Vanuatu rapid climate risk assessment framework and methodology

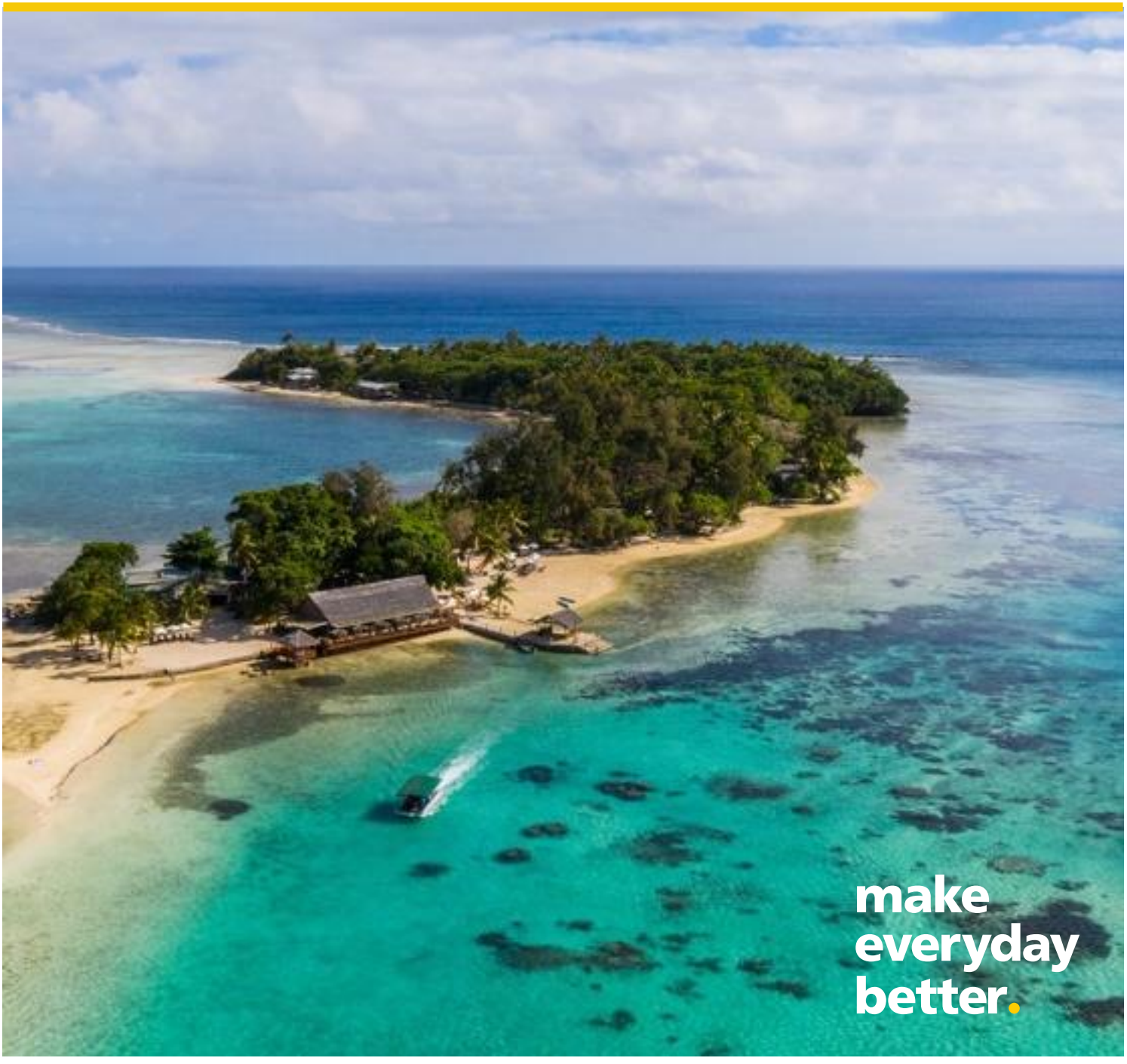
12 December 2023

Vanuatu Rapid Climate Risk Assessment Framework and Methodology

FINAL

Prepared for Secretariat of the Pacific Regional Environment Programme (SPREP)
Prepared by Beca International Consultants Ltd

12 December 2023



Contents

Appendices

Revision History

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1	Erin Connolly, Kayla Baker, Carlos Carvajal	Draft for Client Review	20/11/2023
2	Erin Connolly and Carlos Carvajal	Final Version	8/12/2023

Document Acceptance

Action	Name	Signed	Date
Prepared by	Erin Connolly, Kayla Baker, Carlos Carvajal		8/12/2023
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on behalf of	Beca International Consultants Ltd		

Executive Summary

Beca International Consultants Limited (Beca) has been commissioned by the Secretariat of the Pacific Regional Environment Programme (SPREP) to prepare a Rapid Climate Risk Assessment Framework and risk screening tool, and test it on the tourism sector (the 'Project'). Beca has undertaken consultation with key stakeholders identified by SPREP and the Vanuatu Department of Tourism (DOT) to understand their climate risk assessment needs, their roles and the contributions they can make to this project. The engagement with these stakeholders and information gathered has been used to inform the development of the Vanuatu Rapid Climate Risk Assessment Framework (RCRAF) and methodology (this report and associated Excel screening tool), the application of the framework to a tourism case study and the development of a financial projection mechanism for tourism (future project outputs).

Van-KIRAP has developed the future projections for climate hazards and a hazard-based impact assessment guideline. This Project expands on the Van-KIRAP work to create a rapid climate risk assessment tool that enable a representative from an industry or sector, who has operational expertise but may have limited experience regarding climate hazards, to complete a rapid high-level risk screening of their operations. The risk assessment will identify areas within their operations that are at risk from climate hazards in the future.

The Tool is an Excel workbook that takes inputs from the user and provides the results in a report. The inputs to the Tool are prompted through questions relating to:

- The industry's interactions to both the natural and built environment and the specific activities it carries out,
- Which climate hazards are relevant to the industry and have previously impacted their operations, and
- What response measures are already in place to manage hazards.

The vulnerability of elements of the industry/sector is included in the Tool as default preliminary scores which consider how sensitive the element typically is to each climate hazard and its capacity to adapt in the face of challenges. These default values can be updated in the response form to better reflect the context of the user's industry/sector operations. The exposure of elements to climate hazards is filled out by the user and, with vulnerability, is used to determine the risk of the climate hazard to each element.

As part of the results report, the Tool produces the top three climate hazards that could impact the industry/sector and the top elements of the industry/sector that are at risk, based on the risk scores calculated from the user's vulnerability and exposure inputs.

This RCRAF tool can be used by industry/sector experts in the Infrastructure, Fisheries, Water, Agriculture and Tourism sectors to complete a high-level screen of their sectors assets and operations to determine the areas that will be most at risk to climate change. This identification will allow for prioritisation of risks that require further investigation or where adaptation activities need to be focussed.

1 Introduction

Beca International Consultants Limited (Beca) has been commissioned by the Secretariat of the Pacific Regional Environment Programme (SPREP) to prepare a Rapid Climate Risk Assessment Framework and risk screening tool and test the tool on tourism sector (the 'Project').

Vanuatu is subject to multiple natural hazards that have historically caused devastating damage, including tropical cyclones, earthquakes, intense rainfall, volcanic eruptions, and tsunamis. The 'on the ground' damages, severity and intensity of many of these natural hazards, alongside climatic hazards, will be exacerbated by climate change into the future. For example, tropical cyclones have a history of causing significant damage to infrastructure within Vanuatu, disrupting life and business, and are expected to intensify into the future. To minimise the future impacts of climate hazards, it is important that key industry sectors in Vanuatu have a sound understanding of the overall risks climate change poses to their existing and future operations and see how these risks may change over time. This enables informed decision making in future planning to increase the resilience of communities and sectors in Vanuatu.

The goal of this project was to develop a Rapid Climate Risk Assessment Framework (RCRAF or 'framework') and methodology that can be applied to five selected sectors within Vanuatu to allow them to identify where they are most at risk from climate change.

The Vanuatu RCRAF and screening tool has been developed to guide users through an assessment of the potential direct physical risks of climate change and is relevant to users and operations within the five key sectors of Infrastructure, Fisheries, Water, Agriculture and Tourism sectors. The framework is 'rapid' because it is intentionally at a high level allowing for a screening of relevant climate hazards, to identify existing or future operations or features that would be at risk from climate hazards, and how these risks change in the future. This RCRAF enables prioritisation of adaptation planning and response actions (noting adaption responses is not the focus of the tool).

The framework leverages the scientific climate hazard products and tools that have been produced in recent years by Van-KIRAP and partners (e.g. CSIRO, VMGD). The key climate hazards investigated for the five key sectors align with those assessed in Van-KIRAP and include:

- Coastal Inundation
- Drought
- Extreme Rainfall
- Tropical Cyclones
- Ocean Acidification
- Marine Heatwaves
- Extreme Temperatures

1.1 This Report

The purpose of this report is to explain the background, methodology development and application of the framework. This report follows from the project Inception Report (Beca, 2023a) and Stakeholder Consultation Report (Beca, 2023b) which have outlined the project aims, steps and summarise the feedback on consultation with key stakeholders.

This report introduces this project and how this RCRAF aligns with the existing Van-KIRAP climate information products and outputs (Section 2), provides a background to the rapid climate risk assessment (Section 3), the

specific intent and methodology within the framework (Section 4 and 5), and concludes in Section 6 with recommendations for how the RCRAF can be applied to maximise effectiveness and uptake.

Accompanying this report is the digital Excel workbook risk screening tool.

Future stages of this project include commission for Beca to provide i) user guidance training materials ii) a case study where the framework is applied to a specific tourism sector, and iii) a financial projections mechanism for the tourism sector.

Figure 1: Vanuatu tropical cyclone aftermath, Pango Road, Port Vila.

2 Project Background

2.1 Vanuatu Context

Vanuatu is a South Pacific Ocean nation consisting of approximately 80 islands. It is known for its beautiful landscapes, rich culture, and an extensive offering of tourist activities. Its position in the South Pacific and on the Pacific Ring of Fire means Vanuatu is subject to multiple natural hazards such as tropical cyclones, intense rainfall, earthquakes, volcanic eruptions, and tsunamis. The impact of many these natural hazards is increasing due to climate change, which poses additional risks including sea level rise, more frequent marine heatwaves and extreme rainfall events as well as hotter temperatures. Tropical cyclones have been particularly severe in the recent decade, resulting in significant damage to infrastructure and livelihoods.

To minimise the impacts of natural hazards and climate change and improve the nation's resilience, it is important to acknowledge that while risks cannot be eliminated, they can be identified, assessed, reduced, and managed. As such, resilient and sustainable development has been a key priority for the Vanuatuan government in recent years and there has been a significant effort to understand the climate risks and how they may change over time by undertaking climate risk and vulnerability assessments. These assessments enable the Vanuatu government to make informed decisions regarding the improvement of Vanuatu's climate resilience.

Some key pieces of climate risk and resilience work are detailed below.

2.1.1 Recent Climate Risk and Resilience Work in Vanuatu

Vanuatu Climate Futures Portal, a Climate Information Services portal has been established as part of Climate Information Services for Resilient Development in Vanuatu (Van-KIRAP) by the Commonwealth Science and Infrastructure Research Organisation (CSIRO), Vanuatu Meteorology and Geo-Hazards Department (VMGD), and SPREP. The portal includes a climate data visualisation tool, allowing users to view projections of climate hazards spatially and temporally, as well as data explainers, summaries, case studies, and other resources.

The aim of the portal is to facilitate the application of climate information within the agriculture, infrastructure, fisheries, tourism, and water sectors in Vanuatu. It sits alongside guidance for undertaking climate hazard impact assessments for those five sectors in Vanuatu[1].

Other climate risk work includes the following (non-exhaustive list):

- Vanuatu National Adaptation Plan of Action (2019-2030), developed by the National Advisory Committee on Climate Change, 2007[2].
- Climate Change and Disaster Risk Reduction Assessment for Greater Port Vila, developed by SPREP[3]
- Sarakata Flood Mitigation and Early Warning System Gap Analysis, developed by SPREP[4]

[1] CSIRO, SPREP and VMGD (2023). Climate hazard-based impact assessments for Vanuatu: A step-by- step guide on climate change related impact assessments for key sectors. https://www.vanclimatefutures.gov.vu/assets/docs/Van-KIRAP-Guidance.pdf

[2] National Advisory Committee on Climate Change (NACCC) (2006). National Adaptation Programme for Action (NAPA) https://unfccc.int/resource/docs/napa/vut01.pdf

[3] UN-HABITAT (2015). Climate Change Vulnerability Assessment: Greater Port Vila. https://fukuoka.unhabitat.org/wp-content/uploads/2021/12/PVVA_FullReport_Endorsed.pdf

[4] SPREP (2023). Sarakata Flood Mitigation and Early Warning System Gap Analysis report https://www.sprep.org/publications/sarakata-flood-mitigation-and-early-warning-system-gap-analysis-report

- ClimateWatch mobile app and the National Traditional Knowledge Indicators booklet to facilitate the use of observing nature to forecast weather and the climate, developed by Van-KIRAP and the Climate Information Services for Resilient Development in Vanuatu, and released in November 2023[5].

2.2 Project evolution

The step-by-step guide on climate change related impact assessments for agriculture, infrastructure, fisheries, tourism and water sectors, developed by CSIRO and VMGD for the Van-KIRAP Climate Futures Portal aims to guide users in undertaking climate impact assessments as the first step in completing comprehensive risk assessments used for policy development and adaptation planning[1](see Van-KIRAP portal). As an important element of a *comprehensive* risk assessment, their impact assessment is designed to be technically detailed and therefore is not easily implemented on the ground to inexperienced or unfamiliar users.

SPREP have identified the need for *rapid* assessments for use in resource-constrained situations that utilise qualitative, non-technical information to build an evidence base for identifying risks and prioritising adaptation options.

The goal of the Vanuatu Rapid Climate Risk Assessment Framework and Methodology project is to address that need and establish the assessment framework and associated methodology for use by non-experts on the ground. The assessment framework will enable the user to highlight key areas of high impact or risk for which adaptation options can be assessed.

To ensure consistency with other climate impact and risk assessments being carried out in Vanuatu, the RCRAF assessment has been informed by the Van-KIRAP guidance and is designed to be used alongside climate information products, resources within the Van-KIRAP Climate Futures portal, and to be applicable to the same key five sectors in Vanuatu.

Figure 2: Steps for conducting climate hazard-based impact assessments from the Van-KIRAP guidance on climate change related impact assessment for sectors.

[5] SPREP (2023). New mobile app and booklet to help preserve Vanuatu's traditional climate knowledge https://www.sprep.org/news/new-mobile-app-and-booklet-to-help-preserve-vanuatus-traditional-climate-knowledge

2.3 Stakeholder Engagement

Previous natural hazard events in Vanuatu, and the response to them, has shown that future guidelines, plans, and methodologies aiming to prepare and protect communities from natural hazards should be developed *with* the people of Vanuatu and should combine traditional knowledge and scientific knowledge[6].

Therefore, in developing the RCRAF, it was vital to include key stakeholders from across Vanuatu, including representatives from a range of sectors and government departments, were invited to engagement workshops, the aim being to understand their concerns, needs and roles within the framework.

These workshops were followed by an online survey, and guided the development of the RCRAF by providing insights into their needs and what role they can play within the framework development. The key questions asked are below:

- What is your organisation?
- Where do you operate within Vanuatu?
- What climate issues are you already seeing in your sector?
- How is climate change already affecting your organisation?
- What would help you to consider climate risks into your future planning?
- What role does your organisation play in identifying climate change risks in Vanuatu?
- Who do you think the end users of this framework will be?

Key outputs:

- The framework should be accessible, simple to use and cater to a wide range of abilities and a understanding of climate change and climate risks.
- The needs of the users will vary depending on the size and location of their operation.
- For tourism specifically, operators focus is typically on immediate day-to-day/season-to-season activities rather than mid to long term risk.
- Training, guidance and support is needed for the framework to be widely accepted and utilised throughout Vanuatu.

Refer to Section 4 for how these outputs have informed the development of the RCRAF. For a detailed account of the stakeholder engagement process, see Appendix D, and refer to the Stakeholder Consultation report[7] (Beca, 2023b).

Note that the final draft of this framework and methodology report was provided to Project Stakeholders. However, no review comments were received.

[6] Cronin, Shane J (2003). Participatory methods of incorporating scientific with traditional knowledge for volcanic hazard management on Ambae Island, Vanuatu. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=934ef7196328d3ca4e38c7918d1d5f745d058825

[7] Beca (2023b). Stakeholder Consultation report FINAL- Appendix D.

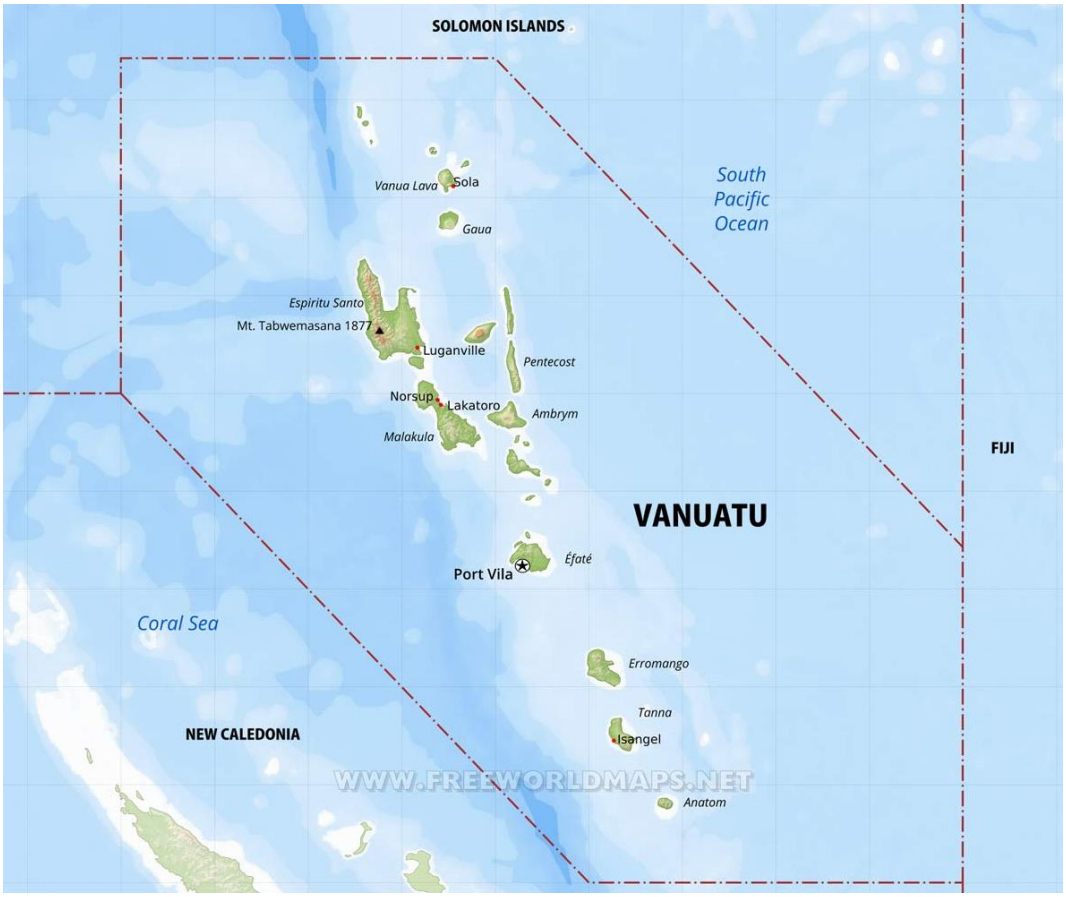


Figure 3: Vanuatu location Map.

