishes. Customs relating to family, weddings, funerals, births and other days are respected and facilitated. Local crafts such as Tais are used wherever possible.

Rubbish and recycling
We recycle food scraps and vegetative matter. Rubbish that we can't recycle is transported to Dili garbage tip by truck at our cost as there is no garbage service in Liquica. Sewerage waste is also transported to Dili at our cost.

Lessons Learned

There are a number of lessons learned from this Caimeo Beach Resort case study that are valuable for the Timor-Leste tourism industry and future resort developers.

- Ocean tides, sea levels and wave actions are changing and will continue to do so;
- Developments along the coastline must consider mitigatory measures to protect the property;
- Climate change is real and will affect small island nations such as Timor-Leste;
- Expect the unexpected.

CASE STUDY 2: CLIMATE CHANGE AWARENESS ON ATAURO ISLAND

Introduction

Timor-Leste's Ataúro Island is the untouched ecotourism gem of Southeast Asia. Just a short boat ride from the capital of Dili, Ataúro offers everything you could imagine or want in a relaxing tropical getaway: lush mountains with dozens of trails to explore; white sand beaches and gently lapping waves; volcanic mountains shrouded with wispy clouds; people and communities still living by local traditions; and the most biodiverse reefs in the entire world, with hundreds of dolphins and whales swarming the surface.

The tourism stakeholders of Ataúro established a tourism association to lead a collective approach to the sustainable development of their island. Originally formed as a group of tourism champions, the Asosiasaun Turizmu Koleku Mahanak Ataúro (ATKOMA) has been working since the year 2000 to pursue a common vision for developing low-impact tourism on the island of Ataúro. Through the support of USAID's Tourism for All Project, ATKOMA was legally registered on February 22, 2019 and is expanding its role to become the official Destination Management and Marketing Organization for Ataúro Island. ATKOMA aims to increase cooperation among local stakeholders to support the sustainable development of Ataúro's tourism industry while preserving the community's natural and cultural assets and improving the lives of local residents. ATKOMA also strives to be the most comprehensive source for travel information about Ataúro Island and will advocate and mobilize collective action to enhance visitor safety, beautification of the destination, and ensure sustainable economic development and cultural sustainability.

In 2019 the members of ATKOMA along with USAID's Tourism For All Project developed a Sustainable Tourism Strategy for the Island. The shared vision to grow an inclusive tourism industry while protecting the island's natural and cultural resources is succinctly encapsulated in the 2030 vision statement.

In the year 2030, Ataúro Island will be a pristine protected area and world-famous ecotourism destination with low impact development, renewable energy, healthy reefs, and vibrant communities that welcome a limited number of respectful visitors who will enjoy excellent service and authentic cultural and natural experiences provided by the people of Ataúro.

Notably, Ataúro's Sustainable Tourism Strategy is aligned with the National Government's 2030 Tourism Policy which is organized around 5 Ps – *Prioritize, Prosperity, Protect, Partnerships, and People*, *resulting* in the following priorities being established for Ataúro to achieve its vision 2030:

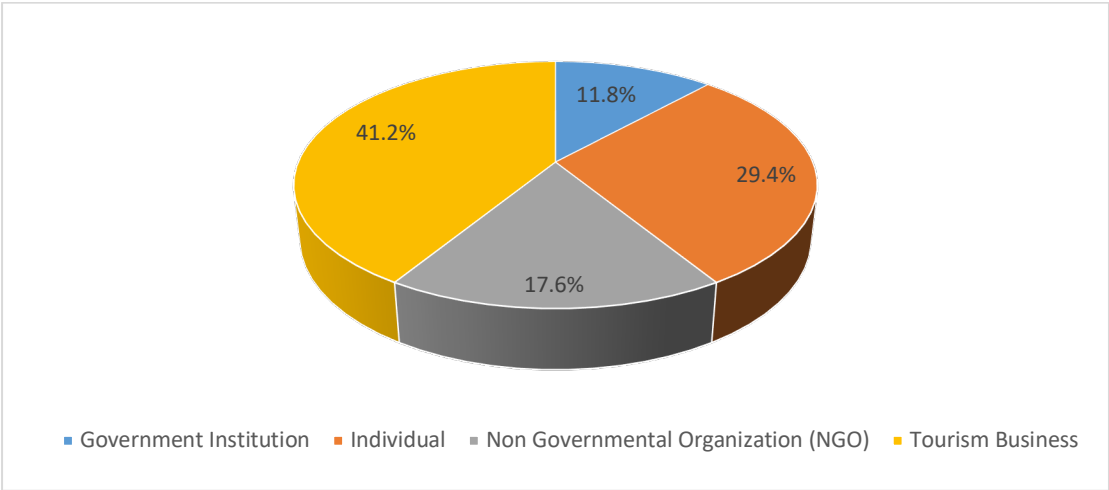
Priority 1 - Assist the government to **prioritize** investments & policies needed to improve the business enabling environment.
Priority 2 - Enhance the **prosperity** of businesses & community enterprises
Priority 3 - **Protect** natural and cultural resources
Priority 4 - Strengthen destination **partnerships**
Priority 5 - Provide training & business skills to the **people** of Ataúro

Under Priority 2, it was recognized that "Tourism is a dynamic, rapidly changing industry. A variety of economic, political, demographic, and environmental factors are driving that change, including increased access to new destinations, the development of the "experience" and "sharing" economies, and growing environmental awareness and concerns over climate change."

