



Swiss Re

# Risk financing solutions and transfer mechanisms to promote climate resilience for ecosystems

Output 4 of TA 6742-REG  
Building Coastal Resilience through  
Nature Based and Integrated Solutions in  
Asia and the Pacific



## Social and economic importance of healthy coral reefs

- provide natural protective services and other valuable ecosystem services
- first line of defence for coastal cities, communities, infrastructure, etc.
- offer essential habitat 25% world's marine species
- providing essential food and livelihoods to millions of people.
- provide economic benefits of up to US\$16.1 bn/yr from marine ecosystem services



## The risks of Business-as-Usual

- Over 50% of coral reefs lost since 1980's - with significant environmental, social and economic consequences.
- To assure long-term social and economic resilience – particularly for those most connected to the ocean.
- It is imperative that the resilience of ocean ecosystems are built



## Project Purpose

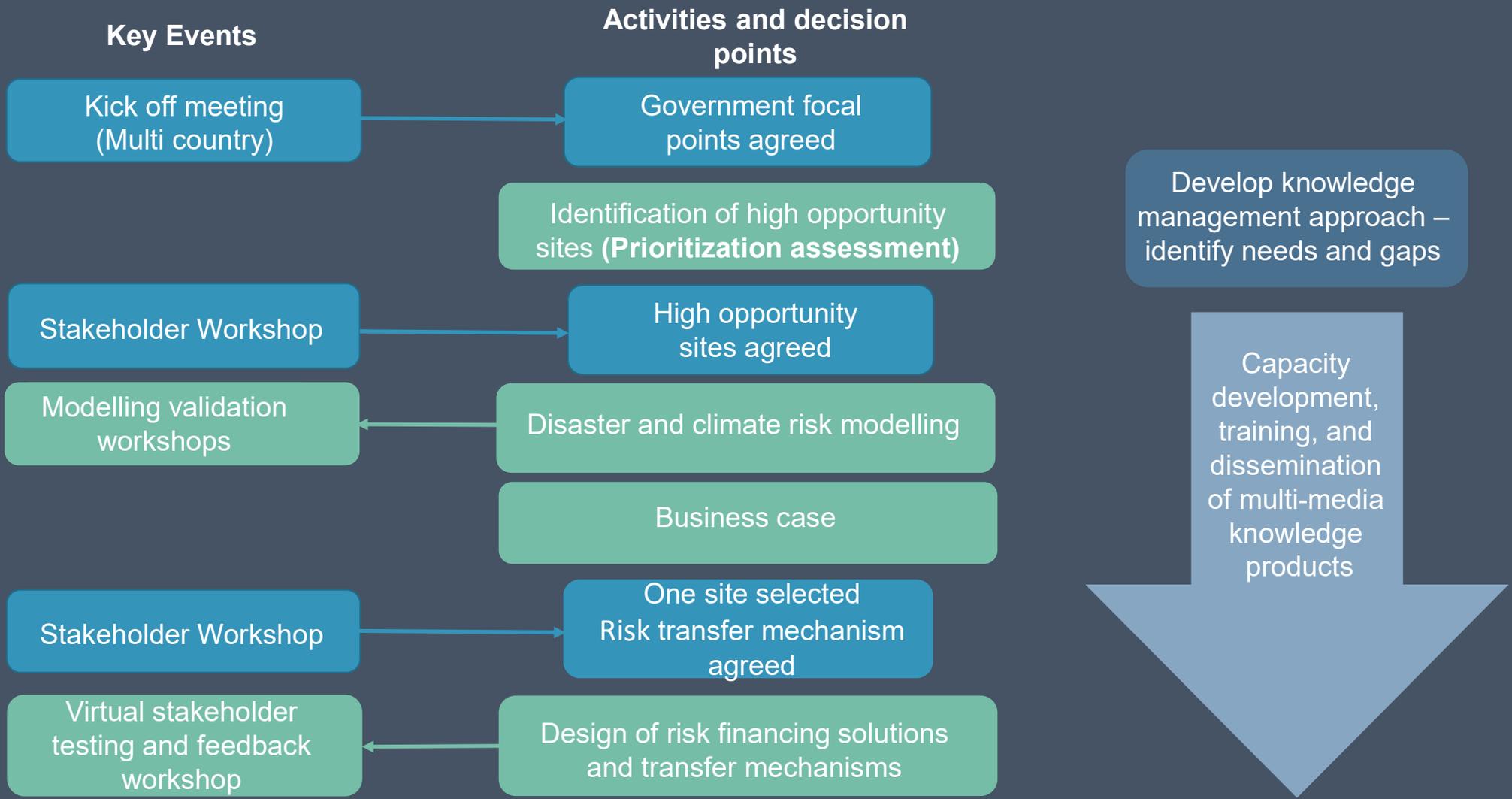
Identify and make recommendations for the applicability of sustainable financing and risk management models and approaches for coral reef ecosystems in targeted, high-opportunity sites in four countries, namely Fiji, Indonesia, the Philippines and Solomon Islands, towards increasing the climate resilience of coastal businesses, communities and their livelihoods.