3 Background to the Rapid Climate Risk Assessment Framework

3.1 Rapid Climate Risk Assessment Frameworks

A rapid climate risk assessment is a method of quickly and effectively screening risks which may arise as a result of climate change effects on natural climate-driven hazards.

The framework underpinning this RCRAF is intentionally high-level to cover a broad set of potential climate change hazards and consider the range of possible impact on the five key sectors. It is likely to highlight key areas of high impact or risk which may then be targeted for future detailed studies at regional, district or local level.

A RCRAF generally comprises three assessment steps:

1. A climate hazard assessment step which identifies the probability, intensity and timescale of the key hazards and identifying areas that may be particularly impacted, taking into account the historical trends and current situation, as well as future scenarios based on available scientific evidence. *The climate hazard information products produced by CSIRO within Van-KIRAP comprise the climate hazard step of this RCRAF. Login details are provided in Section 3.3.*
2. An impact screening step which identifies exposure and vulnerability (adaptive capacity and sensitivity) of features and elements at risk
3. A risk assessment step to help users to identify their key climate risks. The framework provides high level risk prioritization so that sectors can make informed decisions on actions and investment into climate adaptation and resilience.

The RCRAF developed for Vanuatu incorporates these three steps as described in Sections 3.3, 3.5, and 3.6, and shown in Figure 4. The steps, including sub-steps, outline the inputs and methodology for each step that make up the framework.

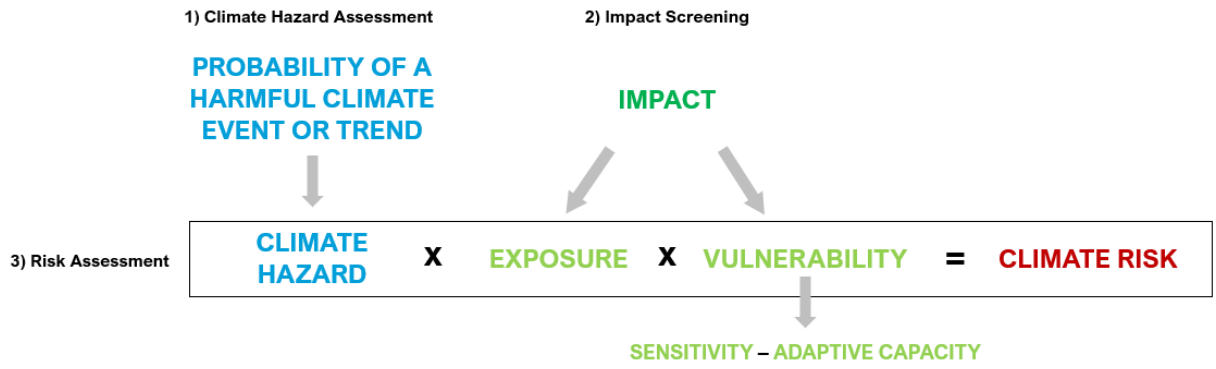


Figure 4: Risk within the C40 RCRAF assessment framework methodology.

3.2 The Vanuatu Rapid Climate Risk Assessment Framework

The Vanuatu RCRAF follows guidance in the New Zealand Ministry for the Environment (MfE) guidance for climate change risk assessments[8] by using a three of 'domains' to identify particular elements at risk. These include natural environment, built environment and people/operations. This MfE methodology was established

[8] NZ Ministry for the Environment (2021). A guide to local climate change risk assessments
https://environment.govt.nz/publications/a-guide-to-local-climate-change-risk-assessments/

by leading risk authors and shares common themes from other well established climate risk assessment frameworks, such as the C40 risk framework[9].

Additionally, as discussed in Section 2.2, this assessment framework is informed by, and aligns with, the Van-KIRAP Climate Futures Portal and associated climate risk assessment guidance, developed by CSIRO and VMGD. However, because the objective is to develop a rapid and easy to undertake assessment, the steps for conducting assessment have been adjusted from the steps in CSIRO's Figure 2 to the steps below (Figure 5).

The Rapid Climate Risk Assessment tool has been developed to support Step 4.

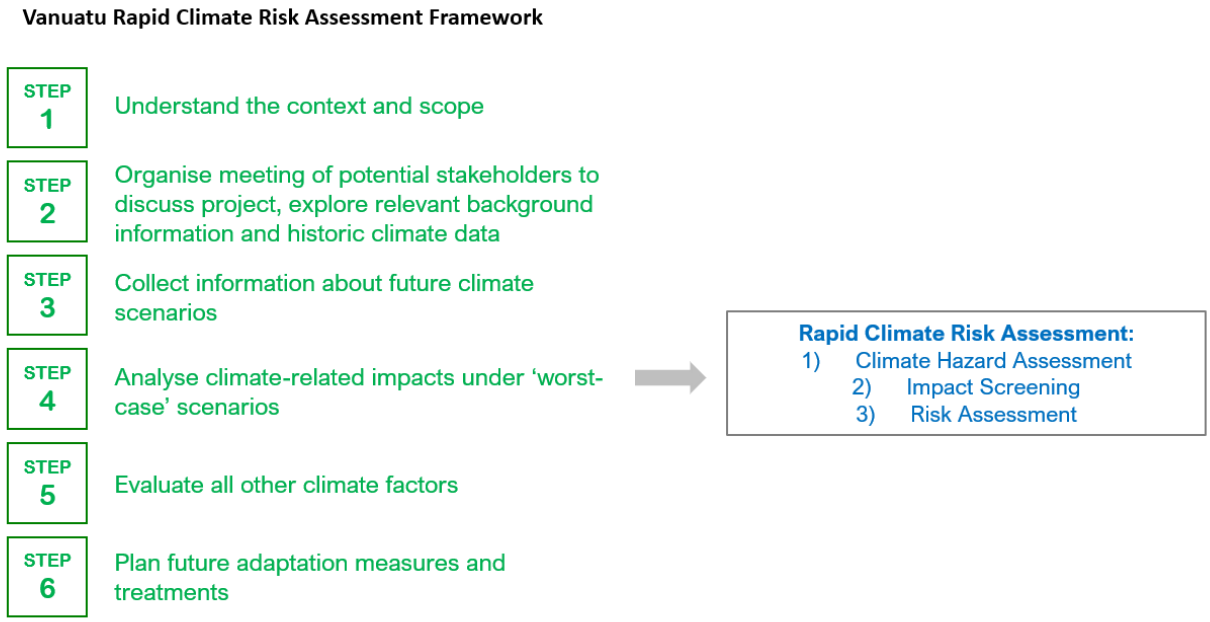


Figure 5: Steps for conducting the rapid climate risk assessment within the Vanuatu Rapid Climate Risk Assessment Framework, adapted from the Van-KIRAP guidance. The Rapid Climate Risk Assessment tool has been developed to support Step 4.

Figure 6shows the Vanuatu Rapid Climate Risk Assessment Framework, including the steps, objectives, users, inputs, outputs and outcomes.

[9] C40 Cites Climate Leadership Group, Inc. website (2023) https://www.c40.org/

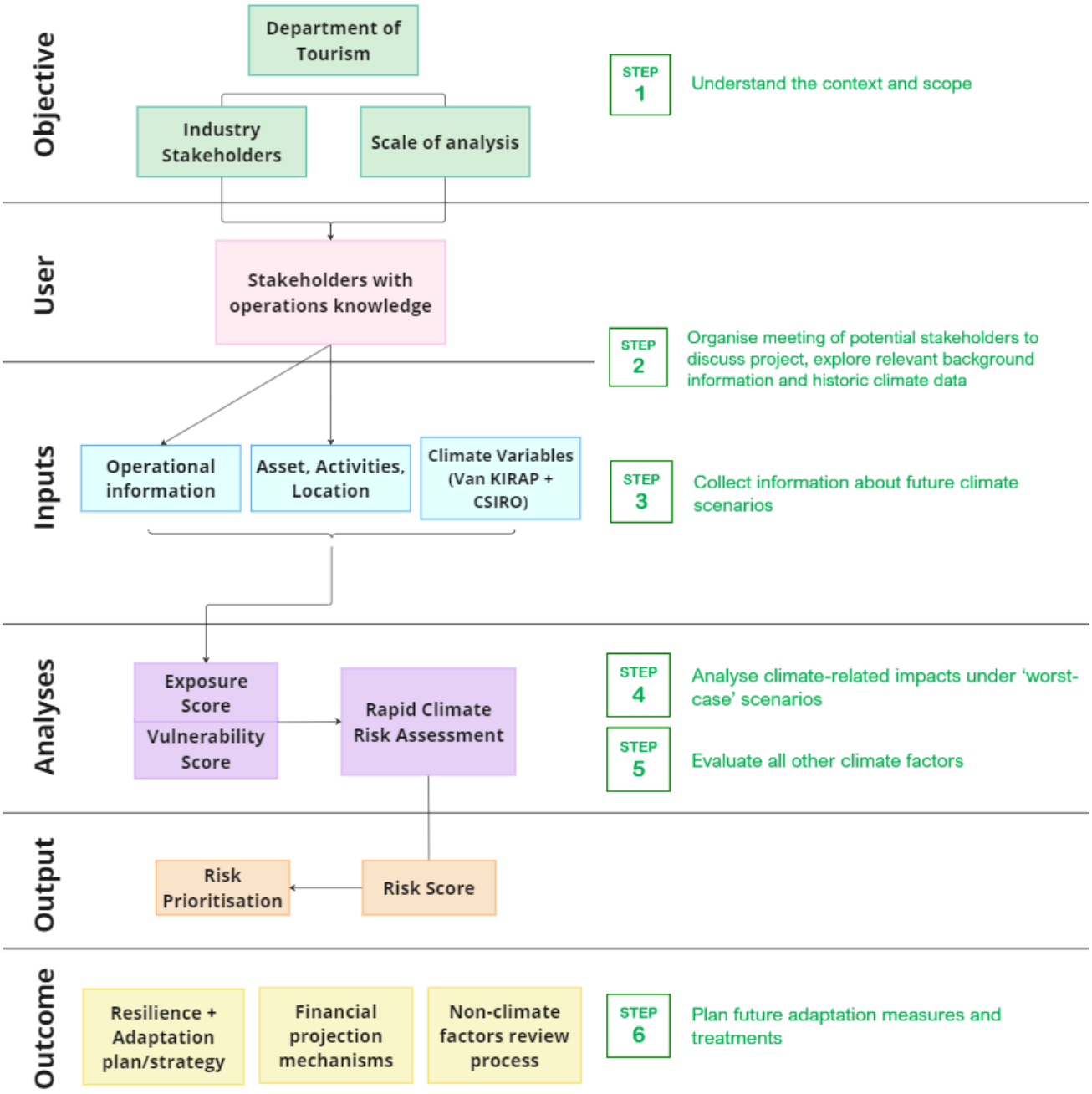


Figure 6: Flow chart showing the process of the Vanuatu Rapid Climate Risk Assessment Framework

3.3 Climate Hazard Assessment

The climate hazard assessment identifies the probability, intensity, and timescale for key hazards as well as the areas that may be particularly impacted, taking into account historical trends, the current situation and future scenarios based on scientific projections.

As discussed in Section 2.1.1, there has been a significant amount of work completed to date on Vanuatu's key climate hazards, including projections for a series of timescales. This assessment framework draws on this data, particularly the projections of climate hazards in the Van-KIRAP portal, with supplemental information from other sources where necessary. These hazards, and their definitions can be found in Table 1.

Representative Concentration Pathways (RCP) are emission trajectories from the IPCC 5th Assessment Report and the CMIP5 model ensemble (see Figure 7). The Van-KIRAP portal contains climate data, generally in two future emissions scenarios, RCP2.6 and RCP8.5 indicating the increase in radiative forcing in Watts/m² due to the net change of energy in the atmosphere due to greenhouse gas concentrations. RCP2.6 is an emission removal pathway, where greenhouse gases are removed from the atmosphere and the radiative forcing is stabilised by 2100. RCP8.6 depicts continuous high global emissions without effective mitigation. Within Van-KIRAP these are shown over four timeframes. This RCRAF utilises the high-emissions scenario RCP8.5 in present day, mid-century (2050) and end-of-century (2090) (Figure 7). Using RCP8.5 to screen the impacts achieves the conservatism needed to identify the most significant impacts for management and a greater level of confidence in the assessment.

A summary of the climate variable information available at the time of framework development can be found in Appendix B, with a synthesis of the key climate hazard data in Appendix C.

The Van-KIRAP portal can be accessed here, using the login details:

Username	test
Password	vanKirap123

The portal provides a walkthrough document to help users navigate the portal.

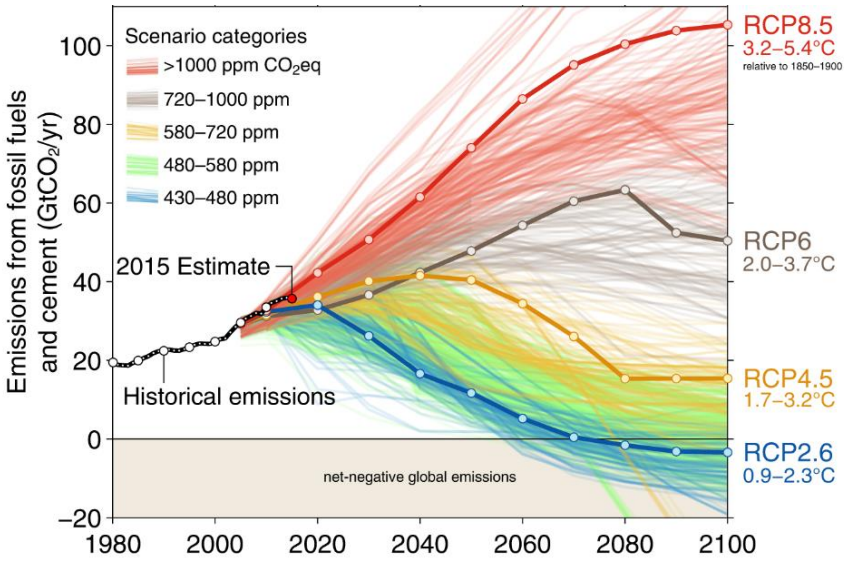


Figure 7: RCP scenarios showing annual emissions of fossil fuel per year until the end-of-century, including the projected global warming temperatures under each scenario.

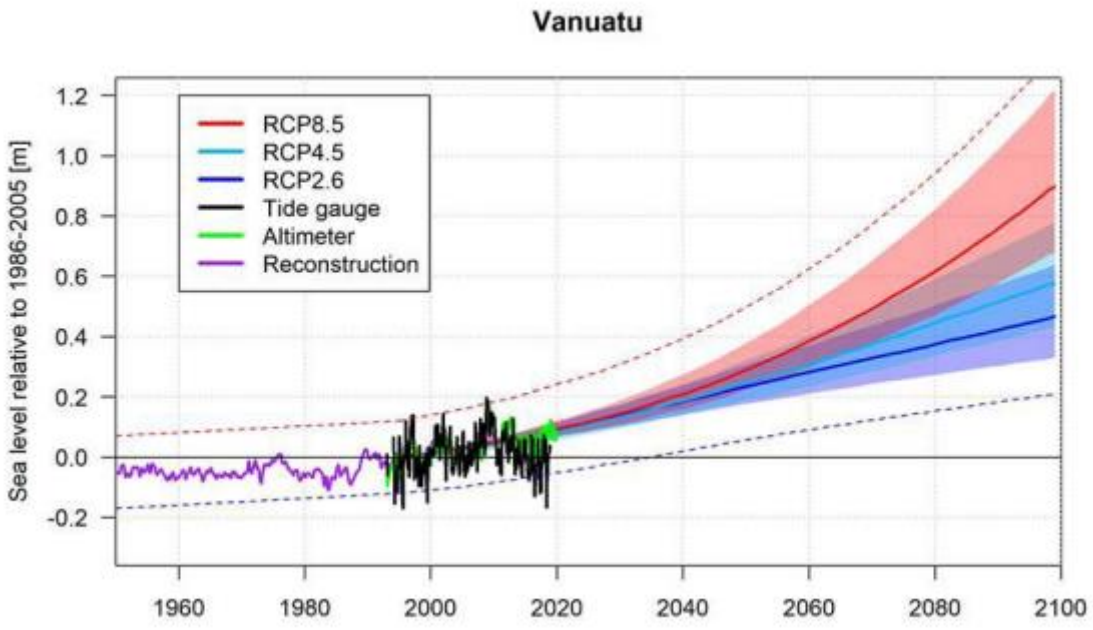


Figure 8: Observed and projected relative sea-level change for Vanuatu (VanKIRAP, 2023)

Table 1: Climate hazard definitions and Vanuatu examples

Climate hazard	Description [10]	Vanuatu Example
Coastal inundation (see Van-KIRAP explainer here)	Coastal inundation is flooding caused by a range of coastal processes, including a combination of tides, storm surges, storm waves, interannual sea level variability and future sea level rise. Inundation is also affected by tectonic processes such as seismic uplift or subsidence. Climate change will increase the severity of coastal inundation events, due to sea level rise and changes to storm wave generating events.	Coastal inundation includes flooding of coastal land areas (including crops and houses in these areas), infrastructure damage (such as roads, ports and buildings), and cause saltwater intrusion to groundwater, and coastal erosion. Examples occur during tropical cyclones, king tides, especially when it coincides with a coastal storm or combined with extreme rainfall and river floods.
Drought (see Van-KIRAP explainer here)	Drought is an acute lack of water compared to normal conditions due to a lack of rainfall over an extended period, usually more than a few months. The water shortage can impact activities, groups, sectors and related natural resources. Climate change is projected to increase the frequency, duration, and intensity of drought events. With the greatest droughts having the largest increase in frequency,	Drought conditions in Vanuatu have historically been influenced by the El Nino Southern Oscillation (ENSO). During a El Niño phase, Vanuatu tends to experience lower than usual rainfall and increased day time temperatures, leading to drought like conditions (Vanuatu Meterology & Geo-Hazards Department, 2023).