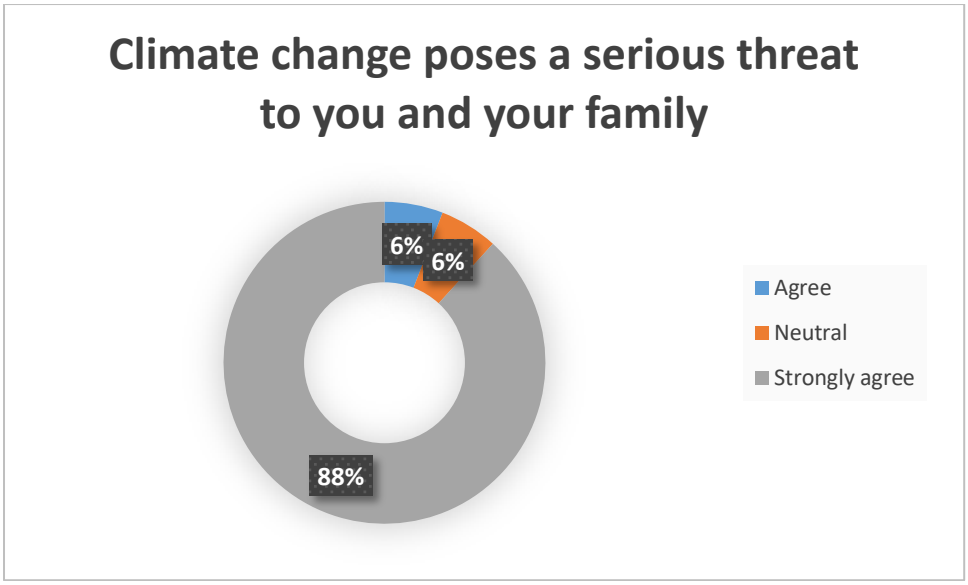
To better understand the perceptions of climate change, USAID's Tourism For All conducted a tablet-based survey with 17 residents of Ataúro Island involved in tourism development, particularly members of ATKOMA and representatives of local government. The objective of the survey was to better understand their perceptions and awareness of climate change, its potential impact on the island and possible mitigation/adaptation strategies. The questionnaire consisted of 17 questions and was administered by members of the Project staff.

Perceptions of Climate Change among Ataúro Island Residents

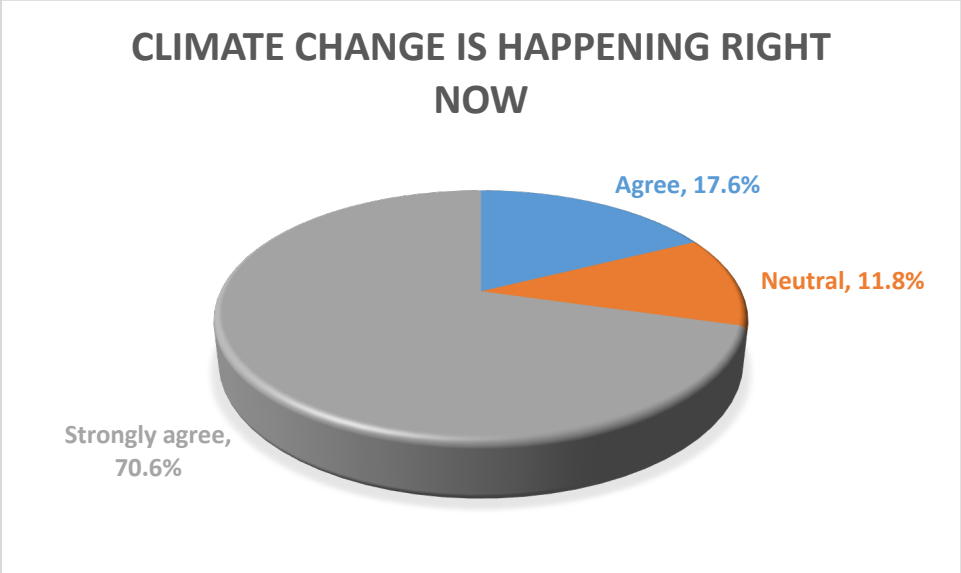
The following pie chart provides an overview of the representation of survey respondents. The majority (7) being from tourism businesses.



All 17 respondents stated that they had heard about climate change and believe that it poses a threat to Timor-Leste's future in ways ranging from food production, disease, the ocean degradation. As depicted in the below graph, 88% stated that climate change poses a 'serious' threat to them and their families.



The majority of respondents (12) agreed that climate change is caused by human activities and that its impacts are underestimated in the news. They also agreed that climate change is already happening as shown in the below graph.