## Project objectives

- **Building the case for effective coral reef protection, restoration and sustainable management** by defining the range of goods and services they provide and quantifying the environmental, social and economic risks associated with their damage;
- **Implementing strong policies and governance approaches** to underpin their protection, restoration and sustainable management; and
- **Assessing viable options for sustainable financing and risk management models and approaches**, to optimize and complement the limited public funds allocated for coral reef protection and restoration.





## Next steps

- **In-country coordinators** to reach out to representatives from Government Ministries/Agencies
  - Fiji: Francis Areki
  - Indonesia: Ahmad Baihaki
  - Philippines: Diane Figueroa
  - Solomon Islands: Steve Mosese
- Establish a **Project Advisory Committee** and regional coral reef finance and insurance advisory group.
- Determine approach for Solomon Islands' finalisation of prioritization assessment to **identify high opportunity sites** in Fiji and Indonesia; and confirmation of site/s for Philippines.



1. Climate Risk Score methodology
2. Initial prioritisation overview
3. Role of insurance and risk management



# Swiss Re's Climate Risk Score can help to quantify the change in climate patterns and the potential impacts on coral reefs

## Introduction

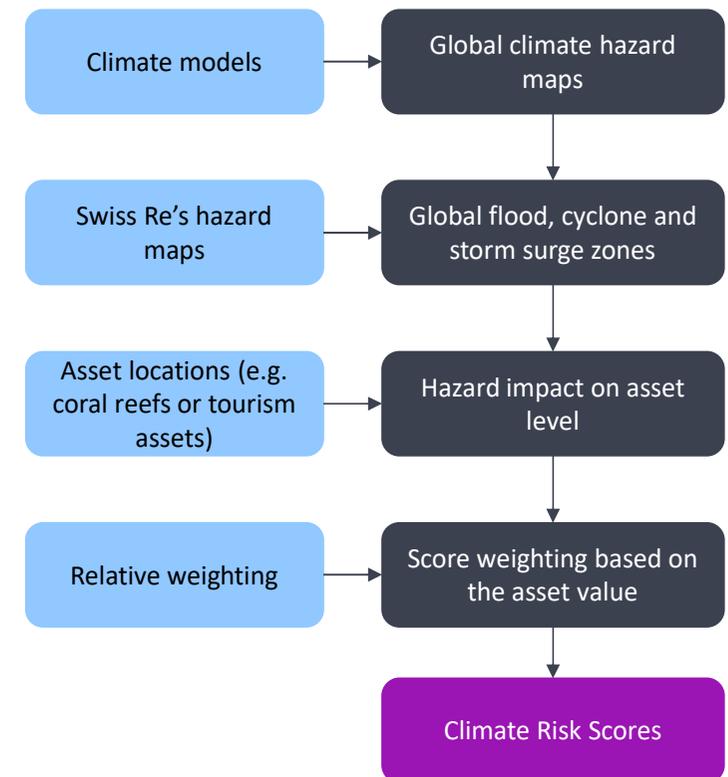
Swiss Re Climate Risk Scores (CRS) help quantify the changes in **climate patterns** such as **precipitation amounts** or **temperature norms**. The Scores can support stakeholders understand the most pressing climate risks and **develop risk mitigation plans** to increase resilience against these climate risks.

The Climate Risk Scores combine (i) robust science based on data used for the Intergovernmental Panel on Climate Change last Assessment Report (**IPCC AR6**) with (ii) risk layers (e.g. Flood zones) from Swiss Re's proprietary natural catastrophe framework

By using the scores, it should be possible to answer questions such as:

- How does climate change impact the **frequency** and **severity** of **weather-related hazards** at an asset location level or a global/regional portfolio?
- Which **peril** has the most significant **increase**?
- Which assets/regions are of high risk and where should **adaptation** be of high priority?

## Process



# Climate Risk Scores and scenario analysis will provide written reports on the climate exposures for each country / nominated site

## Future Climate Risks for coral reefs



Extreme precipitation



Heat wave



Climate seasonal wetting



Severe wind



Flood



Sea level rise

## Scenarios

- Three scenarios regarding climate change based on **CO<sub>2</sub> concentration** Shared Socioeconomic Pathways (SSP)
- **SSP5-8.5:** Plausible and accurate representation of the concentrations of CO<sub>2</sub> that would be reached on the business-as-usual path.
- **SSP2-4.5:** Intermediate pathway though the stabilization of CO<sub>2</sub> emissions (650 ppm CO<sub>2</sub>) by 2100
- **SSP1-2.6:** Optimistic pathway due to strict policies leading to carbon dioxide (CO<sub>2</sub>) emissions decline to zero by 2100 and a below-2°C warming
- **Score runs from 0 to 10 with 10** meaning the most extreme increase in risk between 1995 and 2085 on a global scale (0-3 low to relatively important, 3-6 relatively important to major, 6-10 major to critical)

## Deliverables

### Climate Risk Modelling Services

Analysis will focus on the scores that will have the most significant impact on areas surrounding coral reefs, namely:

- Heat wave
- Severe wind (Cyclone/Typhoon and storm surge)
- Sea level rise
- Extreme precipitation
- Flood