[10] SPREP, CSIRO & VMGD (2023). Vanuatu Climate Futures Portal https://vanclimatefutures.gov.vu/dashboard/climate-extremes

Climate hazard	Description [10]	Vanuatu Example
	duration and intensity. Therefore, the severe droughts will get more severe (Van-KIRAP, 2023)	This was last experienced during the severe 2015 droughts, and 2020 in the Southern Islands.
Extreme rainfall (see Van-KIRAP explainer here)	The risk of extreme rainfall is due to a combination of factors, including tropical cyclones, interannual rainfall variability (wet season from November – April), and the El Niño Southern Oscillation. The total amount of rainfall can be used as an additional indicator of extreme rainfall. Extreme rainfall events are expected to increase in intensity.	Vanuatu can experience periods of extreme rainfall due to the presence of tropical cyclones and the location of the Southern Pacific Convergence Zone and the Inter Tropical Convergence Zone. Additionally, the climate in Vanuatu during the La Niño phase of ENSO typically results in wetter than average conditions (Van-KIRAP, 2023).
Tropical cyclone (see Van-KIRAP explainer here)	Tropical cyclones are rotating storms that develop over tropical oceans that are over 25.5 °C and within 5 degrees of latitude from the equator where there is sufficient Coriolis force to create the rotation. In the South Pacific Ocean, a tropical cyclone is defined by a 10-minute sustained wind speed of 17.5 metres-per-second or greater. Tropical cyclones cause strong winds, heavy rainfall, and storm surges. The risk of tropical cyclones is greater during the southern hemisphere's 'cyclone season' from November – April. The frequency of tropical cyclones within 500km of Vanuatu is expected to decrease, but the intensity of these events will increase (Van-KIRAP, 2023).	Tropical Cyclones in Vanuatu are influenced by the position and intensity of the Southern Pacific Convergence Zone and the ENSO phase. Where, the El Niño phase is associated with fewer tropical cyclones and La Niña is associated with more tropical cyclones (Van-KIRAP, 2023).
Ocean acidification (see Van-KIRAP explainer here)	The risk of ocean acidification, a reduction of the ocean's pH, is due to an increase in atmospheric CO_2 concentrations and heat stress such as marine heatwaves. Aragonite Saturation State is the measure of how easily aragonite, a calcium carbonate produced and used by many marine organisms to build skeletons, shells or coral, dissolves in the ocean. The reduction of aragonite in the ocean strongly correlates to changes in ocean pH, therefore the Aragonite Saturation State is a useful indicator of ocean acidification. Ocean acidification is projected to increase in severity towards the end of the century, with a continual trend in decreasing ocean pH (Van-KIRAP, 2023).	Ocean acidification in Vanuatu is caused primarily driven by the absorption of excess carbon dioxide from the atmosphere. Temperature can have an indirect effect on this. Ocean acidification hinders the ability of marine organisms such as corals and shell-forming species requiring calcium carbonate to build and maintain their skeletal structures. In Vanuatu, this could lead to marine environments with reduced health and less diverse inhabitants.

Climate hazard	Description [10]	Vanuatu Example
Marine heatwaves (see Van-KIRAP explainer here)	Marine heatwaves are defined as 'discrete, prolonged anomalously warm water events which last for five or more days, with sea surface temperatures warmer than the 90th percentile relative to climatological values'. Marine heatwaves are caused by a number of factors, including ocean currents that build up areas of warm water, air-sea heat flux (warming of the oceans surface by the atmosphere), and climate variability drivers like the El Niño Southern Oscillation. Marine heat waves are projected to increase in frequency and duration, therefore increasing the intensity of each event. This projection is greater in the north of Vanuatu (Van-KIRAP, 2023).	Elevated sea temperatures associated with marine heatwaves can trigger coral bleaching, a stress response in which corals expel their symbiotic algae. This can lead to the loss of colour in coral reefs and, if prolonged, result in the death of coral colonies. In Vanuatu, this would have a direct impact on the fisheries and tourism sector.
Extreme Temperature (hottest day of the year) (see Van-KIRAP technical report here)	There is spatial distribution of temperature patterns throughout Vanuatu. This includes the mean daily temperature, mean annual temperature, the hottest day, and the coolest night. The coolest and drier months are from July to September, while the warmest and wettest months are from January to March. Additionally, the Northern region tends to be hotter and wetter than the Southern region.	The temperature in Vanuatu the temperature is influenced by its tropical climate and geographical location in the South Pacific characterized by warm temperatures throughout the year. Temperatures are generally higher during the wet season and cooler during the dry season. Coastal areas in Vanuatu may experience milder temperatures due to the moderating influence of the surrounding ocean and the cooling effect of sea breezes. Tropical cyclones will also affect local temperatures.

3.4 Elements

The elements defined in Table 2 have been drawn from the New Zealand National Climate Change Risk Assessment[11] and amended to reflect the Vanuatuan context for the RCRAF.

[11] Ministry for the Environment (2020). National Climate Change Risk Assessment for New Zealand: Main Report. https://environment.govt.nz/assets/Publications/Files/national-climate-change-risk-assessment-main-report.pdf

Table 2: Definitions of elements used for impact screening.

	Element	Definition
Natural	**Coastal/Marine Ecosystem**	Coastal ecosystems exist where the land meets the sea or the part of the marine environment that is strongly influenced by land-based processes, for example salt marshes, estuaries, beaches and mangrove forests. Marine ecosystems are aquatic environments which includes shallow reefs, deep oceans, coastal waters, and marine protected areas. Example: Vanuatu has many marine and coastal ecosystems, including coral reefs, mangroves, seagrass areas, seamounts, and deep-sea trenches. These ecosystems support over 770 fish species, whales, dolphins, and sea turtles and are susceptible to a range of climate hazards.
	Terrestrial Ecosystem	Terrestrial ecosystems are ecosystems found on land, including tundra, taiga, temperate deciduous forest, tropical rain forest, grassland, and deserts. Vanuatu's tropical and subtropical rainforests are home to a wide range of flora and fauna and are susceptible to changes in temperature and rainfall.
	Freshwater Ecosystem	Freshwater ecosystems are a subset of aquatic ecosystems and refer to water from rivers, lakes, reservoirs, and underground streams. Freshwater is used by a wide variety of plants and animals and are often used for recreation. Vanuatu is home to several freshwater springs, known as the blue holes, that attract both locals and tourists. Such freshwater sources are susceptible to many climate hazards including extreme rainfall, tropical cyclones, and drought.
Built	**Inhabited Buildings**	Inhabited buildings refer to all buildings in which people reside or work, relating to the industry and its operations. For example, office buildings, shops, hotels etc.
	Ports/Wharves	Ports refer to harbor areas in which ships and boats load and unload goods and passengers. Wharves are used to dock yachts, small boats and include vessel launching/retrieving facilities often located nearby. Vanuatu has two major ports, Port of Vila in the capital Vila on Efate Island, and Port of Luganville in Santo. Numerous ferry wharves and ramps support marine transport around the outer islands.
	Airports/Airfields	Airports refers to the 2 major airports (Port Vila and Luganville) and the 24 other airports and airfields in Vanuatu, including operational assets such as the airplanes, runways, vehicles, etc.
	Telecommunications	Telecommunications refers to all infrastructure associated with information transmitting technologies and communications, including wired phones, cellphones, radio and television broadcasting and the internet.
	Electricity	Electricity refers to all assets and infrastructure associated with the generation, transmission, and distribution of electricity to end-use customers. For example, power plants, transmission lines, electricity meters.
	Wastewater Infrastructure	Wastewater infrastructure refers to the network of pipes that collect and carry residential, business, and industrial effluents to wastewater treatment systems, and the treatment systems themselves.
	Transport Assets	Transport assets refers to the assets and infrastructure associated with transport, including private vehicles, public transport vehicles and infrastructure, roads, bridges, cycle, and foot paths.

	Water Supply	Water supply refers to the source, treatment, transportation, and distribution of potable water, for example wells, bores, pumps, pipe networks and treatment facilities.
	Storm Water/Flood Management	Stormwater/flood management refers to all stormwater infrastructure and assets, and any flood management infrastructure in place
	Uninhabited Buildings	Uninhabited buildings refer to all buildings in which assets are stored relating to the industry and its operations, and are not intended for people to inhabit. For example, boat sheds, warehouses, barns.
	Evacuation Structures	Evacuation structures refers to elevated structures with sufficient elevation, structural durability and weathertightness to elevate potential evacuees above floodwaters, shelter from extreme winds and rainfall, and be at a safer location inland from extreme waves. May also include emergency water supply, electricity supply and communications facilities.
	User Defined, or Other	Any element not listed, that is relevant to the industry and its operations.
Operations	**Outdoor Land activities**	Outdoor land activities refer to operations that take place inland and aren't protected by buildings/infrastructure, for example farming, tourist activities like hiking and ziplining.
	Outdoor Marine Activities	Outdoor marine activities refers to operations taking place within the marine environment, for example fishing, scuba diving, marine education and training
	Outdoor Freshwater Activities	Outdoor freshwater activities refer to operations taking place within freshwater environments, for example freshwater fishing and recreational swimming.
	Outdoor Coastal Activities	Outdoor coastal activities refer to operations taking place within the coastal environment, for example surfing, snorkeling and fishing.
	Land Transportation Activities	Land transportation activities refers to any land transport operations, for example transport of goods, taxi services.
	Water Transportation Activities	Water transportation activities refers to any marine transport operations, for example boat tours, water taxi services, cargo transport.
	Office/Shop/Admin Activities	Office/shop/admin activities refers to operations taking place within buildings, for example, retail, desktop-based business, education, and indoor training.
	Goods Supply Activities	The supply of critical physical goods/services the operation requires to operate. Those which are susceptible to a range of climate-related impacts, including extreme weather events, resource scarcity such that potential disruptions would prevent the operation. For example, a restaurant relies on food supply, a construction company relies on materials.
	Construction Activities	Construction activities refers to operations associated with the construction of assets or infrastructure, for example constructing buildings, infrastructure such as ports and bridges, roadworks. Construction activities can be disrupted due to climate events, causing delays in projects.

3.5 Impact Screening

The impact screening is to identify potential consequences of the climate-driven hazards to the sector being evaluated. The screening is to consider the range of possible sites, assets and activities or operations which the

industry relies on for their existing of potential future activities. Identification of these potential consequences by the user is to support strategy and planning of future operations.

As described above, the climate scenario and timeframe for the impact screening step is RCP8.5, a high-emissions scenario, at present day, mid-century, and end-of-century. To enable users to identify the potential impacts of climate change they must consider what elements of their industry or business could be impacted.

It is intended that the user is able to access the climate hazard information in the Van-KIRAP portal whilst completing the impact screening and risk assessment.

Table 3 contains the results of an initial screening potential impacts of climate hazards to each of the elements. For example, elements which are not directly associated with marine and ocean activities, such as farming or road construction, are not selected in the screening.

Table 3: Potential impacts of climate hazards on elements of industry

		Coastal Inundation	Extreme Rainfall	Tropical Cyclone	Drought	Marine Heat Waves	Ocean Acidification	Extreme Temperature
Natural	Coastal/Marine Ecosystem	X	X	X	X	X	X	X
	Terrestrial Ecosystem	X	X	X	X			X
	Freshwater Ecosystem	X	X	X	X			X
Built	Inhabited Buildings	X	X	X	X			X
	Ports/Wharves	X	X	X	X		X	X
	Airports	X	X	X	X			X
	Telecommunications	X	X	X	X			X
	Electricity	X	X	X	X			X
	Wastewater Infrastructure	X	X	X	X			X
	Transport Assets	X	X	X	X			X
	Water Supply	X	X	X	X			X
	Storm Water/Flood Management	X	X	X	X			X
	Uninhabited Buildings	X	X	X	X			X
	Evacuation Structures	X	X	X				X
Operations	Outdoor Land activities	X	X	X	X			X
	Outdoor Marine Activities	X	X	X	X	X	X	X
	Outdoor Freshwater Activities	X	X	X	X			X
	Outdoor Coastal Activities	X	X	X	X	X	X	X
	Land Transportation Activities	X	X	X	X			X
	Water Transportation Activities	X	X	X	X	X	X	X
	Office/Shop/Admin Activities	X	X	X	X			X
	Goods Supply Activities	X	X	X	X	X	X	X
	Construction Activities	X	X	X	X			X

3.6 Risk Assessment

The risk assessment step helps users to identify their key climate risks. The RCRAF will provide high level prioritised risks so that sectors can make informed decisions about actions and investment into climate adaptation and resilience.

In this framework, the assessment of risks involves scoring the *exposure* and *vulnerability* of the element-at-risk to climate hazards identified in the impact screening. Scoring the risks will allow the user to sort and prioritise them. Refer to Section 5.3 for details on vulnerability and exposure.

The scoring process has been informed by the New Zealand MfE (2021) guidance detailed in *A guide to local climate change risk assessments*[12]. Table 4 shows the risk scoring method based on the exposure and vulnerability.

Table 4: Risk rating matrix

		Exposure			
		Low	Moderate	High	Extreme
Vulnerability	Extreme	Moderate	High	Extreme	Extreme
	High	Low	Moderate	High	Extreme
	Moderate	Low	Moderate	Moderate	High
	Low	Low	Low	Moderate	High

Risks are prioritised according to:

- Risk rating in present day, mid-century and end-of-century
- Vulnerability

3.7 Existing Risk Management

Risk management is the process of developing plans, actions and strategies to reduce the probability and severity of the effects of identified risks, based on risk assessments and climate data that inform decision-making around climate hazard risk. The RCRAF guides the user through preliminary evaluation of existing risk management undertaken by their industry to educate about future planning following the results from the RCRAF assessment.

Risk management can include hard protection such as physical structures for flood control and evacuation. It can also include institutional and behavioural actions, such as creating inclusive strategies for individuals and communities to cope with risks and recover from them.

As discussed in Section 3.6, the risk scoring and prioritisation process is essential for risk management as it shows the main risks that need to be addressed with management measures.

3.8 Adaptation Approaches

The purpose of the Vanuatu RCRAF is to assess climate risks, consider existing adaptation approaches and provide prioritisation of risks for future adaptation planning, which may include detailed risk assessment of priority risks.

Adaptation is the process of adjustment to actual or expected climate and its effects, to moderate harm. Within communities, people can work together to reduce the impact of climate hazards, through social networks,

[12] NZ Ministry for the Environment (2021). A guide to local climate change risk assessments. https://environment.govt.nz/assets/publications/climate-risk-assessment-guide.pdf

nature-based or hard-engineering solutions, upgrades to existing buildings and infrastructure and by being better prepared[13].

There is no single 'correct' solution for adapting to more severe climate hazards, the adaptation approach depends on the element at risk, climate hazard and the people, property and systems/processes impacted. The approach can involve multiple strategies and can also be expected to change over time.

A common adaptation framework is the protect, accommodate, retreat, and avoid framework (PARA)(Figure 9):

- **Protecting** assets from risk, for example by building protective structures such as sea walls
- **Accommodating** risk, for example by incorporating adaptation options into the design of developments
- **Retreating** from risk, for example by relocating existing development away from high-risk areas
- **Avoiding** risk, for example by locating development away from areas prone to hazards

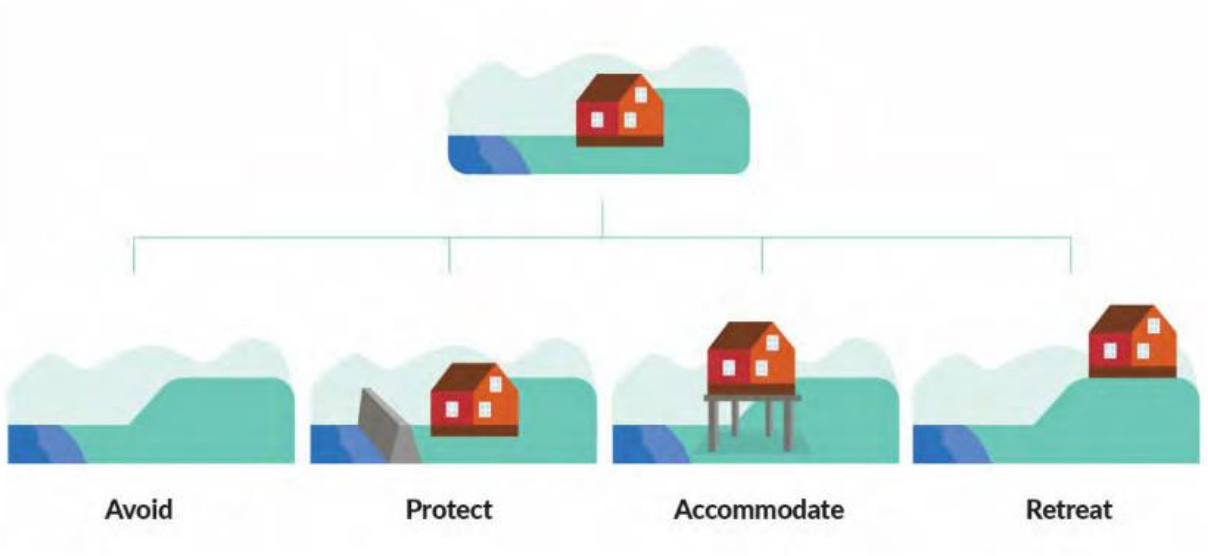


Figure 9: Adaptation options for responding to rising sea-levels - avoid, protect, accommodate, retreat.

4 Rapid Climate Risk Assessment Framework

The Vanuatu Rapid Climate Risk Assessment Framework has been developed to enable non-climate-experts in Vanuatu to identify and prioritise their climate risks and set them up for exploring adaptation options. Figure 10 shows the process of the assessment with user inputs, assessment outputs and examples.

4.1 End Users

Stakeholder engagement indicated that the end users for the framework should be those within the industry bodies, industry associations and government departments who can support individual businesses and operators to undertake climate risk assessments of their operations and activities and guide the individual operators to adaptation responses.