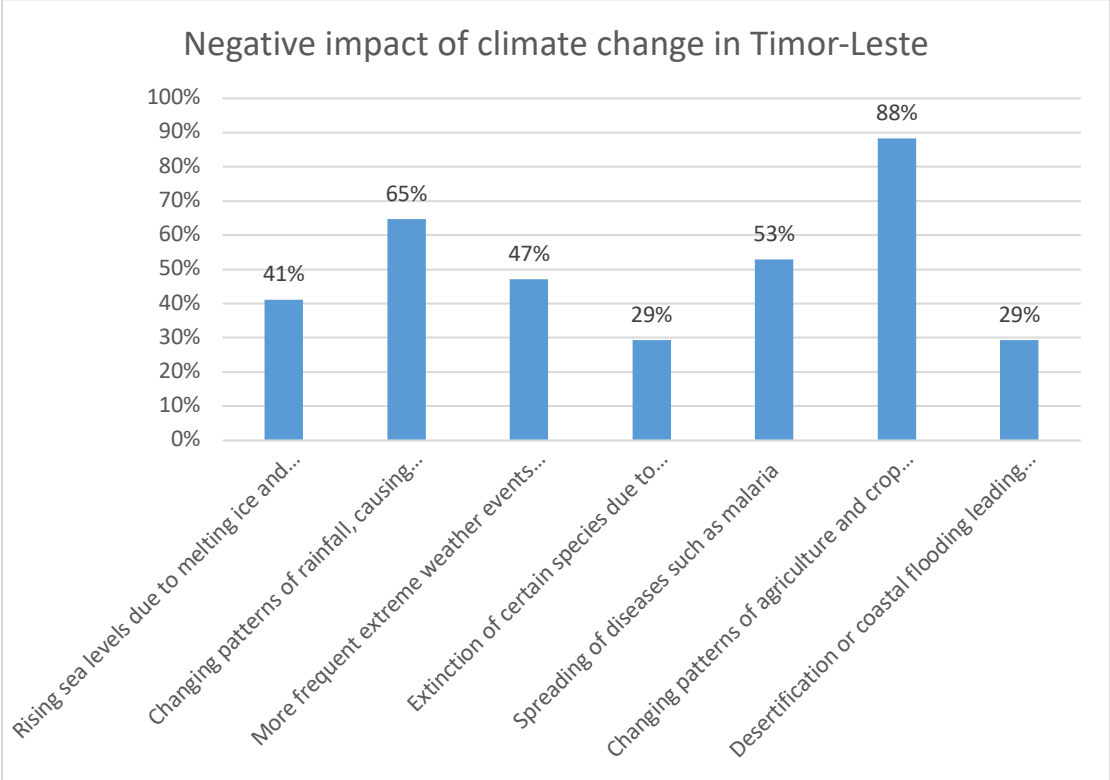
When asked if they were prepared to reduce their energy usage to help tackle the impacts of climate change, there was a less enthusiastic response with only five strongly agreeing. This could possibly be due to the fact that energy consumption by residents of Ataúro Island is already quite low in comparison to residents of Dili.

There was general agreement that temperatures have risen over the past decade (12) and that there have been noticeable changes in the environment, such as rising sea levels and less predictable weather patterns. Some also stated that as the temperatures rise their livestock is vulnerable and dying. Changes in the corals and the emergence of invasive species has also been observed.

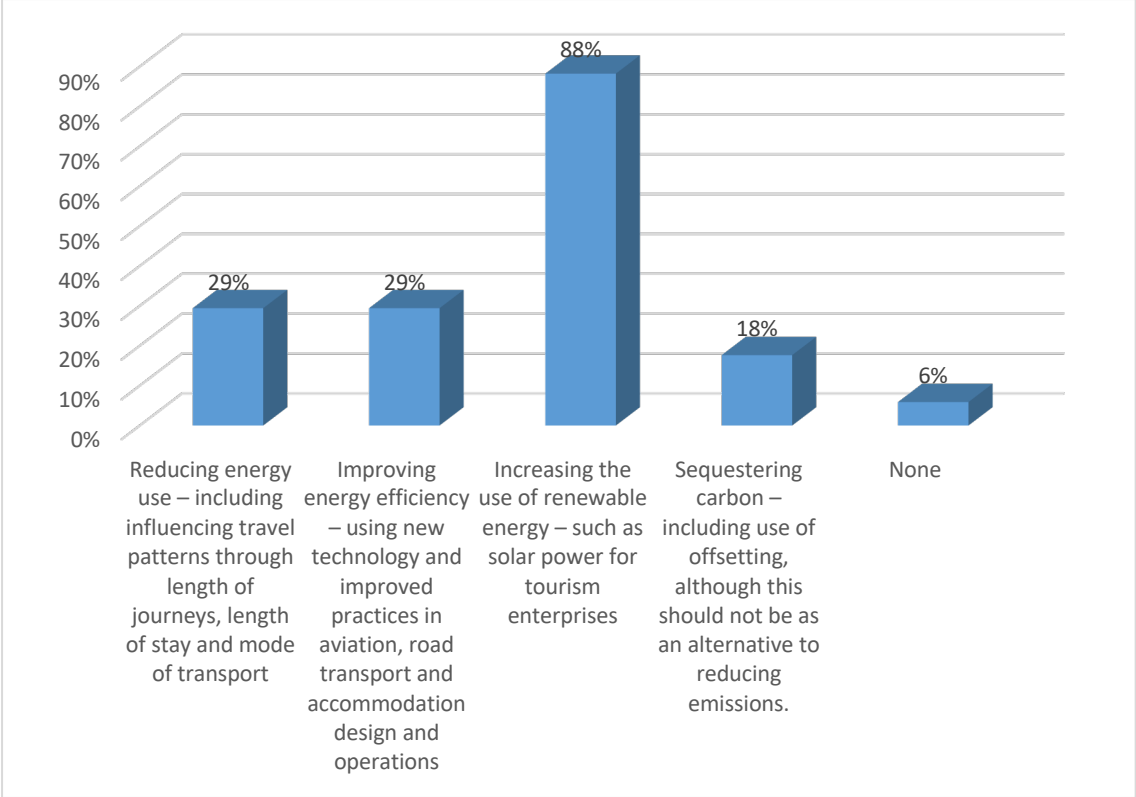
When asked what actions can be taken to lower the vulnerability to climate change a majority (14) suggested the need for socialization from government and