[13] NZ Ministry for the Environment (2022). Adapt and thrive: Building a climate-resilient New Zealand https://environment.govt.nz/assets/publications/climate-change/MFE-AoG-20664-GF-National-Adaptation-Plan-2022-WEB.pdf

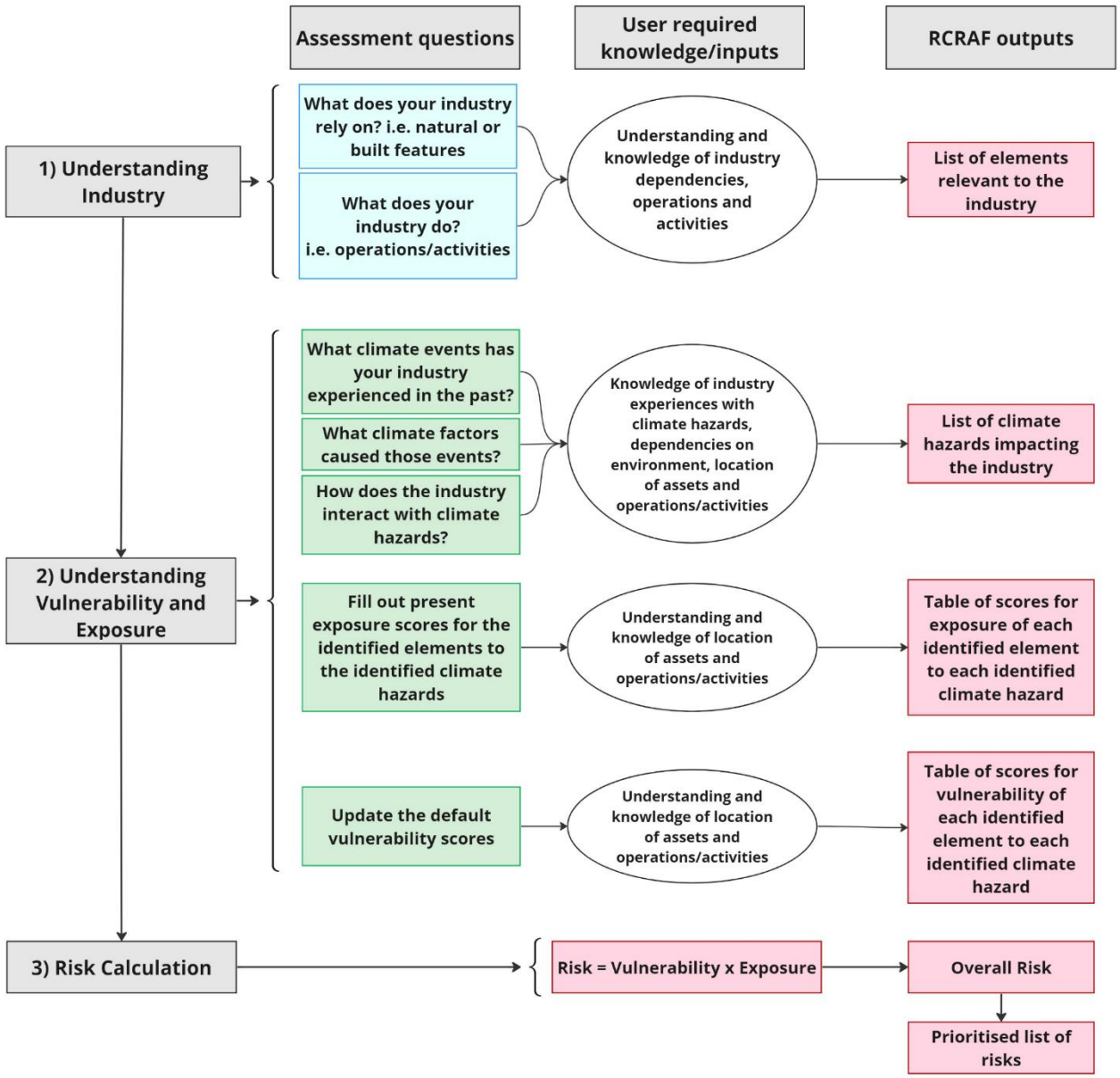
The end user is understood to have a working knowledge of the industry such that they can complete the rapid risk assessment. It is also anticipated that the end user be connected to the key operators on the ground and stakeholders in government licencing and regulation. This approach encourages use of the tool without needing to cater to the entire range of abilities when it comes to climate risk and digital competency.

Although, these agencies and departments can become central points at which training and guidance can be delivered, which is a need that was highlighted during consultation. Additionally, risk information can be gathered by such agencies and consolidated to inform decision making at different levels across short-, medium- and long-term climate risks throughout Vanuatu.

4.2 The Assessment Tool

The assessment framework is administered through a Microsoft Excel workbook which can be shared between agencies/government departments and individual operators.

The tool has been designed to be simple to use and hosted in desktop-based Microsoft Excel. Some of the benefits of using a workbook are that it can be used offline, transferable between users and is a widely used software with readily available user resources.



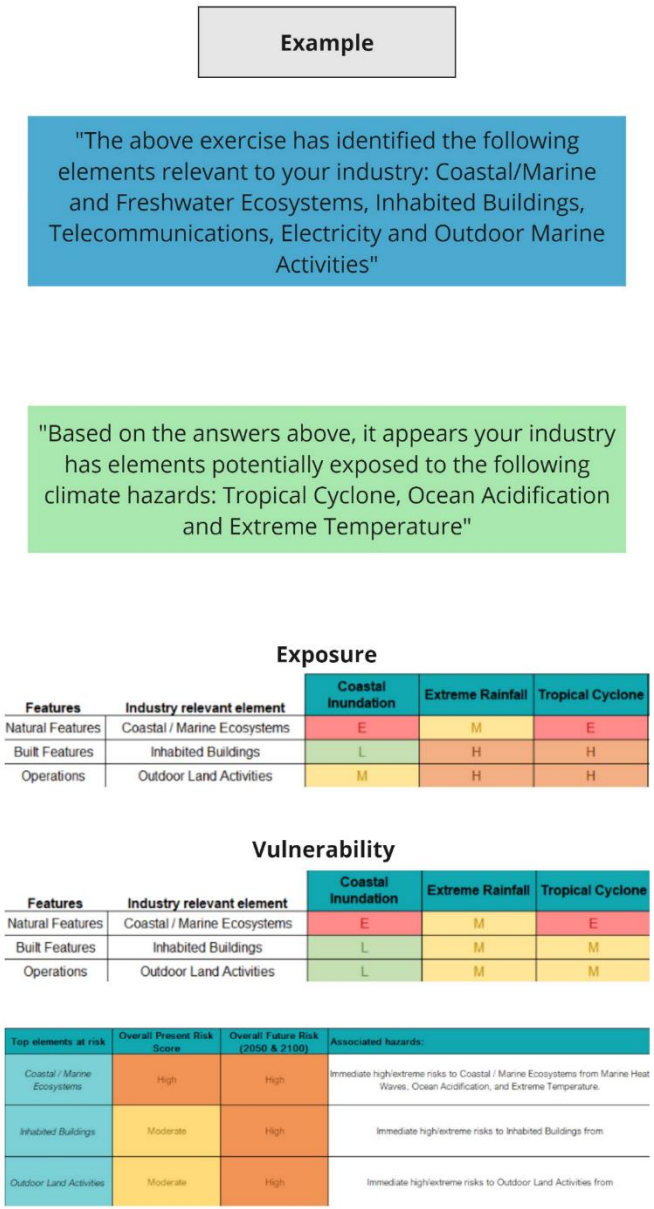


Figure 10: Vanuatu Rapid Climate Risk Assessment process.

5 Methodology

As discussed in Section 3.1 and Figure 10, the Vanuatu Rapid Climate Risk Assessment Framework follows the three steps: climate hazard assessment, impact screening and risk assessment.

5.1 Climate Hazard Assessment Methodology

The climate hazard assessment step is built into the assessment framework and draws on the work carried out by CSIRO on the Van-KIRAP Climate Futures portal and climate risk assessment guidance. The seven key climate hazards detailed in Section 0 have been identified as probable, impactful risks in the present day, mid-century and end-century timescales.

It is recommended that the Vanuatu Rapid Climate Risks Assessment workbook be used alongside the Van-KIRAP portal.

5.2 Impact Screening Methodology

The impact screening occurs through a series of questions. The user is able to identify which impacts of climate hazards on elements of the five industries will be material to them and their operations. Table 5 summarises the questions asked in the workbook. The climate information used to inform the initial vulnerability scoring is summarised in Appendix C (Table 14) along with the identified gaps in available data (Table 15).

Table 5: Impact screening questions

Understanding Industry *The user is asked to mark each element within the natural, built, and operational categories with a yes if it is relevant to them, or no if it is not.*	**Rationale**
Does your industry rely on or involve any of the following natural features, either now or potentially in the future? (i.e., coastal/marine ecosystems, terrestrial ecosystems etc.)	These questions identify which elements are relevant to the user's industry that could be impacted by climate change.
Does your industry rely on or involve any of the following built features, either now or potentially in the future? (i.e., telecommunications, electricity, inhabited buildings etc.)	
What does your industry do? Which of the following operations and activities are involved? (i.e., outdoor marine activities, Land Transportation Activities etc.)	
Exposure *The user is asked to mark yes for climate hazards that have already impacted their industry and no to those that haven't. They also need to respond yes or no to a series of location based questions and provide details where relevant.*	**Rationale**
What climate hazards have impacted your industry in the past? Tick 'Yes' to all that are relevant. Please describe how the climate hazard(s) impacted your industry's people, property, systems/processes.	These questions identify how the elements are exposed to the climate hazards and feed into the exposure scoring process.
Does your industry have elements located within 100m of the coast?	
Does your industry have elements located at less than 10m elevation from sea level?	
Does your industry have / use elements that can be impacted by (or rely on) ocean conditions? (i.e. Ocean acidification and marine heatwaves affecting reefs and fish stock) have elements located in the ocean? (i.e., reefs, fisheries)	

Understanding Industry *The user is asked to mark each element within the natural, built, and operational categories with a yes if it is relevant to them, or no if it is not.*	**Rationale**
Does your industry have elements that critically rely on a natural water supply (river, groundwater) (e.g., rainfall on crops, water intake at stream for drinking water)?	
Does your industry have elements located near a river, stream or lake with a history of flooding?	
Do high temperatures significantly impact the effectiveness or safety of work activities, ecosystems, agricultural productivity or sites / assets in your industry?	
Exposure Scoring *The user is provided five exposure ratings and their definitions (see Section 5.3 for definitions): Extreme, High, Moderate, Low, and Not Applicable, and asked to score the exposure of all elements identified to the climate hazards.*	Prompting the user to score their industry's exposure allows for a more accurate assessment.
Vulnerability	**Rationale**
Vulnerability scoring *The user is provided initial vulnerability scores of Extreme, High, Moderate, Low, or Not Applicable for each element. They are asked to use the definitions provided (see Section 5.3 for definitions) and their understanding of their industry to update the vulnerability scores.*	Default scores are provided based on the perceived vulnerability, however having the user update the scores using their understanding of their industry results in a more accurate assessment.
Understanding Existing Climate Risk Management *The user is asked to answer yes or no to the following questions.*	**Rationale**
Has your industry prepared or implemented measures to manage risk associated with Coastal Inundation?	These questions help to understand how the indicated disruption/damage to the user's industry due to climate hazards is being managed within the industry
Has your industry prepared or implemented measures to manage risk associated with Extreme Rainfall?	
Has your industry prepared or implemented measures to manage risk associated with Tropical Cyclone?	
Has your industry prepared or implemented measures to manage risk associated with Marine Heat Waves?	
Has your industry prepared or implemented measures to manage risk associated with Ocean Acidification?	
Has your industry prepared or implemented measures to manage risk associated with Temperature?	
Adaptation *Using the PARA framework presented in the tool (and in Section 3.8) the user is asked to think about their industry's current exposure and vulnerability and which PARA adaptation actions have been taken to manage the impacts from climate hazards. The user is given the chance to add commentary about the risk management actions taken.*	**Rationale**
Has a PROTECT action been taken? E.g. building seawall to protect site, protecting fields from flooding.	These questions help to understand what actions

Understanding Industry *The user is asked to mark each element within the natural, built, and operational categories with a yes if it is relevant to them, or no if it is not.*	**Rationale**
Has an ACCOMMODATE action been taken? E.g., raising buildings to allow flood water underneath.	have been taken to increase resilience to climate change.
Has a RETREAT action been taken? E.g., planting crops in less flood prone fields, moving dive operations to healthier reefs.	
Has an AVOID action been taken? E.g., banning construction of new structures within 100m of coast in flood prone areas.	
Hazard Forecasting Information *The user is asked to answer yes or no to the following questions. There are also links provided to the information referenced in the questions.*	**Rationale**
Does your industry use formal warning systems to forecast climate hazard events? (e.g. VMGD forecasting)	These questions help to understand what methods are currently used to forecast climate hazard events and increases awareness of available information and tools.
Does your industry use traditional indicators to notify of upcoming potential issues? (e.g. traditional observation of bird activity to warn of pending cyclone)	
Does your industry use the Van-KIRAP Climate Futures portal?	

5.3 Risk Scoring Methodology

The following exposure, vulnerability and risk matrices follow the New Zealand MfE guidance detailed in *A guide to local climate change risk assessments*[14].

5.3.1 Exposure

This identifies the scale of exposure of the Sector to climate hazards, from a high, medium or low, and based on how much of the sector-specific features (e.g. land, assets, population and systems) may be at risk from the climate hazards.

Example: Infrastructure located near the coast is likely to be exposed to coastal inundation (flooding from the sea during storms), the closer to the coast the infrastructure is located then the greater the exposure will be. Similarly, the greater proportion of assets near the coast would imply a greater exposure for the sector.

Table 6: Exposure rating scale

Exposure rating	Quantitative definition	Qualitative definition
Extreme	>75% of sector/element is exposed to the hazard	Significant and widespread exposure of elements to the hazard
High	50-75% of sector/element is exposed to the hazard	High exposure of elements to the hazard
Moderate	25-50% of sector/element is exposed to the hazard	Moderate exposure of elements to the hazard
Low	5-25% of sector/element is exposed to the hazard	Isolated elements are exposed to the hazard

[14] NZ Ministry for the Environment (2021). A guide to local climate change risk assessments. https://environment.govt.nz/assets/publications/climate-risk-assessment-guide.pdf

Present-day exposure

The exposure scoring is to be input by the user by comparing the location and characteristics of the industry's features with the spatial and temporal distribution of the climate hazards. Hence, the user is asked to input their *present-day* exposure score based on their knowledge of recent and present climate hazards to their industry or sector, and as prompted by the Impact Screening questions.

If the user does not input a present-day exposure score, the scoring (present and future) defers to a national-scale default exposure score determined using the Van-KIRAP climate hazard information and a generic representation of elements at risk within an industry or sector. The default scoring is primarily to inform the changing risk over time, and are only intended to build upon the user's own knowledge and exposure scoring.

Future exposure

The RCRAF, then, uses the user's exposure input to determine a *future* scoring. This future exposure scoring departs from the MfE guidance by including a default escalation of risks into the future. The escalation is based on climate scenario RCP8.5 projections where, at a national scale, the overall effects of climate change are expected to exacerbate most risks arising from climatic events (refer to Climate hazards described in Section 3.3 and the Van-KIRAP portal).

Within the framework, logic is applied to ensure the risks are escalated from the user's present-day input, and such that the scoring cannot be inadvertently de-escalated over future timeframes. This is indicated in Table 7.

The rules of 2050 and 2100 exposure scoring escalation are as follows:

- For 2050, scores can escalate or de-escalate by one exposure rating only.
- For 2100, scores can escalate by one exposure rating and cannot de-escalate.
    - Due to the climate scenario used, RCP8.5, climate hazards are worsening over time and are expected to be the more severe in 2100 than 2050.
- Extreme remains the highest score.

Table 7: Example of scoring escalation rules. The arrows represent the change from one level of exposure rating to another. The present-day arrow shows the difference between the default score (on the top) and the user's input (on the bottom), and the 2050 and 2100 arrows show the subsequent logic of the escalation/de-escalation.

		Default or user input	Default calculation for future timeframe	
	Description and logic	Present Day	2050	2100
Escalation	The user inputs a score which has escalation of the present-day score by one (from Low to Moderate). This results in the 2050 score escalating by one, from Moderate to High and the 2100 score escalating further, from High to Extreme.	Low (*Default*)	Moderate	High
		⬇	⬇	⬇
		Moderate (*User*)	High	Extreme
	The user inputs a score which has escalation of the present-day score by two (from Low to High). This results in the 2050 score escalating by one, from High to Extreme and the 2100 score remaining at Extreme.	Low (*Default*)	High	Extreme
		⬇	⬇	⬇
		High (*User*)	Extreme	Extreme
De-escalation	The user inputs a score which has de-escalation of the present-day score (from Moderate to Low). This results in the 2050 score de-escalating from Moderate to Low and the 2100 remaining at High.	Moderate (*Default*)	Moderate	High
		⬇	⬇	⬇
		Low (*User*)	Low	High
	The user inputs a score which has de-escalation of the present-day score by two (from High to Low). This results in the 2050 score de-escalating by one, from Extreme to High, and the 2100 remaining at Extreme.	High (*Default*)	Extreme	Extreme
		⬇	⬇	⬇
		Low (*User*)	High	Extreme

5.3.2 Vulnerability (Sensitivity and Adaptive Capacity)

Assessing vulnerability of the Sector to climate hazards involves a qualitative evaluation of how susceptible the exposed assets and operations are to climate risks. Consider factors like sensitivity (how easily they can be affected) and adaptive capacity (how well they can cope).

Example – Adaptive Capacity: If there are early warning systems in place and/ or the infrastructure has been designed with coastal inundation resilience in mind then this has increased its adaptive capacity and lowered its vulnerability.

Example – Sensitivity: If the infrastructure relies on ground water or has aging piped infrastructure then it would also be sensitive to rises in the groundwater table that is associated with coastal inundation. Making the infrastructure more vulnerable to the coastal inundation exposure.

Table 8: Vulnerability matrix (combining sensitivity with adaptive capacity)

		Sensitivity			
		Low	Moderate	High	Extreme
Adaptive Capacity	Very low	Moderate	High	Extreme	Extreme
	Low	Low	Moderate	High	Extreme
	Medium	Low	Moderate	Moderate	High
	High	Low	Low	Low	Moderate

Table 9: Vulnerability rating definitions

Vulnerability rating	Definition
Extreme	Extremely likely to be adversely affected, because the element or asset is highly sensitive to a given hazard and has a low capacity to adapt.
High	Highly likely to be adversely affected, because the element or asset is highly sensitive to a given hazard and has a low capacity to adapt.
Moderate	Moderately likely to be adversely affected, because the element is moderately sensitive to a given hazard and has a low or moderate capacity to adapt.
Low	Low likelihood of being adversely affected, because the element has low sensitivity to a given hazard and a high capacity to adapt.