establishment of local law "tara bandu" to prohibit people from cutting trees, burning forest and haphazardly dumping garbage. There was a strong sense that the GoTL needs to prioritize resources to address the risk of climate change. There was less enthusiasm when asked if their company/organization can commit resources stating that they are already constrained with limited resources. Most people also perceive climate change as a long-term risk.

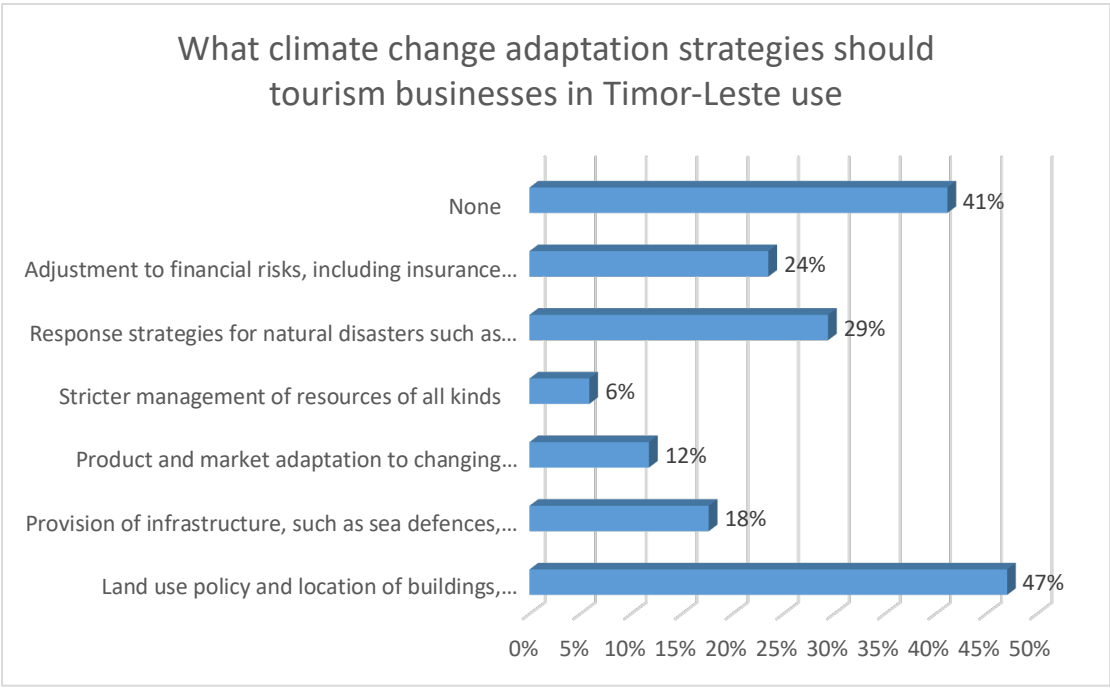
When asked to select from a variety of negative impacts of climate change in their community changing patterns of agriculture/crop yields caused by inconsistent rain fall ranked highest.



In terms of climate change mitigation strategies survey participants consider increased use of renewable energy such as solar power as the most practical. When asked what climate change mitigation strategies should tourism businesses in Timor-Leste use, the most favored (88%) is increased use of renewable energy as depicted in the below table.



In terms of climate change adaptation strategies survey participants view land use policy as the most viable, particularly avoiding developments too close to the shoreline.



Mitigatory and Adaptive Measures Taken on Ataúro Island

Ataúro Island is perhaps one of the most vulnerable parts of Timor-Leste when it comes to climate change. The island has a fragile shoreline and marine eco-system, both of which are its primary tourism assets.

Due to limited infrastructure, the community and local businesses are forced to adopt mitigatory measures such as solar panels and reduced energy usage. There is one generator for the entire island that only operates from sundown to sunup and covers the main areas on the east coast (Makili, Vila, Beloi and Bikeli). The west coast of the island does not have access to electricity any time of the day. Furthermore, because of Atauro's isolation from the mainland, many guest houses (i.e. Barry's Place and Ataúro Dive Resort) are built with local materials, which is a notable good practice.

USAID's Tourism For All Project worked with communities and NGOs on Ataúro to develop a sustainable management plan. Key challenges on Ataúro were prioritized and divided into three categories, summarized as follows:

MARINE

Unsustainable fishing
Seaweed cultivation limiting fishing areas
Limited access to fishing grounds
Marine debris and pollution
Impact from boats
Loss of habitat
Climate change
Lack of wildlife management
Maritime boundary security
Unsustainable marine tourism
Lack of enforcement
Lack of fisheries supply chain / infrastructure
Lack of knowledge on sustainable fishing gears
Lack of clarity on current and proposed marine management systems

TERRESTRIAL

Lack of land connectivity / accessibility
Freshwater scarcity
Lack of electricity
Land border conflicts
Deforestation
Lack of waste management
Lack of sustainable agricultural practices
Hunting wildlife
Climate change
Challenges to animal husbandry

SOCIO-CULTURAL

Youth migration
Underdeveloped basic infrastructure
Gender inequality
Undocumented local stories
Outside cultural influences
Lack of telecommunications
Lack of health services and facilities
Unprotected heritage sites
Mass tourism / bad tourism
Limited education and livelihood opportunities
Loss of Indigenous culture (practice and knowledge)
Lack of community engagement and coordination

Solutions to address these challenges were identified and associated management objectives were developed, with clear targets and timelines for implementation. The management objectives are briefly summarized as follows:

MARINE

Secure Ataúro as a Marine Protected Area (M-1), with formal recognition (M-2), a community-based collaborative management unit (M-3), a Management Plan with clear effectiveness indicators for biodiversity, fisheries, socio-economics and fisheries (M-4) that are routinely monitored (M-8), and with sustainable financing (M-5); and complemented by improved sustainable fishing infrastructure and support (M-9) and

TERRESTRIAL

Develop a land zoning plan for Ataúro Island that supports conservation, sustainable management, local livelihoods, and sites of socio-cultural and historical importance, using a 'ridge-to-reef' approach (T-2) designed through a collaborative multi-stakeholder team including communities, government and development partners (T-1).

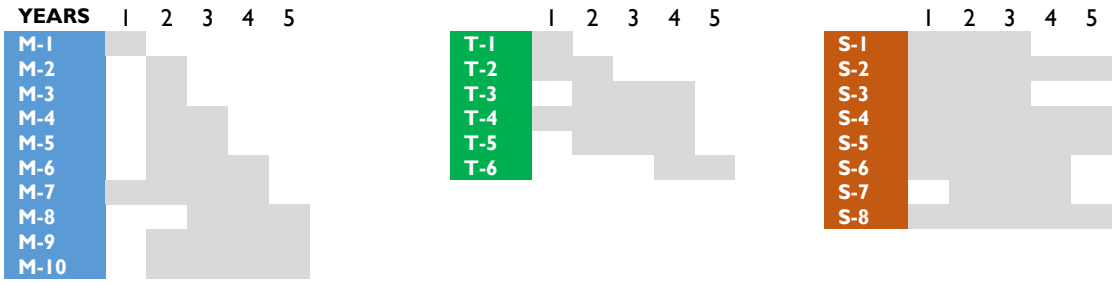
SOCIO-CULTURAL

Support current livelihoods on Ataúro to adopt best-practice approaches to sustainability and optimize existing income generation (through fishing, farming, livestock, tourism and associated enterprises) (S-1). Promote training and education to optimize alternative livelihood opportunities that reduce destructive or extractive activities

a clear regulatory support framework (M-7). Ensure communities are engaged throughout the MPA establishment and management processes, particularly regarding on-site management (M-6), with associated capacity building provided on sustainable fisheries, MPA management and patrol, surveillance and educative enforcement techniques (M-10). Establish a clear, one-stop tourism user fee to update and clarify the existing 'reef tax' and ensure optimal income generation and equitable distribution and benefit streaming to local stakeholders (M-5).

Establish improved road connectivity following best-practice principles for land, soil, slope and natural habitat integrity (T-3), and advance water conservation, collection, distribution and management systems to address water scarcity (T-4). Promote and establish renewable energy systems to become a showcase site in Timor-Leste for energy best-practice (T-5). Ultimately conjoin the land and marine spatial plans to upgrade Ataúro to National Park status (T-6).

(S-2) with improved information and communication technology (ICT) facilities and service providers (S-7). Ensure natural and historical heritage sites (S-3) and the indigenous culture of Ataúro Island are protected and promoted (S-4). Improve health services and facilities (S-6) and establish and enforce a zero-one-use plastics policy on the island for waste management (S-5). Ensure community engagement with equitable gender representation in all proposed activities (S-8).



These objectives have been complemented by a stakeholder analysis assessing levels of both interest and influence to implement change across societal groups; as well as a portfolio of development partners intended as a reference tool to promote the coordination of efforts and advance collaboration between partner organizations active on the island.

The SMP is intended to provide a framework for the sustainable development of Ataúro, to be implemented under the leadership of the Post Administrator and five *Chefe Suco* (lead representatives), supported by Dili Municipality and MAF, with implementation support provided by development partner collaborations and associated funders.