5.3.3 Risk

Risk is the potential for consequences (positive or negative) to the exposed asset or operation of the sector that results from a particular climate hazard, whilst accounting for the vulnerability to that hazard.

Example: The risk faced by the owner/ user of the coastal infrastructure above involves the combination of exposure and vulnerability. If the infrastructure has high exposure to coastal inundation and low adaptive capacity (high vulnerability), the risk of property damage, displacement, economic loss, and social disruption is elevated. Alternatively, if the owner/ user has taken proactive measures to adapt (low vulnerability), the risk is mitigated.

Table 10: Risk matrix (combining vulnerability and exposure)

		Exposure			
		Low	Moderate	High	Extreme
Vulnerability	Extreme	Moderate	High	Extreme	Extreme
	High	Low	Moderate	High	Extreme
	Moderate	Low	Moderate	Moderate	High
	Low	Low	Low	Moderate	High

5.3.4 Overall Risk and Prioritisation:

To determine the overall risk and prioritisation of different hazards and/or elements, an average of the individual risk ratings (e.g. extreme rainfall risk to outdoor land activities) was computed with different weights. 'Extreme' risks had the highest weight and 'Low' risks the lowest weight (Table 10). The average was based on all the relevant elements or hazards for each category, so that they could be ranked by their risk rating.

Table 10: Exposure and Vulnerability scores

Rating Order	Rating Scores for Vulnerability and Exposure (Present, 2050, 2100)
Extreme	4
High	3
Moderate	2
Low	1
N/A	0

For instance, a feature that scores high exposure (score=4) and moderate vulnerability (score=2) at present time, will have an average overall present risk score equal to 3 (High). That overall risk score may stay the same for 2050 (overall risk = 3), and intensify in 2100 (overall risk = 4, extreme). Hence, the overall future risk for 2050 and 2100 will be extreme (average =3.5). The prioritisation of the features will be based on these overall risk scores.

The prioritisation reflects the severity and urgency of the threat, which means that the overall present risk was followed by future overall risk for 2050 and 2100. Based on this, a top (up to) 3 hazards and (up to) 5 elements can be identified in the results report for the user's prioritisation. Hazards ranked at the top are the ones that produce the highest overall risks (impact) for present and future across multiple industry features. Industry elements ranked at the top are the ones that have the highest overall risks scores affected by one or multiple hazards.

6 Limitations and Recommendations

There are certain limitations identified of the RCRAF, as detailed above. Recommendations on how these could be addressed are detailed below.

- **Uncertainty** of climate variables. Modelled data from Van-KIRAP portal does not include uncertainties. This has in part been addressed by using a probabilistic approach, where each climate exposure is classified into low, medium, high and extreme. Allowing the user to understand the range of possibilities and associated uncertainties that would come with a single value.
- **Confidence** of the climate variable data has not been assessed or verified as part of development of this framework. This could be addressed by completing a sensitivity check of the tool with different extremes of the data entered.
- **Mapping** of the spatial distribution of the climate variables is limited within the Van-KIRAP Climate Futures Portal. Mapping capabilities have not been included with this tool, if a full climate risk assessment were to be conducted then a mapping component could be considered to quantify inter island data variability.
- **Non-spatial** distribution of the climate variable data has been applied for this Rapid Risk Assessment Framework due to the reduced resolution in the mapping function on the Van-KIRAP Climate Futures Portal. This limitation has been addressed to some extent by relying on user's input to determine their proximity to climate hazards. This limitation can be minimised by undertaking a detailed climate risk assessment for specific sites, guided by the high level risk careening of priority risks.
- **Non-economic** or non-cost approach has been implemented to assess vulnerability, exposure, and consequently risk of climate hazards. Hence, the output is a qualitative overall risk with no associated costs. This limitation can be addressed when undertaking a detailed climate risk assessment following the results of the RCRAF, which should incorporate cost in order to guide future decision-making process.
- **Single RCP** of RCP8.5 has been used for this framework, using RCP8.5 to provide a rapid and high-level screening of climate risks achieves the conservatism needed to identify the most significant impacts for management and decision planning. If a more detailed risk assessment is undertaken of priority risks then that will allow for the exploration of a range of scenarios and multiple timeframes.
- **Five (5) sectors** of infrastructure, fisheries, tourism, agriculture, and water were used as the basis of creating this framework. The ability to expand the RCRAF outside of these sectors may be dependent on the further investment on the tool development which will incorporate engaging with a diversity of stakeholders to determine other sectors' needs.

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Appendix A – Glossary

Glossary

Term	Definition
Adaptation	Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned.
Adaptive Capacity	The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.
Airports	Airports refers to all 26 airports in Vanuatu, including operational assets such as the airplanes, runways, vehicles etc.
Climate Driver	A changing aspect of the climate system that influences a component of a human or natural system.
Climate Projection	A projection of the response of the climate system to emission or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models under different climate scenarios.
Climate Variability	Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events.
Coastal inundation	Coastal inundation is the flooding of coastal areas, caused by a range of factors, including tides, storm surges, storm waves, interannual sea level variability and sea level rise.
Coastal/Marine Ecosystem	Coastal ecosystems exist in the land close to the sea or the part of the marine environment that is strongly influenced by land-based processes, for example salt marshes and estuaries. Marine ecosystems are aquatic environments with high levels of salt (i.e. Pacific Ocean). Vanuatu has many marine ecosystems, including coral reefs, mangroves, seagrass areas, seamounts and deep-sea trenches. These ecosystems support over 770 fish species, whales, dolphins and sea turtles and are susceptible to a range of climate hazards.
Consequence	The outcome of an event that may result from a hazard. It can be expressed quantitatively (e.g., units of damage or loss, disruption period, monetary value of impacts or environmental effect), semi-quantitatively by category (e.g., high, medium, low level of impact) or qualitatively (a description of the impacts).
Construction Activities	Construction activities refers to operations associated with the construction of assets or infrastructure, for example constructing buildings, infrastructure such as ports and bridges, roadworks. Construction activities can be disrupted due to climate events, causing delays in projects.
Direct risk	Where there is a direct link between a hazard and an element at risk that is exposed and vulnerable. For example, storms and flooding damaging buildings and infrastructure, droughts leading to crop failure, or extreme temperatures causing heat stress.

Drought	Drought is an acute lack of water compared to normal conditions due to a lack of rainfall over an extended period, usually more than a few months. The water shortage can impact activities, groups, sectors and related natural resources.
El Niño Southern Oscillation (ENSO)	ENSO is a periodic bimodal variation in the sea surface temperature and air pressure across the equatorial Pacific Ocean. El Niño: Easterly trade winds over the Pacific Ocean weaken, slowing the ocean current drawing surface water away from the Western coast of South America, reducing the upwelling rate of colder deep ocean water on this coast and flattening the thermocline allowing the surface water on the east of the Pacific basin to warm. La Niña: Easterly trade winds over the Pacific strengthen, increasing the ocean current drawing surface water away from the Western coast of South America, increased the upwelling rate of nutrient-rich cold deep ocean water on this coast and increasing the thermocline, reducing the surface water temperature on the east of the Pacific basin. ENSO is strongly correlated with multiple tele-connections globally, causing effects to temperature, atmospheric pressure and precipitation.
Electricity	Electricity refers to all assets and infrastructure associated with the generation, transmission, and distribution of electricity to end-use customers. For example, power plants, transmission lines and electricity meters.
Elements at Risk	People, values, species, sectors, assets etc. that are potentially vulnerable to climate change impacts.
Evacuation Structures	Evacuation structures refers to elevated structures with sufficient height to elevate evacuees above inundation due to tsunami waves, and cyclone shelters. Legislation in Vanuatu regarding Natural Disasters determines the logistic hubs during a disaster of Port Vila and Luganville.
Exposure	The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.
Extreme rainfall	The risk of extreme rainfall is due to a combination of factors, including tropical cyclones, interannual rainfall variability (wet season from November – April), and the El Niño Southern Oscillation. The total amount of rainfall can be used as an additional indicator of extreme rainfall.
Freshwater Ecosystem	Freshwater ecosystems are a subset of aquatic ecosystems and refer to water from rivers, lakes, reservoirs, and underground streams. Freshwater is used by a wide variety of plants and animals and are often used for recreation. Vanuatu is home to a number of freshwater springs, known as the blue holes, that attract both locals and tourists. Such freshwater sources are susceptible to many climate hazards including extreme rainfall, tropical cyclones, and drought.
Goods Supply Activities	The supply of critical physical goods/services the operation requires to operate. Those which are susceptible to a range of climate-related impacts, including extreme weather events, resource scarcity such that potential disruptions would prevent the operation. For example, a restaurant relies on food supply, a construction company relies on materials.

Hazard	The potential occurrence of a physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.
Impacts	The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards, exposure, and vulnerability. Impacts generally refer to effects on lives, livelihoods, health and well-being, ecosystems and species, socio-economic and cultural assets, services, and infrastructure. Impacts may be adverse or beneficial.
Inhabited Buildings	Inhabited buildings refers to all buildings in which people reside or work, relating to the industry and its operations. For example, office buildings, shops, hotels etc.
Land Transport Activities	Land Transportation Activities refers to any land transport operations, for example transport of goods or taxi services.
Marine Heatwaves	Marine heatwaves (MHWs) are a “discrete, prolonged anomalously warm water event” which lasts for five or more days, with temperatures warmer than the 90th percentile. MHW events were defined by their duration (number of days above the 90th percentile threshold), maximum intensity (maximum temperature above the climatological mean attained during the event), mean intensity, and cumulative intensity (sum of the daily intensities through the duration of the MHW event occurrence; Hobday et al. 2016). MHWs are categorised into four intensity categories, defined by multiples of difference between the mean climatology and the 90th percentile threshold, and includes “Moderate” (Category I, 1-2x), “Strong” (Category II, 2-3x), “Severe” (Category III, 3–4×), and “Extreme” (Category IV, >4x).
Ocean Acidification	A reduction in the pH of the ocean, caused by an increased uptake of carbon dioxide (CO2) from the atmosphere, accompanied by other chemical changes (primarily in the levels of carbonate and bicarbonate ions) over the time scale of years to decades.
Office/Shop/Admin Activities	Office/shop/admin activities refers to operations taking place within buildings, for example, retail, desktop-based business, education, and indoor training.
Outdoor Coastal Activities	Outdoor coastal activities refers to operations taking place within the coastal environment, for example surfing and fishing.
Outdoor Freshwater Activities	Outdoor freshwater activities refers to operations taking place within freshwater environments, for example fishing and recreational swimming.
Outdoor Land activities	Outdoor land activities refers to operations that take place inland and aren't protected by buildings/infrastructure, for example farming, tourist activities like hiking and ziplining.
Outdoor Marine Activities	Outdoor marine activities refers to operations taking place within the marine environment, for example fishing, scuba diving, education and training.
Ports/Wharves	Ports refer to harbour areas in which ships and boats load and unload goods and passengers. Wharves are used to dock yachts and small boats. Vanuatu has two major ports, Port of Vila in the capital Vila on Efate Island, and Port of Luganville in Santo.

Risk	The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. Relevant adverse consequences include those on lives, livelihoods, health and wellbeing, economic, social, and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems, and species. Risks result from interactions between climate-related hazards with the exposure and vulnerability of the affected system.
RCP	Representative Concentration Pathway. Emission trajectory from the IPCC 5th Assessment Report and the CMIP5 model ensemble.
Sea Level Change/Rise	Sea level can change, both globally and locally, due to; (1) changes in the shape of the ocean basins; (2) changes in the total mass of water and, (3) changes in water density. Factors leading to sea level rise under climate change include both increases in the total mass of water from the melting of land-based snow and ice, and changes in water density from an increase in ocean water temperatures and salinity changes.
Sea-Surface Temperature	The temperature of the ocean surface. The term sea-surface temperature is generally representative of the upper few metres of the ocean as opposed to the skin temperature, which is the temperature of the upper few centimetres.
Sensitivity	Refers to the degree to which an element at risk is affected, either adversely or beneficially, by climate variability or change. Sensitivity relates to how the element will fare when exposed to a hazard, which is a function of its properties or characteristics.
Storm Surge	The phenomenon of temporary sea level rising that is commonly associated with low-pressure weather systems (cyclones), excluding waves.
Storm Water/Flood Management	Stormwater/flood management refers to all stormwater infrastructure and assets, and any flood management infrastructure in place
Telecommunications	Telecommunications refers to all infrastructure associated with information transmitting technologies and communications, including wired phones, cellphones, radio and television broadcasting and the internet.
Terrestrial Ecosystem	Terrestrial ecosystems are ecosystems found on land, including temperate deciduous forest, tropical rain forest, and grassland. Vanuatu's tropical and subtropical rainforests are home to a wide range of flora and fauna and are susceptible to changes in temperature and rainfall.
Traditional Knowledge	The understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For many indigenous peoples, this knowledge informs decision-making about fundamental aspects of life, from day-to-day activities to longer-term actions. This Traditional Knowledge (TK) is integral to cultural complexes, which also encompass language, systems of classification, resource use practices, social interactions, values, ritual, and spirituality. The TK informs weather and climate predictions based on the behaviour of plants and animals, temperature and rainfall, and astronomical indicators such as stars and the sun.
Transport Assets	Transport assets refers to the assets and infrastructure associated with transport, including private vehicles, public transport vehicles and infrastructure, roads, bridges, cycle, and foot paths.

Tropical Cyclone	Tropical cyclones are rotating storms that develop over tropical oceans that are over 25.5 °C and within 5 degrees of latitude from the equator where there is sufficient Coriolis force to create the rotation. In the South Pacific Ocean, a tropical cyclone is defined by a 10-minute sustained wind speed of 17.5 metres-per-second or greater.
Uninhabited Buildings	Uninhabited buildings refer to all buildings in which assets are stored relating to the industry and its operations. For example, boat sheds, warehouses, and barns.
User Defined, or Other	Any element not listed that is relevant to the industry and its operations.
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm, and lack of capacity to cope and adapt
Wastewater Infrastructure	Wastewater infrastructure refers to the network of pipes that collect and carry residential, business, and industrial effluents to wastewater treatment systems, and the treatment systems themselves.
Water Supply	Water supply refers to the source, treatment, transportation, and distribution of potable water, for example wells, bores, pumps, pipe networks and treatment facilities.
Water Transportation Activities	Boating activities refer to any marine transport operations, for example boat tours, water taxi services and fishing.

B

Appendix B – Climate Variables

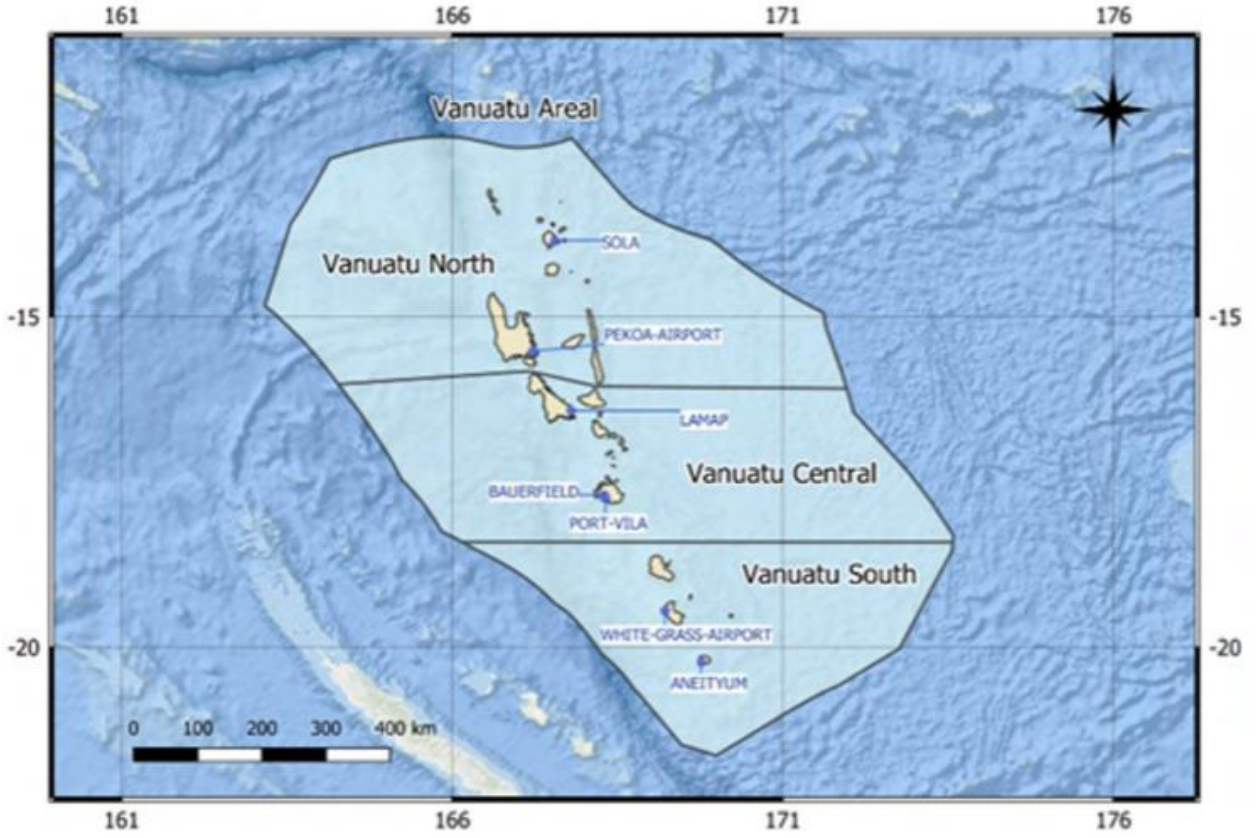


Figure 11: Map of Vanuatu and the three sub-national regions.

Relative to the 20-year period, 1986-2005, for RCP8.5. Median values with the 10th to 90th percentile range of uncertainty in brackets.

Climate Variable	Description
Temperature (°C)	Increase in average temperature?
Rainfall (%)	Percentage change in rainfall
Extreme rainfall (%)	Percentage increase in extreme rainfall
Sea level (m)	Sea level change in metres
Cyclone intensity (%)	Percentage increase in cyclone intensity
Cyclone frequency (%)	Percentage increase in cyclone frequency
Marine heatwaves (days)	Number of marine heatwave days in one year

Table 11: Summary of projected climate change for Vanuatu North for the present day, mid-century, and end of century (Van-KIRAP, 2023).