Lessons Learned

The Ataúro case study indicates that there is evidence of awareness of climate change on the island and that there is a need for increased awareness of the importance of sustainability among community members. This will enhance a sense of ownership and community stewardship. The SMP will provide one avenue for such socialization with USAID's Tourism For All Project intending to do an island wide awareness program. Accommodation providers on Ataúro Island are also pioneering sustainable development practices by using local construction materials and utilizing renewable energy such as solar panels.

CASE STUDY 3: THE EASTER 2021 CLIMATE CHANGE CALAMITY

Introduction

This case study is being developed in the aftermath of the April 4, 2021 floods in Dili and across much of Timor-Leste. The heavy rains are likely caused by the effects of climate change and demonstrate the need for improved resilience in planning and infrastructure development. The West Pacific Monsoon, Madden Julian Oscillation and La Niña conspired to create ideal conditions for increased rainfall and tropical storms in the region. All of these conditions were in place for the 2021 floods.

The meteorological station in Timor-Leste's densely populated capital Dili recorded more than 400 mm rainfall from April 3rd to 4th. Intense rains of up to 70 mm per hour swelled mountainous catchments and sent tidal waves of floodwaters and debris into populated areas. These heavy rains caused floods and landslides in all 13 municipalities of Timor-Leste. More than 14,000 people were displaced and 10,000 homes were submerged by the floods, with 42 fatalities recorded – 22 of them in Dili alone. Dili, the capital, was worst affected when 12 hours of nonstop rains resulted in the overflow of rivers and the inundation of many neighborhoods, with a majority of households experiencing some level of damage to their homes and property and critical infrastructure such as roads and bridges was destroyed.

The full picture of the impact across the country is still emerging several weeks after the event, but relief workers reported that entire communities were completely cut off from support, emergency services, food resupply, aid, medical support, and power and clean water supplies. There was significant damage to agriculture, at a time when many depend on subsistence farming.

Town water supplies have been cut and contaminated in many areas, with many people collecting water, washing and playing in 'creeks' and city monsoon drains. Electricity lines were brought down in a number of areas. Tens of thousands of people have lost their refrigerators, kitchens, beds, clothes, vehicles, possessions, savings.

Enormous efforts were made to clear rivers and drains of mud, clean streets and the majority of houses, feeding and housing thousands of displaced people. Almost everybody who was flooded lived in a one story house and lost the majority of their life belongings. Thousands of houses were consumed, buried, or half buried: mud filled some houses, hard aggregate sand and rock filled others.

Major widespread health risks include water borne diseases (typhoid, cholera, leptospirosis, hepatitis A, internal and external bacterial infections), malaria, dengue fever, malnutrition, and mental health issues.

Timor-Leste now finds itself overwhelmed by the cascading effects of two simultaneous calamities – catastrophic floods and COVID-19, a challenge unrivalled by any other since the death and destruction that was the tragic outcome of the country's struggle for independence in 1999. The government has established a

technical working group to identify public infrastructure that has been destroyed or damaged by the floods and for formulating proposals for their reconstruction or rehabilitation. Members of the Hotel Owners of Timor-Lorosa'e (HOTL) association reported losing an average of USD $11,000 due to repairs, cleaning, as well as lost and damaged assets during the floods. With business operating costs remaining the same, hotel members have experienced extensive losses, with increased likelihood of unemployment and new risks of declining income and spending across the country.

Prior to the flood, the Government's national annual budget had already been adjusted to respond to the management and consequences of the Covid-19 crisis, by diverting funds that had been allocated to the 2021 operational and development budgets of a range of ministries to others such as the Ministry of Health. In response to the flood, the Government had to adjust its budget once more to cover urgent work of infrastructure replacement and relief operations, further depleting funds available to several ministries, including the Ministry of Tourism, Commerce and Industry.

Once the short-term rehabilitation measures have been taken care of, it is clear that a major overhaul of urban planning, infrastructure development and climate change adaptation, resilience and mitigation will need to be addressed, both financially and socially.

Mitigatory and Adaptive Measures

Dili suffers from poor urban planning and has failed to consider adaptive measures to counter climate change leading to flooding like that experienced in April 2021. Whilst urban development plans have been drawn up in the past and building regulations are in place, they are not implemented properly. The movement of population from rural areas to the capital has led to an increase in unregulated, haphazard building, with the creation of "shanty towns" of flimsy shacks in parts of Dili that are not suitable for residential development. These have sprung up in Tasi Tolu and the banks of the Comoro River, for example, both of which were very badly affected by the flood, with some constructions swept away by the storm waters.

Flood hazard is further increased by the proliferation of concrete structures that reduce surface water infiltration, the widespread use of multi-pylon concrete bridges that trap flood debris, and inadequate design and maintenance of urban drainage channels that are perennially choked with sediment and urban waste and thus do not function well in flood conditions.

In the context of tourism, it is worth noting that in Dili the road that runs along the coast is one of the most-travelled by tourists. Multiple hotels and restaurants have been established there, attracted by the beachside location. Beach road suffered very serious damage in the flood and was completely undermined in one location. Access to the Cristo Rei Statue and beach and was also cut off. Although several repairs are underway, infrastructure along Beach Road is likely to suffer continual damage in years to come as the buffer zone between beach and asphalt decreases and planning for runoff is ignored.