Vanuatu North			
Climate Variable	**2020 – 2039**	**2040 – 2059**	**2080 - 2090**
Temperature (°C)	0.7 (0.5 to 0.8)	1.2 (0.9 to 1.6)	2.7 (2.0 to 3.3)
Rainfall Nov-Apr (%)	-1 (-7 to 6)	-1 (-13 to 9)	-2(-17 to 18)
Rainfall May-Oct (%)	-2 (-15 to 10)	-0 (-23 to 15)	-3 (-34 to 27)
Extreme Rainfall (%)	8 (-12 to 24)	4 (-16 to 38)	-3 (-13 to 40)
Sea Level (m)	0.14 (0.10 – 0.18)	0.28 (0.22 – 0.37)	0.73 (0.56 – 0.99)
Cyclone Intensity (%)		1 (-6 to 12)*	5 (-10 to 20)*
Cyclone Frequency (%)		-12 (-40 to 0)*	
Marine Heatwaves (days)		200 – 330	340 - 360

Table 12: Summary of projected climate change for Vanuatu Central for the present day, mid-century, and end of century (Van-KIRAP, 2023).

Vanuatu Central			
Climate Variable	**2020 – 2039**	**2040 – 2059**	**2080 - 2090**
Temperature (°C)	0.7 (0.5 to 0.8)	1.2 (0.9 to 1.6)	2.7 (2.0 to 3.3)
Rainfall Nov-Apr (%)	0 (-15 to 7)	-2 (-17 to 10)	0 (-26 to 18)
Rainfall May-Oct (%)	-2 (-16 to 13)	-4 (-22 to 13)	-4 (-32 to 28)
Extreme Rainfall (%)	6 (-12 to 23)	11 (-5 to 30)	16 (9 to 54)
Sea Level (m)	0.14 (0.10 – 0.18)	0.28 (0.22 – 0.37)	0.73 (0.56 – 0.99)
Cyclone Intensity (%)		1 (-6 to 12)*	4 (-6 to 16)*
Cyclone Frequency (%)		-12 (-40 to 0)*	
Marine Heatwaves (days)		170 – 300	320 - 360

Table 13: Summary of projected climate change for Vanuatu South for the present day, mid-century, and end of century (Van-KIRAP, 2023).

Vanuatu South			
Climate Variable	**2020 – 2039**	**2040 – 2059**	**2080 - 2090**
Temperature (°C)	0.7 (0.5 to 0.8)	1.2 (0.9 to 1.6)	2.7 (2.0 to 3.4)
Rainfall Nov-Apr (%)	-2 (-14 to 7)	-1 (-17 to 8)	2 (-31 to 22)
Rainfall May-Oct (%)	-4 (-15 to 14)	-5 (-18 to 14)	-2 (-30 to 25)
Extreme Rainfall (%)	-6 (-12 to 9)	41 (-2 to 57)	23 (13 to 28)
Sea Level (m)	0.14 (0.10 – 0.17)	0.28 (0.22 – 0.37)	0.73 (0.56 – 0.99)
Cyclone Intensity (%)		1 (-6 to 12)*	2 (-6 to 11)
Cyclone Frequency (%)		-12 (-40 to 0)*	
Marine Heatwaves (days)		160 – 310	320 - 360

C

Appendix C – Climate Variable Information Availability

Table 14: Climate variable information availability. Note that CMIP5 projections are only available within Van-KIRAP portal for two emissions scenarios; low (RCP2.6) and high (RCP8.5).

Climate Variable	Historical Baseline	Projected Period	Source
Coastal Inundation flood mapping (1, 10 & 100-year ARI at increments of 0.25m SLR to 10m)	1995	CMIP5 (low, high) 2020-2039 2040-2059 2060-2079 2080-2099	Van-KIRAP
Extreme Rainfall (Yearly maximum rainfall for given ARI)	1985	CMIP5 (low, high) 2040-2070 2070-2100	Van-KIRAP
Total rainfall (annual, seasonal and monthly scale) or anomaly	1995	CMIP5 (low, high) 2020-2039 2040-2059 2060-2079 2080-2099	Van-KIRAP, CSIRO and SPREP publication
Sea level rise anomaly	1995	CMIP5 (low, high) 2100	CSIRO and SPREP publication
Temperature (min, mean and max annual)	1995	CMIP5 (low, high) 2020-2039 2040-2059 2060-2079 2080-2099	Van-KIRAP
Tropical cyclone frequency and intensity (% increase)	1985	CMIP5 (low, high) 2070-2100	Van-KIRAP
Tropical cyclones and extreme rainfall	-	2°C global warming	CSIRO and SPREP publication
Tropical cyclone wind speed (% increase)	1985	CMIP5 (low, high) 2070-2100	Van-KIRAP
Aragonite Saturation State (Proxy for ocean acidification)		CMIP5 (low, high) 2100	World Bank
Marine heatwave projections (multiple parameters)		CMIP5 (low, high) 2020-2039 2040-2059 2060-2079 2080-2099	Van-KIRAP

Table 15: Gaps or issues identified in review of climate variable information.

Variable	Issue	Approach
Catchment based flood hazard modelling and mapping	Other consultants have been commissioned within the Van-KIRAP programme to produce	The outputs of flood hazard mapping are anticipated to conform to typical flood mapping outputs; maps of

Variable	Issue	Approach
	catchment-based flood mapping for selected catchments in Vanuatu (We understand the catchments modelled are the Cara catchment on Santo and the Malae catchment on Efato). We understand NIWA and another consultant are leading this and interfacing with CSIRO and the PMU. However, draft or final results are not available or have been uploaded to the Van-KIRAP portal as of 20 November 2023.	flooding extent, depth and velocity for a range of storm magnitudes (rainfall intensity-duration ARI), climate change conditions (high/low emissions and SLR) and future timeframes (short-long term). We communicated with CSIRO and the flood modelling consultants to understand if their anticipated outputs support inclusion within the RCRAF framework. We received a draft of the report providing insights of flood mapping. However, the RCRAF is a non-spatial tool, so the information provided only helped the understanding of the overall flooding risk.
Vertical Land Movement (VLM)	Vanuatu is in a seismically active region and subject to tectonically driven uplift and subsidence. This vertical land movement can accelerate or offset the apparent sea-level rise rates at the coast. It is unclear whether VLM is included within the Van-KIRAP portal sea-level rise future scenarios.	We used Van-KIRAP portal information on SLR as it stands. No vertical land movement has been included in the analysis, however, this as an additional step that could be consider in the future based on clients needs.
All	The Van-KIRAP portal climate information services is based on CMIP5 projections (from the AR5 2013 suite of IPCC reports). Newer climate projections are available (CMIP6) from the latest IPCC reporting phase (2021, AR6) but are not included.	Continue to use Van-KIRAP and CSIRO climate information products as they exist. Request statement from CSIRO about alignment of CMIP5 projections with CMIP6 at national scale across Vanuatu.

Table 16: Nation wide sector related information available.

Name	Description	Source
Open street map	Open-source database of built assets (buildings, roads) with some building uses. No QA or validation available.	OSM (link)
Pacific Data Hub maps and data catalogue	Hub for pacific datasets. Internationally sourced mapping on ocean boundaries, reefs, wind zones and some population information.	PDH (link)
Pacific Climate Change programme (PACCSAP)	Pacific Climate Change information – based on AR5 assessment. Prepared by SPREP and CSIRO. Superseded by Van-KIRAP.	PACCSAP (link)

Name	Description	Source
Climate Change Knowledge Portal (World Bank)	World Bank Country Profiles (CMIP5). Superseded by Van-KIRAP.	World Bank (link)
NextGen projections (2021)	Current and Future Climate for Vanuatu. Superseded by Van-KIRAP.	RCCAP (link)
Pacific Risk Information System (PACRIS)	Data from 2012-2015 research. GIS and tabular data includes partial coverage of built and natural environment information.	PCRAFI (link)
Case study 'infobytes' information for 5 key sectors [Note – these outputs are not accessible at the time of writing, hence the quality and type of information is unknown]	Example case study information for: - Infrastructure (Road length exposed to 3x ARI coastal flooding events with SLR) - Fisheries (8 fishery sites and national mapping of coastal habitats (mangroves, coral) overlaid with recent future marine heatwave parameters) - Tourism (1 tourism site exposure to 3x ARI coastal flooding events) - Agriculture (suitability of 5x crops under climate scenarios) - Water (maps of average monthly rainfall and temperature)	CSIRO within Van-KIRAP

D

Appendix D – Vanuatu Stakeholder Consultation Report

Vanuatu Stakeholder Consultation Report

FINAL

Prepared for Secretariat of the Pacific Regional Environment Programme (SPREP)
Prepared by Beca International Consultants Ltd

23 November 2023

Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
1	Sophie Andrews		31/10/2023
2	Kristin Renoux		1/11/2023

Document Acceptance

Action	Name	Signed	Date
Prepared by	Kristin Renoux and Sophie Andrews		23/11/2023
Reviewed by	Mike Allis		23/11/2023
Approved by	Cushla Loomb		23/11/2023
on behalf of	Beca International Consultants Ltd (BICL)		

Executive Summary

Beca International Consultants Limited (Beca) has been commissioned by *the Secretariat of the Pacific Regional Environment Programme* (SPREP) to prepare a rapid climate risk screening and test on tourism sector (the 'Project'). For this stage of the project, Beca has undertaken consultation with key stakeholders identified by SPREP and the *Vanuatu Department of Tourism* (DOT) to understand their climate risk assessment needs, and the roles and contributions they can make to this project. The engagement with these stakeholders and information gathered is being used to inform the development of a rapid climate risk assessment framework and methodology, the application of the framework to a tourism case study and the development of a financial projection mechanism for tourism.

This report explains the stakeholder consultation process undertaken and the scope, needs and roles of stakeholders identified during the consultation sessions.

The impact of Tropical Cyclone *Lola* during the final week of consultation from the 24 October 2023 impacted planned engagement, and the third stakeholder session was not able to proceed, however valuable information and themes came through from the two consultation sessions held.

During consultation stakeholders highlighted the need for an accessible climate risk assessment framework that can be used by stakeholders across the five key sectors (Infrastructure, Fisheries, Water, Agriculture and Tourism) as well as future in country guidance and training to support the end users to successfully use and implement the framework.

Tourism stakeholders provided information about the impact of climate change on different tourism activities. In particular, stakeholders referenced the impact on the Vanuatu Dive Industry as being of particular concern. For this reason, the tourism case study selected the Dive Industry for testing the Rapid Climate Risk framework.

1 Engagement Scope

It was agreed with SPREP at the Inception Meeting that due to the compressed timeframe to deliver the project, stakeholder consultation would be undertaken over a two-week period and utilising set ‘sessions’ that stakeholders could choose from. To facilitate greater attendance by a broad range of stakeholders a mixture of days and times were provided.

Three sessions of 2 hours each were scheduled and invites sent to key stakeholders identified by SPREP and the Department of Tourism. Stakeholders were advised that they were only required to attend one session. The sessions were coordinated by the Department of Tourism, who invited the stakeholders to select a session and maintained the register of attendance for each session.

SPREP and DoT identified 18 target stakeholders to undertake consultation with. These stakeholders are as detailed in Appendix C.

The purpose of the consultation has been to understand the roles and needs of the stakeholders, and to identify the end users of the framework and the format that will be the most appropriate for these end users.

The purpose of this report is to analyse the information gathered from the consultation sessions to appropriately inform the direction and format of the framework and methodology, case study and financial projections mechanism for the project.

Guidance and training were included within the original scope of this project but were deferred due to funding timeframes.

2 Stakeholder Engagement Process

Stakeholders were provided with a 2-page project summary document prior to the consultation sessions. This provided a brief description of the project and the objectives of the engagement sessions. In each session, the Beca team utilised a presentation to describe the background to the project, the scope of the rapid climate risk assessment and pose particular questions of attendees around user needs for the framework. The project summary document and presentation are attached as Appendix A of this report.

Beca facilitated three virtual stakeholder consultation sessions on the 18th, 19th and 24th of October 2023. The minutes from the first two meetings can be found in Appendix B. Unfortunately, all Vanuatu-based stakeholders were unable to attend the third session due to Tropical Cyclone *Lola* impacting the country.

To supplement the absence of the third consultation session, all stakeholders were provided with an opportunity to respond to the key engagement questions through a short online survey questionnaire.

The questions asked to the stakeholders at these consultation sessions were as follows:

- What is your organisation?
- Where do you operate within Vanuatu?
- What climate issues are you already seeing in your sector?
- How is climate change already affecting your organisation?
- What would help you to consider climate risks into your future planning?
- What role does your organisation play in identifying climate change risks in Vanuatu?
- Who do you think the end users of this framework will be?

2.1 Session attendees

All sessions were attended by internal stakeholders of SPREP, with Session 1 and 2 attended by the Vanuatu Meteorology and Geo-Hazards Department (VMGD).

Session 1

The external stakeholders who attended Session 1 were three representatives of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) involved in the VanKIRAP project previously and the Country Manager for Tropical Agencies Limited who is also the Domestic Shipping National Representative for the Chamber of Commerce.

Session 2

The external stakeholders who attended Session 2 was the Acting director of the Department of Tourism and a representative from the Vanuatu Environmental Science Society (VESS). This representative is also the president of the Vanuatu Scuba Operators Association, she co-owns the Big Blue Dive Company which operates around Vanuatu, and her partner operates a metals recycling business.

Session 3

No external stakeholders were able to attend due to Tropical Cyclone *Lola.*

2.2 Stakeholder survey

To support the stakeholder consultation and increase the opportunity to provide comment, a survey with key questions was sent to all stakeholders provided by SPREP and the Department of Tourism.

The questions asked in this survey were:

1. What is the name of your organization and its core activities?
2. Where do you operate within Vanuatu? E.g. Regions, critical locations and infrastructure, key activities, and communities.
3. How do you currently consider climate risks to your infrastructure and activities? E.g. risk assessments, planning tools, national hazard information
4. What format of a rapid climate risk assessment tool would be most practical for your decision making? E.g. excel workbook, flow chart, app
5. What would prevent you from using a climate risk framework and methodology? E.g. capability, capacity, equipment

No responses to the survey were received by the deadline required to meet the tight project timeline (end of day on the 31st October 2023).

3 Engagement Outcomes

This section outlines the key messages and findings from the Engagement Sessions. A full record of meeting minutes of the sessions is included in Appendix B.

3.1 Session one

3.1.1 Stakeholders' organisation

The representatives from SPREP and VMGD offered stakeholder perspectives from the client and project manager point of view.

The Vanuatu country manager for Tropical Agencies Limited (TAL) also has a role as the domestic representative for the chamber of commerce as well as a role in commercial shipping. His role at TAL is to coordinate with cruise ships and their associated port, berthing and some shore excursion activities. There are two TAL offices in the country (Santo and Port Vila) and these support cruise activities during the cruising season (November to March).

The three CSIRO representatives attended the consultation session on behalf of CSIRO. They offered perspectives from multiple in-country missions and over 5 years working on the VanKIRAP project.

3.1.2 Climate change observations

The TAL representative relayed that the perspective of shipping agencies and cruise lines in Vanuatu is that their biggest concerns is the number of weather-related incidents which affect their operations and schedules. In the past these events caused impacts such as ships being diverted to other islands, bypassing Vanuatu for other ports, as well as flooding and landslips on roads which limit access to the Port and shore activities and truncates the time which tourists have for activities.

3.1.3 End user discussion

They provided ideas from previous community engagement in Vanuatu, expressing that the framework is more likely to get traction with end users if it is in a format that is accessible and caters to a range of capabilities. This should recognise both the time pressures and level of understanding of users, especially if it were the tourism operators. There was also a recommendation to use infographics to display information for the framework.

3.2 Session Two

3.2.1 Stakeholders' organisation

Our second stakeholder engagement session included the representatives from SPREP and VMGD with two additional stakeholders- the Acting Director for the Department of Tourism and a representative from the Vanuatu Environmental Science Society (VESS).

The representative from VESS is also the president of the Vanuatu Scuba Operators Association and the co-owner of Big Blue Dive company. From a scuba and diving perspective, the representative made many references to environmental degradation, bleaching of the coral reefs, particularly after a cyclone and marine heat waves.

The indirect risks to the tourism industry were also discussed, with mention of a reduction in local food production which is often used by a large number of the operators to provide to tourists on diving trips.

3.2.2 Climate change observations

From a scuba and diving perspective, the representative of VESS made many references to environmental degradation, bleaching of the coral reefs, particularly after a cyclone and marine heat waves. It was noted that as the temperature of the water cools again after the cyclone, the reefs start to return, however, recently, the temperature of the water hasn't returned to a cold enough temperature to provide relief to the reef.

The indirect risks to the tourism industry were also discussed, with mention of a reduction in local food production which is often used by a large number of the operators to provide to tourists on diving trips.

3.2.3 End user discussion

The President of the Vanuatu Scuba Operators Association notes the tourism industry operators are more focussed on the immediate day-to-day or season-to-season risks of the activity/operations, and that the medium to long-term risks such as increasing climate impacts are rarely looked at by tourism operators.

The majority of investment for operators goes into equipment and asset management, with a reduced focus on preparing for future risks. SPREP expressed that the framework would be useful to be targeted towards end users who need support and training, so they have the opportunity to build their capability in identifying potential future risks.

Training and support were also discussed with the intention of enhancing the skills of all operators to use the framework. The potential of incentives in the form of grants or business enhancements were suggested to help develop the buy in of a number of the operators, particularly as some operators are small and struggle with the day-to-day operation of their business. To appropriately provide for this support, the Acting Director of Tourism discussed the potential of involving the Product Development Officers (PDOs) to assist in the training or to offer support in the use of the framework. The PDOs are located in each of the 6 provinces across Vanuatu and are well connected to the operators and National Government Organisations (NGOs) in their respective province.

The need for simplicity in the framework was also emphasised, echoing the conversations from session one about the needs of the end users.

The needs of stakeholders were noted to vary, typically because of size and location of the operations and activities. This led to the suggestion of the end users being address in two levels- the smaller operators in more remote locations being provided with additional support and training to use the framework effectively, and the medium/large operators from islands such as Port Vila and Santo who can use the framework more independently.

It was proposed by the representative of VESS that in order to reach the attention of many operators it would be useful to produce a summary workbook with findings and suggestions for mitigation that are practical and can be used to plan for the future of their operations. This is likely to produce a higher rate of engagement as it reduces the overwhelming feeling of applying the framework or tool themselves.

4 Recommendations

4.1 Training and guidance

Providing for training and guidance to end users for this framework is a key message that has come across in the consultation sessions. Our recommendation is to continue with the proposed Stage 2 of this project which includes preparation of training and guidance materials and facilitation of in-country training sessions. This additional training would enhance uptake and implementation of the framework into the tourism sector of Vanuatu.

4.2 End users

There was varied discussed about the appropriate end users for this framework.

CSIRO and tourism stakeholders indicated that widespread individual operators are very likely to be focussed on their immediate day-to-day operational activities and are unlikely to have capacity to learn about or develop their understanding of the framework or its implementation. As discussed in Section 3.2.3 of this report, it is likely operators would be more receptive towards the framework if the assessment has already been undertaken and they are presented with relevant findings and recommendations.

The consultation identified tourism associations and some government agencies that may be more appropriate entry points to build climate resilience through using the rapid risk assessment framework and methodology.

Our recommendation is the end users for this framework are those within the tourism industry associations and government department officials who can support, as required, individual operators to undertake a climate risk assessment of their operations and activities.

This level of end user is understood to have a working knowledge of the industry such that they could complete the rapid risk assessment. They are also anticipated to be connected to the key operators on the ground and stakeholders in government licencing and regulation. These agencies can provide central points at which training, and guidance can be delivered and the risk information gathered from across sectors and consolidated to inform decision-making at different levels about the short, medium and long term climate risk being faced in Vanuatu.

4.3 Case study

Various tourism related industries were discussed in the consultation sessions; the large accommodation providers, smaller bungalow accommodation, cruise ships, agricultural ‘eco-tourism’ and tourism to experience the pristine reefs, wildlife and beaches. The dive industry was mentioned and discussed in both consultation sessions. This industry was noted as a large contributor to the economy, employed many people around the country, and was an activity that visitors to the island frequently take part in whether they arrive by cruise ship or airport.

During the consultation follow up session we have confirmed with SPREP and DoT that the dive industry is appropriate to take forward as a case study to apply the framework and develop the financial projection mechanisms around.

Relative to the purpose of the project and the information gathered through the stakeholder consultation sessions, focusing the case study on the dive industry appears to be appropriate to demonstrate the rapid climate risk framework.

A

Appendix A – Stakeholder consultation materials

Project: Rapid Climate Risk Assessment Framework, Methodology and Case Study for Tourism Sector and Associated Infrastructure and Fisheries in Vanuatu

Project Outline

This work continues from the VanKIRAP project with VMGD, SPREP and CSIRO.

To create: A high-level framework and methodology to achieve a rapid understanding of the climate change risks that will inform strategic decision making.

Goals: The framework and methodology are accessible and can be understood by stakeholders for future use.

It can be picked up by different sectors and applied in a consistent way that will allow for a sector-wide understanding of the climate risks and assist in building resilience.

It will include a case study of the tourism sector.

Key project outputs:

- Rapid Climate Risk framework and methodology report.
- A rapid assessment of the tourism sector as a case study.
- Financial mechanism for possible adaptation measures for the tourism sector.

Stakeholder Consultation Sessions (3 options)

- 18th October 11am – 1pm (Vanuatu local time)
- 19th October 1-3pm (Vanuatu local time)
- 24th October 11am – 1pm (Vanuatu local time)

Please select a session (**you only need to attend one**!) and join for the full 2 hours. We will start with an overview presentation before seeking your input.

What we want from you…

During the session we will discuss:

- Your specific climate risk related needs
- Who the end users of the framework will be
- The role your organisation has and how climate change may be affecting you
- What format of a risk framework is appropriate for you.
- How you currently consider climate risks
- What is already happening in response to climate risks

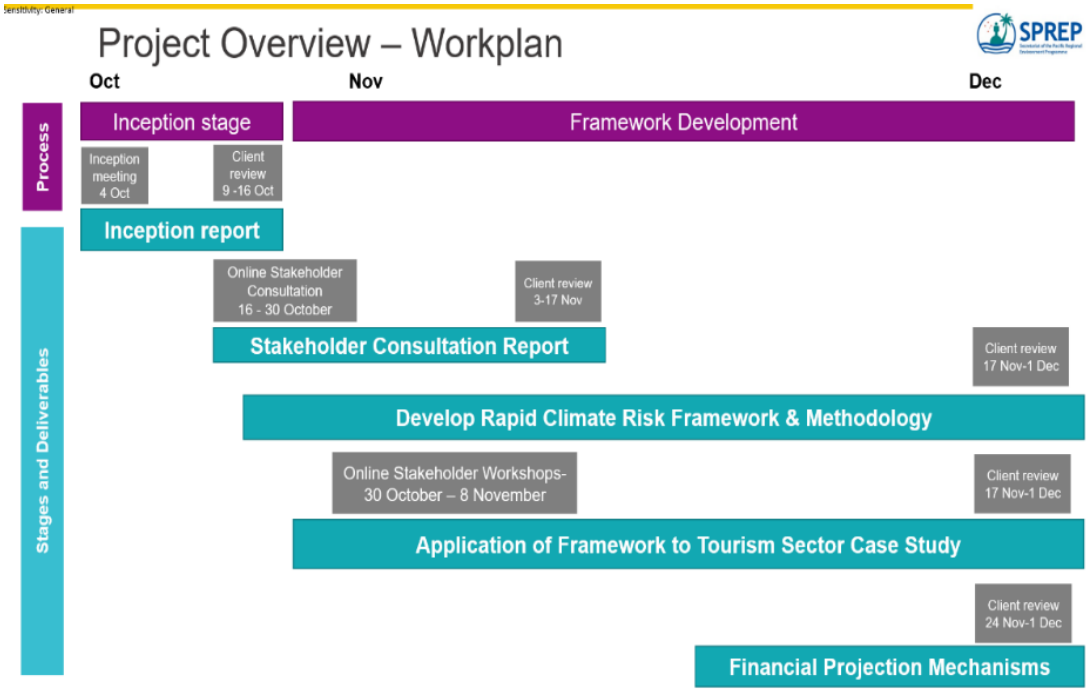
Beca Project Facilitators:

Mike Allis
Climate Science Expert

Sophie Andrews
Project Support

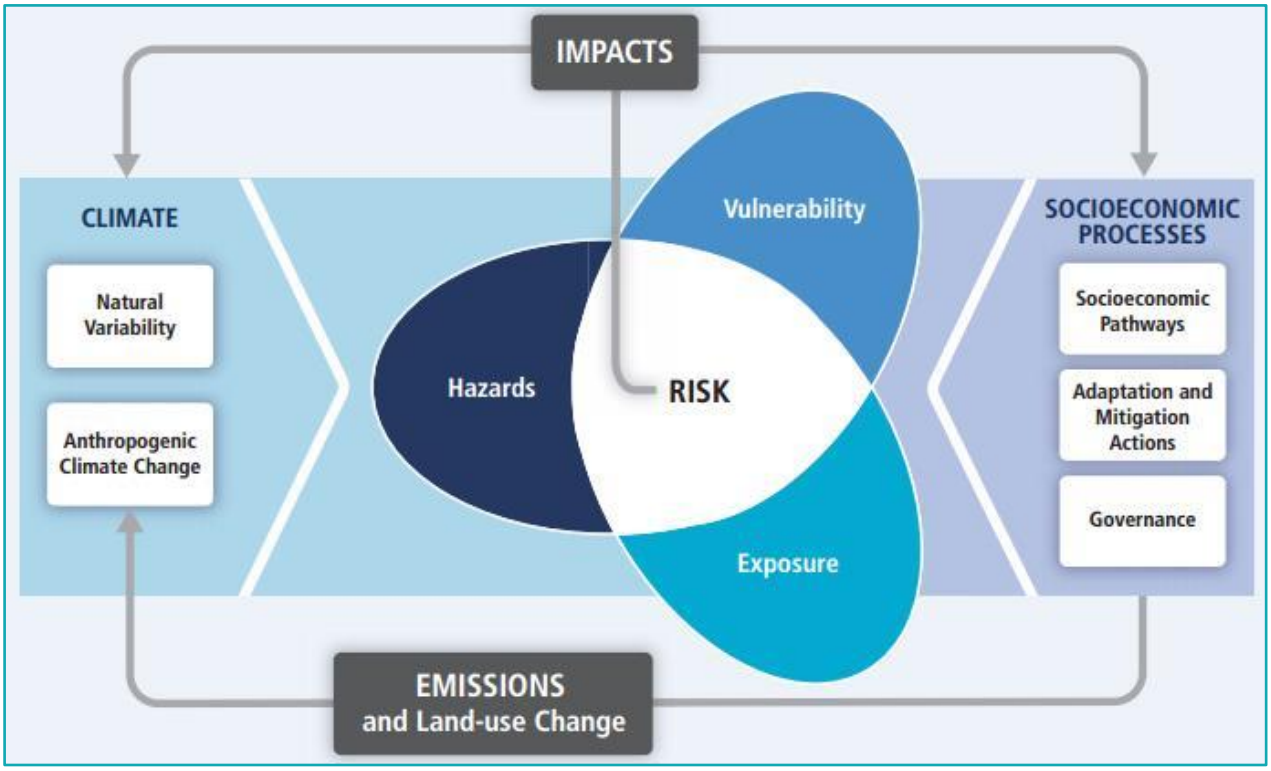
Kristin Renoux
Project Lead

Hannington Alatoa
On-island Support



Climate Risks

There are three factors that determine a risk (the physical impact), **Hazards, Vulnerability and Exposure**.



Hazards are a natural or climate change induced physical event that have the potential to cause damage. For example, cyclones, sea level rise, and droughts are hazards. We are not considering non-climate hazards (such as volcanic eruption and tsunami) as part of this project.

Vulnerability is the degree to which an asset or a community can be harmed by a hazard and the ability to adapt to reduce this harm. For example, coral reef areas are more vulnerable than fish to ocean acidification as coral reef species cannot 'move to other areas' as a result of their changing environment.

Exposure refers to the extent to which a system is exposed to a given hazard. For example, a coastal community in a low-lying area can be exposed to a certain level of inundation risk during a storm event.

Vanuatu Rapid Climate Risk Framework Consultation Meeting

18 October 2023

make everyday better.

Meeting Agenda

1. “House Keeping”
2. Introductions from Beca
3. Project, outline and scope
4. Introductions from Stakeholders
5. Project Goals and Discussion
6. Questions and answers

House Keeping

Free and open conversation

- Connectivity
  - Video on when talking if possible
- We want to hear from everyone, please be mindful of time
- Short online survey at the end, to capture your thoughts if we run out of time today
- Sessions will be recorded

Beca Project Facilitators

Kristin Renoux

Project Lead

Mike Allis

Climate Science Expert

Carlos Carvajal

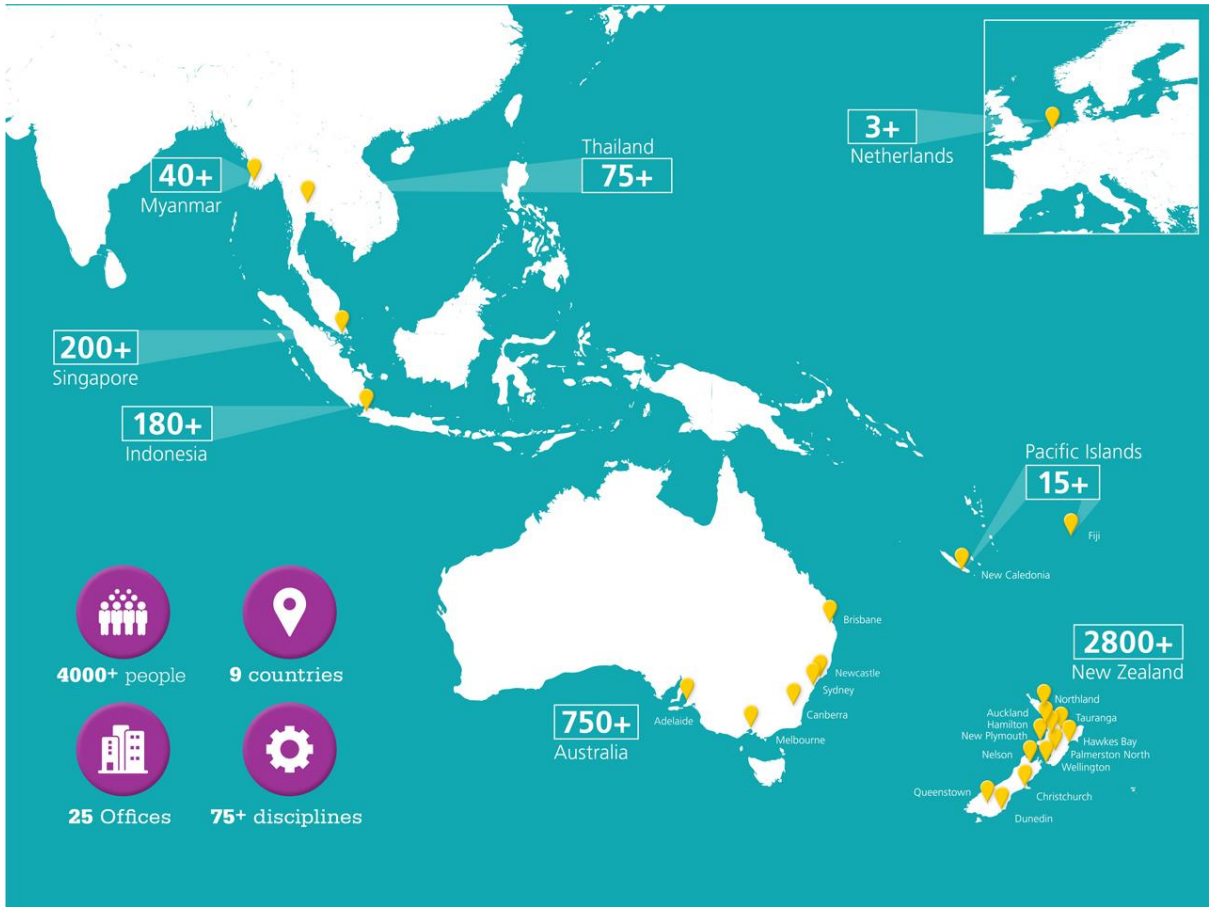
Climate Scientist

Hannington Alatoa

In Country Support

Sophie Andrews

Project Support



SPREP Secretariat of the Pacific Regional Environment Programme

Beca

Project Outline and Scope

Project Overview – Bigger Picture

Van-KIRAP Project

Climate variable mapping, Case studies, Factsheets

Consultation Sessions

- Today!
- Understand stakeholder needs to ensure the framework is accessible.

High Level Rapid Climate Risk Assessment Framework

- Case study on Tourism – Fisheries/ Infrastructure

Project Overview – Workplan

October **November** **December**

Process

Stages and Deliverables

Inception stage

Framework Development

Inception meeting 4 Oct

Client review 9 -16 Oct

Inception report

Today

Online Stakeholder Consultation 16 - 30 October

Client review 3-17 Nov

Stakeholder Consultation Report

Client review 17 Nov-1 Dec

Develop Rapid Climate Risk Framework & Methodology

Online Stakeholder Workshops- 30 October – 8 November

Client review 17 Nov-1 Dec

Application of Framework to Tourism Sector Case Study

Client review 24 Nov-1 Dec

Financial Projection Mechanisms

Stakeholder Introductions

Introductions

1. What is your organisation?
2. Where do you operate within Vanuatu?
3. What climate issues are you already seeing in your sector?

Project Goal & Discussion

CSIRO Climate hazard impact framework:

Rapid Climate Risk framework

-Determine the exposure to each climate hazard for each asset/ operation/ activity

-Collect asset/ operation / activity information to inform vulnerability to each climate hazard

- Analyse the vulnerability of asset / operation/ activity to each climate hazard

Existing knowledge: Van-KIRAP portal and information from CSIRO, SPREP and others

Consultation: Gather an understanding of the end users of the framework

Project Goal

Develop an accessible climate risk framework to provide a consistent way to assess climate risks across the different sectors.

Discussion

1. How is climate change already affecting your organisation?
2. What would help you to consider climate risks into your future planning?
3. What role does your organisation play in identifying climate change risks in Vanuatu?
4. Who do you think the end users of this framework will be?

Format Examples

1. Matrix

Determines the risk based on hazard exposure and vulnerability.

Pro: Could be incorporated into existing risk frameworks.

Likelihood \ Impact	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Low Med	Medium	Med Hi	High	High
Likely	Low	Low Med	Medium	Med Hi	High
Possible	Low	Low Med	Medium	Med Hi	Med Hi
Unlikely	Low	Low Med	Low Med	Medium	Med Hi
Very Unlikely	Low	Low	Low Med	Medium	Medium

2. Excel Workbook

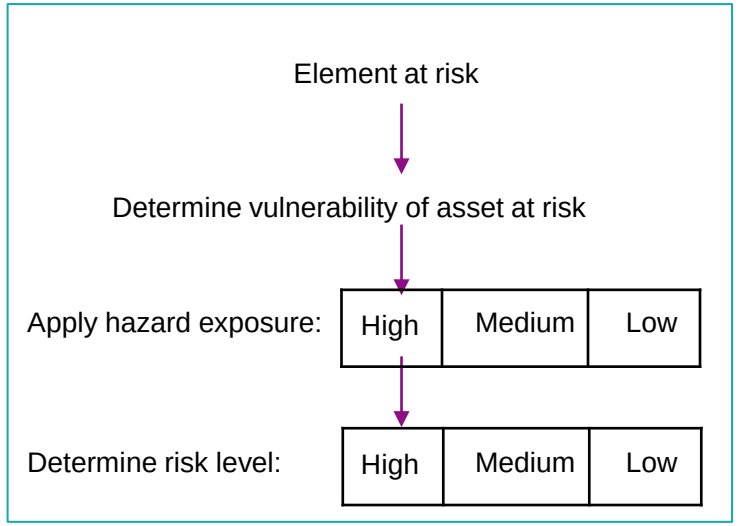
Uses a risk matrix to auto-populate the risk, based on the hazard exposure and vulnerability.