Mitigation

In the days immediately following the flood, one of the most apparent causes was poor waste management leading to clogged up drains. There have been efforts within the Dili community to reduce single-use plastics, but more needs to be done to prevent the catastrophic events of Easter Sunday 2021. Several retail grocers in Dili no longer provide plastic bags to shoppers, but rather sell reusable bags for a token amount. With support from USAID, Mercy Corps has established the Plastics Upcycling Alliance to improve capacity for plastics recycling. However, these efforts will not be effective if there is not strong enforcement, political will and community participation.

There is a need to consider financial incentives to encourage climate change adaptation and mitigation. Timor-Leste does not manufacture vehicles so consequently they are all imported and subject to very high levels of tax at customs. There is an opportunity for government to drastically reduce or waive taxes for electric vehicles in the future. They are not currently available in the country. This could be one of the first steps in a long-term mitigation strategy, of particular relevance to the tourism industry. Other fiscal incentives can be considered in the case of importation of equipment to generate renewable energy. One hospitality-related business, East Timor Trading, has already installed an extensive array of solar panels to power its refrigeration plant and offices. Any excess power generated could be returned to the grid and sold to the national electricity provider. This could support the private sector whose profitability is hampered by the crippling rates for electric energy.

Adaptation

To adapt, reduce deforestation. Generally, Timor-Leste's topography consists of coastal plains, rising steeply to mountainous terrain (the highest point is 2,963 meters) in the center of the country. Precipitation from the mountains cascades into river basins, which are dry for much of the year but subject to flash floods in the rainy season. The event of April 4th manifested itself in Dili town center as an inundation, whilst many communities in the hills surrounding Dili and in the mountains suffered from serious landslides, some causing loss of life. Clearance of vegetation for building and tree felling for construction and fuel has led to soil erosion, increasing the risk of landslides, whilst also contributing to the exacerbation of climate change on a global scale. In addition, sedimentation caused by deforestation is washed into rivers and drains, which increases the effects of flooding in downstream areas and which also affects the marine ecosystem. A major cause of deforestation in Timor-Leste is the prevailing 'slash and burn' shifting cultivation,

which is the predominant farming system. It is a major contributor to climate change and the cause of uncontrolled fires leading to land and environmental degradation, deforestation, loss of biodiversity, soil erosion and landslide susceptibility and degradation of ground water reserve and water supplies. Actions that the tourism industry can take include, but are not limited to: sourcing food from farmers that do not practice slash and burn, incorporate tree planting as part of tour activities, and design buildings (existing and new) to include eco-friendly elements.

Another adaptation measure is public awareness. The Covid-19 crisis has shown that understanding of basic scientific issues by the general public is very poor. Public education and awareness-raising around that topic has been hindered by the prevalence of disinformation on the internet, as is also the case for climate change. This aspect is concerning, as Timor-Leste's response to climate change depends on understanding and acceptance of the issues and risks on the part of the public, leading to behavior change to mitigate the impacts. A vigorous public information campaign is required to address this at all levels, from social media platforms to community meetings and specialized training for national journalists. The latter is of particular importance to prevent the spread of misinformation and disinformation by "reliable" sources. The tourism industry can participate in campaigns to reduce plastics and inform their staff of their role in these efforts.

Lessons Learned

Addressing these issues at the macro level means taking a preventative approach:

- Reducing sedimentation of rivers by managing deforestation in upstream areas due to farming, firewood collection and development activities
- Improving waste management systems to prevent disposal of trash into the rivers
- Improving water flow out of residential areas through construction of adequate and integrated drainage systems
- Developing an integrated plan for urban development to regulate housing development and managing construction of infrastructure, particularly along riverbanks
- Setting up a practical system to respond quickly to the situation to normalise river flow or road access is necessary during the flood events.
- Conducting regular monitoring and maintenance of rivers is vital to avoid overflow during rainy seasons. [24]

Based on their local experience and observations, Institute of Petroleum and Geology (IPG) suggests that the following measures may be appropriate to reduce the incidence of flood-related hardship in Dili.[25]

1. Improved engineering and maintenance of existing drainage infrastructure.

[24] Cardosa, Joao Da Cruz (2021). "Dili floods a costly consequence of poor urban planning', The Interpreter, 13-04-2021 (online), available at: www.lowyinstitute.org (19-04-2021).
[25] Duffy, Brendan and Quigley, Mark (2021). "Flooding and land sliding in Timor-Leste: Linked hazards in a young mountain belt", Geo Down Under, 12-04-2021 (online) available at: geo-down-under.geoscience.education/timor-leste-flood-disaster (28-04-2021)

2. Measures to reduce sedimentation in the river channels. This would need to be based on careful analysis of sedimentation trends, which IPG has already begun to do using Lidar and repeat drone studies.
3. Control of solid waste entering the drainage systems. This would require regulatory and practical measures to be implemented.
4. Consideration should be given to storage of rainwater for domestic use. This would both reduce runoff and alleviate the groundwater situation.
5. Regulatory and practical measures to limit hard landscaping and improved infiltration, possibly coupled with managed aquifer recharge.
6. Improvement of building codes to encourage flood-hardy homes.