Pro: Would be a stand-alone tool

Climate hazard	Element at risk	Risk statement	Risk description	Exposure			Vulnerability	Risk		
				Present	Mid Century RCP8.5	End of Century RCP8.5		Present	Mid Century RCP8.5	End of Century RCP8.5
Sea level rise, coastal flooding	Roading network	**Risk to the roading network due to sea level rise & coastal flooding**	Roading network follows the coast and is at risk from sea level rise which, combined with severe weather and high tides, causing damage and outages.	Low	High	Extreme	High	Low	High	Extreme

3. Flow-chart

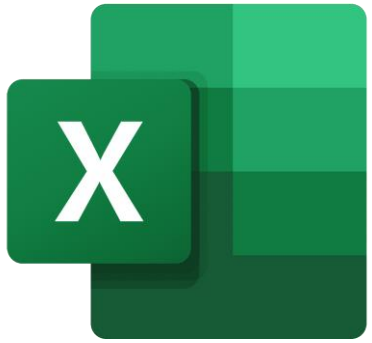
E.g. Step-by-step for each climate variable, accounting for hazard exposure and vulnerability. Could be worked into an excel format too.



Discussion

- Are you familiar with using risk frameworks (E.g, Financial, Health and Safety, Environmental)?

- What is the most useful format to you for making risk assessment decisions?



Likelihood \ Impact	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Low Med	Medium	Med Hi	High	High
Likely	Low	Low Med	Medium	Med Hi	High
Possible	Low	Low Med	Medium	Med Hi	Med Hi
Unlikely	Low	Low Med	Low Med	Medium	Med Hi
Very Unlikely	Low	Low	Low Med	Medium	Medium

Q + A

Post Consultation Survey

- Questions discussed today, plus some additional ones
- Survey will be distributed by Sunny (SPREP) via email
- Responses required by **end of day 31st October**

make
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better.

B

Appendix B – Minutes from stakeholder consultation sessions

Minutes of Meeting

Stakeholder Consultation Session One Minutes

Held 18 October 2023 at 11.00am-1.00pm (Vanuatu time)

Via Zoom

Present:	Sunny Seuseu (SPREP)	Leanne Webb (CSIRO)
	Moirah Matou (VanKIRAP)	Kevin Hennessy (CSIRO)
	Mike Allis (Beca)	Rebecca Gregory (CSIRO)
	Kristin Renoux (Beca)	Mark Pardoe (Country Manager for Tropical Agencies limited (TAL) and Domestic National Representative for the Chamber of Commerce)
	Carlos Carvajal (Beca)	
	Sophie Andrews (Beca)	
	Hannington Aatoa (Beca)	

Apologies:

Distribution:

Item	Notes
1 House Keeping and Introductions	
2 Stakeholder introductions 1. What climate issues are you already seeing in your sector	*1. What is organisation/background? Where do you operate within Vanuatu?* **Mark-** Cruise ship lines, two offices (Port Vila and Santo) Peak season for cruising is November to March- Cyclones, bad weather etc. effect port calls because of safety. From climate sector shipping agency perspective, biggest concern. Have number of this weather-related thing- ***Mark to send to Mike*** One road that leads to port villa is the one road for cruise tours- only road so if something happens, like erosion of road due to weather would have big impact. Wharf road (CSIRO- Vicky Tai might be able to help with detours of the road but not CSIROs wheelhouse yet. They will do some mapping of the road and see the level of risk). **Kristin -** Would you choose to not to go there because of the impacts? **Mark-** Yes, and cargo issues, won't sell or give these in tours- passenger experience dramatically affected. What's the number of people involved in providing experience? Summary to be projected of specific activities.

Item	Notes
	Moirah – rivers that run through roads that didn't happen before. Happening more and more often. Some resorts in Santo – Bungalows already washed out because of erosion and rain fall **Mark**- wearing commercial rep hat: roads washed away- people identifying and working with people to fix this **CSIRO – Leanne** – not mentioned, fisheries issues (to see sea turtles) and they are affected by climate in gender ratio. Roads bumpy already (construction quality). Tropical cyclones limit access to electricity. **Kevin-** Two of the info bites not yet accessible (will be by 12 Nov) NIWA will be doing modelling, to see the increasing issues of flooding (getting bad) **Leanne** - Tourists like to try local produce (plantations might get to expand because it's warmer but coffee really struggling) **Mark –** Infestation of rhinoceros beetle, eating copra plants (Port Vila, Efate) – is there a climate driver behind the infestation?
3 Project outline and scope	**Mike** • Excellent work done already for Vanuatu on project, Beca building on it • Timeline constraints • Financial projections
4 Project Goals and Discussion	**Mike and Kevin**- Beca fits into step 3 and 5 of the CSIRO framework. **Kevin-** It needs to be generic enough to be applied across different sectors (consistent so can be used in a consistent way) **Mark** - unaware of this project itself and haven't has too much to do with the VanKIRAP as private sector (aware but haven't dived into it) **Mike-** Compressed time wise so we can be testing along to see if it's usable *How is CC already affecting your organisation and roles?* **Sunny-** observations- have had discussion with tourism operators in Santo and Efate Tourism operator in Santo concerned in SRL- have a number of beach huts they use for tourists but effecting community and losing land through this. Providing adaptation options, provide for growth next door. One of the most popular places for cruise lines but SLR impacting this. Airport effected by flooding, flights couldn't come in and out- this impacts the ability for people to come to the islands Infrastructure heavily impacted so tourist can't get around

Item	Notes
	2020 cyclone impacted tourism heavily (also because of covid 19) Small scale tourism operators- do not have access to pool water, have to access from ground, but can't do that during a drought **Mark-** Telecommunication cut off during cyclone, no connection to outside world- can't tell family we're okay. In July in 2015, power off for two weeks- comms you can't do business without it. Mark brought back up generator for the office because you can't have that complacency. **Leanne-** took photos of cyclone resistant structure- then took photos afterwards to show that it was resilient (things that you can use to be resilient). What did they do differently? This one has big concrete anchor at the back, made of materials that are locally accessible. Has Vanuatu sustainable tourism strategy been implemented on a community level? Tourism strategy 2021, has been implemented – ***get information from Geraldine on how this is going at the moment.*** What about the people who are on the ground – drought obviously effect workers- has the impact of heat impacting airport workers unloading bags etc, or people unloading cargo. ***Talk to airport and DoT for this info.*** Electricity demand (increasing aircon use etc.) because of heat. **Mike-** what is the increase electricity sources? Mark- mainly uses diesel at the moment but looking at coconut oil etc. Impacts on Hospitals – dengue fever? *What would help you consider climate risks into your future planning?* **Mark**- only getting bigger in people wanting to come to islands, ports need to get bigger, looking at some of the climate impacts but as boots on the ground, couldn't tell you where they are looking at. **Sunny –** from his discussion from department of tourism, department is looking at strengthening their tourism mat. Strengthening between the two departments, the tourism sector will be more resilient working with DoT and Tourism Vanuatu. Methodology scheme to facilitate methodology where they encourage tourism operators to identify risks. Tool developing will help them with their journey providing for all stakeholders (wide range). Using data from the last 13 years, need to update data to help with process. Ministry looking at relocating communities and villages because of SLR but need a methodology like DRR's relocation policy to help inform the future planning decisions.

Item	Notes
	Moirah – Project started in 2018 so most of the planning for risk has been updated from then until now- people starting to include climate change thinking in their business plans. *What role does your organisation play in identifying climate change risks in Vanuatu?* **Mark-** we work in real time- start working with captains or marine managers if issues start to arise- if not booked It can be diverted from mystery island to Port Vila for example. *Are you getting any requests for assurance of operation – how far out?* **Mark –** After cyclone Judy, report asked to be done by minister and they said road is not to be used- public doc so cruise lines diverted from port villa. Against cliff face placed temporary protection/ fixes- report changes, cruise line back but said it's not a long-term solution so have concerns. Cruise line paid for some of works- Min tourism reduced fees by half to accommodate. *Are there any particular services involved in supporting the resilience projects?* **Sunny**- nothing comes to mind but will have a think. **Moirah-** indirect or direct? Both. 5 priority sectors already, will have to think of anyone outside of the these. Department of CC, department of Environment, department of health. ***Can get details for VTO and DoT (Geraldine might have some names and ideas)*** *Who do you think the end users of this framework will be?* **Sunny-** Tourism sector through VTO and Dot will have to provide guidance of who to use it. DOT and VTO responsible for distributing and providing to relevant users. Have to be flexible enough to be used by wide range- need to accommodate all areas ie. waterfalls, beaches, all sites. Are the developers of tourism seen as using this? **Sunny-** vision to be used as a multi sectorial approach but consultation and implementation needs to be done by a multilevel agency, lead by DoT. Need to decide if it will be used for big and small organisations etc. **Kristin-** Are we assuming that there are end users with different understanding of risk management or analyse it for others? Flowchart to outline all steps? Safe to assume that risk management is not everyone's background as should apply/design as such. **Sunny-** needs to be a categorisation of different activities- ie. small scale use this and work with department for CC and large scale use this one to independently access.

Item	Notes
	Leanne – in Santo- graphics used to display technical info in project for end user (info graphics simple and preferable) **Kevin-** very simple step by step guide very helpful. Important to provide for an infographic that give a high-level overview of the risks now, and the risks in the future. Targeted approach very important as sunny said. **Leanne-** Big language barrier- getting stakeholders to drive the consultation as some afraid to ask the questions in English so conversation in Bislama was so much more interactive. **Carlos-** Does the climate relate from Bislama to English the same? Is that understanding there? *Format of tool: Examples shown- are they too detailed based on infographics convo? Does anyone have ideas on how to display/pitch framework for the end users?* High level pitch but risk of losing detail and value with high-level structure. **Sunny-** there will be use of this (examples format) but is something we need to discuss with DOT. Sunny supports- it's a good start but should be refined. **Leanne-** target always the understanding of reasonable capacity. Most of it, as long as you can explain it. **Kevin-** People have in the past found it difficult to discuss or grip likelihood. Think laid out well. Finding balance is challenging. Skipping likelihood all good- exposure more important to discuss. **Kevin-** emissions targets at high level
5 Questions and answers	*We want feedback on how we're done the session- has this been useful to understand our direction of travel?* Yes, all found useful **Kevin-** good discussion- rapid assessment can only do so much **Moirah-** Good questions that really triggered responses etc. Note additional stakeholder came late- ***their question is to be discussed with Sunny and Moirah after meeting.***

Minuted by: Sophie Andrews

Minutes of Meeting

Stakeholder Consultation Session Two Minutes

Held 19 October 2023 at 1.00pm – 3.00pm (Vanuatu time)

Via Zoom

Present:

Sunny Seuseu (SPREP)

Moirah Matou (VanKIRAP)

Mike Allis (Beca)

Kristin Renoux (Beca)

Carlos Carvajal (Beca)

Sophie Andrews (Beca)

Hannington Aatoa (Beca)

Dr Christina Shaw (CEO Vanuatu Environmental Science Society (VESS), President Vanuatu Scuba association, Co-owner of Big Blue Dive Company)

Geraldine Tari (Acting Director for Department of Tourism)

Apologies:

Distribution:

Item	Notes
1 Project Overview	**Moirah**- This is a Green Climate funded project Main objective of project to provide and enhance services provided by CSIRO so more stakeholders can use it for their planning and have better decision making so they have more resilience in the face of Climate Change. Geraldine- Don't have all the answers, hard to find someone to lead the project/ climate resilience charge.
2 Project outline and scope	Purpose of today- meet and gauge incites from stakeholders in Vanuatu • Excellent work done already for Vanuatu on project, Beca building on it • Timeline constraints • Financial projections
3 Stakeholder introductions	1. *What is your organisation/ Background?* **Geraldine** – Acting Director for the Department of Tourism (DOT) **Christina-** CEO of the Vanuatu Environmental Science Society (VESS) and owns Big Blue Dive company with husband. She is the new president of scuba association, and her husband owns recycling company. 2. *Where do you operate within Vanuatu?* What climate issues are you already seeing in your sector?

Item	Notes
	Geraldine- Operate under the Ministry of Trade and Commerce, responsible for the policy and implementation of tourism, offices based in all the 6 provinces. Main activities work around product development office. Currently over a 1000 tourism operation listed (database needs to be updated) Most operators in outer islands (rural) and are often the most impacted through climate issues. We don't have level of impacts and how impacted. There is a programme to help record data and help them in phasing out the development of their operation. Is there a way of feeding people information or gathering information from them? Mosly the ones based in Santo Tana and Port Vila easily contacted, but otherwise, only contacted over social media. Opportunity in improving online accreditation certification. Will take a while – format existing platform, being built on. Can we see a copy of that? Yes, Geraldine will send this through. **Christina** – Environmental scientist role- Projects mostly of threatened species and conservation but also work on ecosystem threats. Depends on what project doing but all throughout Vanuatu. Deliberately not working on Climate change projects, sticking to biodiversity conservation niche. Effects seeing tropical cyclones, tree canopies effected (bats come close to villages, people hunting them after cyclones. High rainfall events that will impact the environment. Trying to make the environment more sustainable. Tourism generally have impacts on environment. Experience in staying in local tourist operations. Tours- very little connectivity on island. Radio used for information a lot in remote islands. Lots of NGOs working on CC but little NGOs working on biodiversity work. Making sure it's not all human focused, raise the voice of the voiceless (animals and plants). If there's a specific climate event, would you expect there would be no contact with them for a while? Probably yes. Planes in one a week, boats in one a month- tricky for repairs, particularly if there's high demand. Are you already seeing specific triggers in the effects on the ground (coral reef bleaching- biggest bleaching event -never seen it so long in….) Temperature changes, 29 degrees started in November, about 2 months early. Also, a crown of thorns outbreak at the moment- if cyclone, knocked over more coral (tipped over). Saw after cyclone pam- lots of canopies fell out and trees fell down, and they El Nino drought caused a lot of them to die because they couldn't recover. **Mike -** Frequency is a driver of that change as well. **Christina -** Usually when cyclone comes through, the water temp drops and the coral stops bleaching but didn't this time. Didn't provide relief.

Item	Notes
	Christina- Wearing scuba association hat. Operators in Santo, Port Vila, a couple up the east coast. Biggest climate effect is on the corals. Most of info of what is happening in terms of cyclones isn't from in Vanuatu. Juggle of when the best time to anchor things down etc. based on losing business is you do too early. Has there been more cancellations due to cyclones (before and after changes)? Biggest impact of concern is post covid recovery and issues with airline function. Climate hasn't come up as much but haven't seen too much change because of the cyclone possibility. People (Charity sector) over enhancing issues on how the recent cyclone impacted/ damage caused. NGOs said it wasn't that bad so although bringing money to charities, tourism sector impacted. Fruit impacted and tour groups do local biscuits and fruit but couldn't for around 3 months. Not much in the market available. Coconut rhinoceros beetle infestation mentioned. **Mike**- does your husband have anything from recycling business? **Christina-** lots of extra material after the cyclones such as metals. VESS have done a plastic survey- People had 18 more bottles in their homes in areas that they didn't think they could get water or relief services. **Moirah-** Been a while since we have had cases/examples of the sea temperatures and coral bleaching. Deployed buoys in Vanuatu to measure temperatures- higher than usual.
4 Project Goals and Discussion	What would help you to consider climate risks in your future planning? **Geraldine-** Said that each operator would have a risk management plan in place, but they haven't had the tools to do one. Varying abilities based on location. Project help in giving operator services to help them develop framework that provides them with sustainability and climate information. **Kristin-** Thinking that the end user goes beyond government organisations and be used by the operators themselves? **Geraldine-** Yes **Kristin-** sometimes developing framework with wide range of end users quite tricky. Need to note that framework can be used with smaller tourism opportunities however they will need to be provided with training and tools to achieve a risk management plan **Christina-**Diving risks common- but looking at short term and not really long term. Concerns going into cyclone seasons but usually not long-term thinking. Usually a lot of investment in equipment and asset management. Not sure there would be much update from medium type businesses unless there is a future risk assessment value to it.

Item	Notes
	Think there are a lot of other threats that get overlooked because of the many Climate change projects. **Geraldine-** do you have comments on who the framework should be targeted at, will it be particularly useful for the end users that don't look into the long term. Thinking who else will have these thoughts, need to look into this as to how these impacts on operators. **Kristin-** journey for a lot of people to get understanding- need to get the buy in from people as to why this is going to support the long term of people's business (case study will be a good example of how this can be implemented). **Christina-** Some operators struggle with the day to day- need to buy in, perhaps from the government with funding/grants if it's undertaken, enhancement to business in some way, or applications to awards etc. The value incentive. **Format of examples** – *Thoughts? What might be useful as an end user?* **Geraldine-** If officers on the ground- the Product development officers in 6 provinces (or provincial managers), excel works to help with the understanding. But if it is a tool for people to take away, needs to be an infographic etc (simple). Provide with both hard copy and electronic version on website. Product development officers well connected to all operators and NGOs in their province. Provincial tourism officers (PTO). What would be key takeaways to pick up and use it? **Christina-** 2 levels of stakeholders- you have the small individual operators on outer islands and medium Vanuatu wide organisation. Tourism association members- required to be a member of one association so good way of attacking it. Not having too much on show at the beginning so it's not overwhelming. Perhaps a workbook with actual suggestions and mitigations that are actual practical so it's useful for next steps (but not too overwhelming so people don't want to start) Have to be a member of a tourism association to get tourism permit. Christina is unfamiliar with VanKIRAP portal. She mentioned she doesn't know what we're going to do differently.
5 Questions and answers	*Feedback on session?* **Geraldine-** DoT doesn't have Questions now but will have questions that pop up as we more through the process and as the feedback comes in.

Item	Notes
	Christina- VanKIRAP project inception meeting a few years ago- don't see how it's going to make a difference. Don't see how it will be used or can be used on the ground- Private sector don't really get help from the government (ie. coral reefs- not much the operators can do themselves, need help). What ability do the small operators have to make a difference using this framework? **Kristin-** Would tourism associations be good entry points to relive the pressure and difficulty of using the framework on small operators? **Christina-** Yes

Minuted by: Sophie Andrews

C

Appendix C- Identified Stakeholders

Stakeholders Identified for Consultation

SPREP and DoT identified 18 key stakeholders to undertake consultation with. These stakeholders are as follows:

- SPREP
- Vanuatu Meteorology and Geo-Hazards Department (VMGD)
- Department of Tourism (DoT)
- Vanuatu Tourism Office (VTO)
- Public Works Department (PWD)
- Department of Geology and Mines
- Department of Ports and Harbor
- Vanuatu Chamber of Commerce and Industry
- Reserve Bank of Vanuatu
- Department of Finance and Treasury
- Commonwealth Scientific Industrial Research Organization (CSIRO)
- Department of Climate Change (DoCC)
- National Disaster Management Office (NDMO)
- Department of Environment Protection and Conservation (DEPC)
- Ministry of Tourism, Trade, Commerce and Ni-Vanuatu Business
- Vanuatu National Statistics Office (VNSO)
- Vanuatu Fisheries Department (VFD)
- Tropical Agency Limited (TAL)