While the tourism industry has limited scope to alter this situation, it can certainly play a role. Some ways include:

1. Reduce single use plastic waste in all operations.
2. Participate in public awareness activities to reduce single-use plastics.
3. Encourage staff to reduce their plastic waste.
4. Do not provide single-use plastic bottles to guests.
5. Participate in clean ups.

Section 3

CONCLUSIONS AND RECOMMENDATIONS

It is evident from the findings of this report that climate change is a serious issue for Timor-Leste's burgeoning tourism industry. A variety of good practice examples of how countries, particularly island destinations, are responding to the climate change. Of utmost importance is for the Government of Timor-Leste in partnership with the private sector to identify and implement adaptative and mitigatory measures.

A first activity, for which USAID's Tourism For All Project has committed resources, is to deliver climate change awareness training to a cross section of tourism stakeholders to socialize the findings of this report. This will take place between May and September 2021. Beyond that, there are a number of activities that can take place to allow Timor-Leste to embark on its climate change journey. These recommendations are founded on information and examples provided in this study and represent international good practice.

The tourism sector in Timor-Leste is in a developmental stage. The potential to include climate change risk reduction design and technology is therefore high. At a macro/policy level, there are several key initial actions that can be taken to respond to the climate change challenge to the country's tourism, including:

- Engage with the National Climate Change Committee to learn from their experience, but more importantly, place the economic importance of tourism and its climate change risks on their agendas, especially through identifying how tourism can provide a rationale and stimulus for addressing broader social impacts of climate change;
- As a follow on to this report, undertake a comprehensive assessment of climate change impacts on the tourism sector and confirm adaptation needs and policy directions, possibly linked with the National Tourism Policy (see Annex A for guiding questions);
- Comprehensive destination level vulnerability assessments are needed to investigate how climate change risks/impacts are relevant to the localized context of the destination's system;
- Improve and increase data collection and improved storage and sharing of data to enable evidence-based decision making on climate change;
- Champion community-themed adaptation strategies revolved around the idea of local identity, the need to produce food locally (and support it) and the need for strong community-government relationships;
- Provide policy leadership by mandating the need to demonstrate integration of climate change considerations in all new development, as part of the government's commitment to sustainable tourism;
- Support effective management of coastal resources through a range of options including locally-managed regional networks of marine protected areas, protection of mangrove and seagrass beds and effective management of fisheries results in a slower decline in these resources;

- Encourage blended finance and mobilize private capital that is financially and socially profitable by delivering on the sustainable development goals (SDGs).
- Invest in negative emissions – carbon offsets that are high quality, such as coral reef or mangroves restoration; and
- Foster dialogue between the government and tourism businesses on climate change risks to the sector from the perspective of business risk reduction and collaboratively agree on sector-wide adaptation strategies.

More generally, the tourism industry can demonstrate its understanding and commitment to responding to the climate change challenge in the following ways:

- Become a signatory to the Tourism Declares Climate Change Emergency, pledge to reduce carbon emissions and raise the profile of Timor-Leste as a destination that is aware and cares;
- Launch an award (possibly in conjunction with the Turizmu Ba Ema Hotu Champions awards) to recognize organizations that are pro-actively responding to the climate change challenge;
- Establish plastic awareness campaigns in partnership with government, schools and companies to keep beaches clear of plastics and preserve Timor-Leste's blue economy;
- Encourage and celebrate the use of renewal energy by industry;
- Market Timor-Leste as a 'green' destination, which represents an adaptation to growing tourist concerns about the tourism footprint; and
- Invest in people and skills and diversify.

ANNEX A. CLIMATE CHANGE AND POLICY

GUIDING QUESTIONS FOR FURTHER INVESTIGATION AND ASSESSMENT

a) *Is climate change and resource management fully addressed in the tourism policy and strategy/master plan?*

This topic should be clearly addressed in the overall tourism policy and plan. Some countries may have established separate or subsequent policies on climate change which should be reflected in any revision of the tourism policy. It should be noted that many policies and actions relating to climate change may exist, such as concerning buildings, which are not specific to tourism but relevant to the sector.

b) *What level of awareness and concern is there about climate change and its implications for tourism?*

The extent to which this has been addressed by the tourism ministry and by industry bodies should be clear from records of meetings and from consultation. It is important to clarify whether awareness exists only at a high level or whether it is widespread in the sector.

c) *Is there sufficient technical knowledge on climate change and on how to relate this practically to tourism?*

While technical knowledge about climate change may be reasonable, weaknesses may lie in the interpretation of this into practical implications for tourism, which can then be acted upon. This is important for the design and implementation of strategies and actions and has implications for capacity building and other assistance.

d) *Are policies and actions in place to mitigate climate change in the sector?*

Governments should take a comprehensive approach to climate change mitigation, including considering issues relating to tourism and transport patterns in the long term as well as more short-term energy use. A range of instruments can be used in mitigation, such as regulations, financial incentives and voluntary instruments. These should include actions and policies to offset carbon emissions from the sector.

e) *Are policies and actions in place to help the sector adapt to the effects of climate change?*

This may relate to a range of adaptation measures, relating to tourism planning, destinations, infrastructure, products and markets, both centrally and locally.

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