### Outputs – A report for each country in scope, detailing:

- Exposure to increased risk of each natural peril
- Estimation of potential damage and economic risk
- Prioritisation of countries
- Variables for agreed range of scenarios

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## Prioritisation exercise - Indonesia example of available climate risk data analysis

### Current Hazards

For **current hazards**, we considered the following:

- Fluvial (river) flood
- Pluvial (rainfall) flood
- Storm surge
- Windstorm

(Note - Wind/storm was not considered as Indonesia is not highly exposed to cyclone activity)

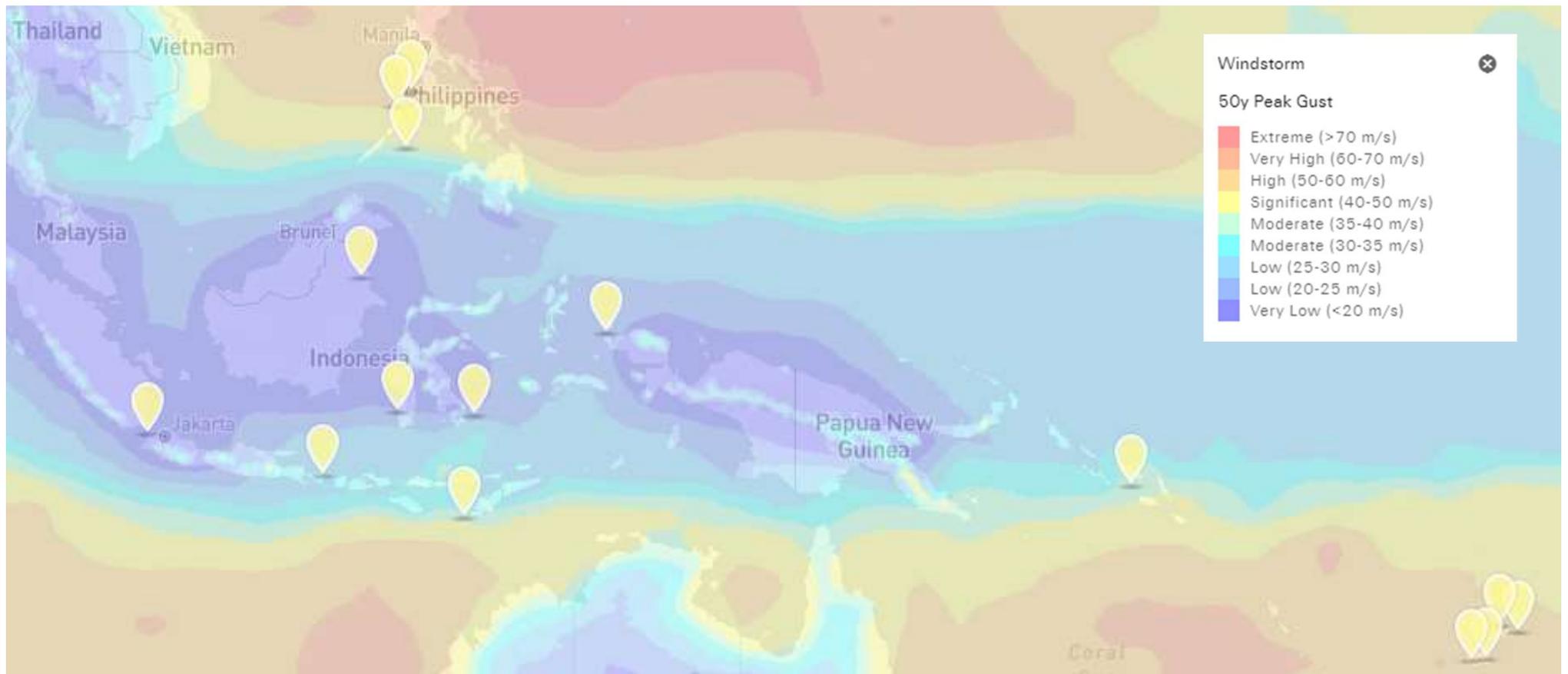
### Future hazards

For **future hazards**, we considered the hazards below, resulting in the anticipated changes:

Projections were made to the year **2040**, under the **RCP8.5 scenario**. These Scenario parameters can be adjusted if needed.

Category	Climate Risk Score	Description of anticipated change
<b>Temperature</b>	Heat wave	Change in heat wave duration and frequency
<b>Flood</b>	Fluvial Flood	Change in extreme river flooding
	Pluvial Flood	Change in extreme flash flooding
<b>Sea Level Rise</b>	Sea Level Rise	Median change in sea level height
<b>Wet</b>	Extreme change in Wet	Change in extreme 90th percentile of precipitation
	Wet	Absolute change in precipitation and change in extreme precipitation
<b>Typhoon/ Cyclone</b>		No material risk for Indonesia

CatNet<sup>®</sup> shows Indonesia is not exposed to cyclone activity, unlike the Philippines



## Example of preliminary results

### Current and future hazard score rankings – storm surge and flooding

Preliminary observations from desktop analysis (examples):

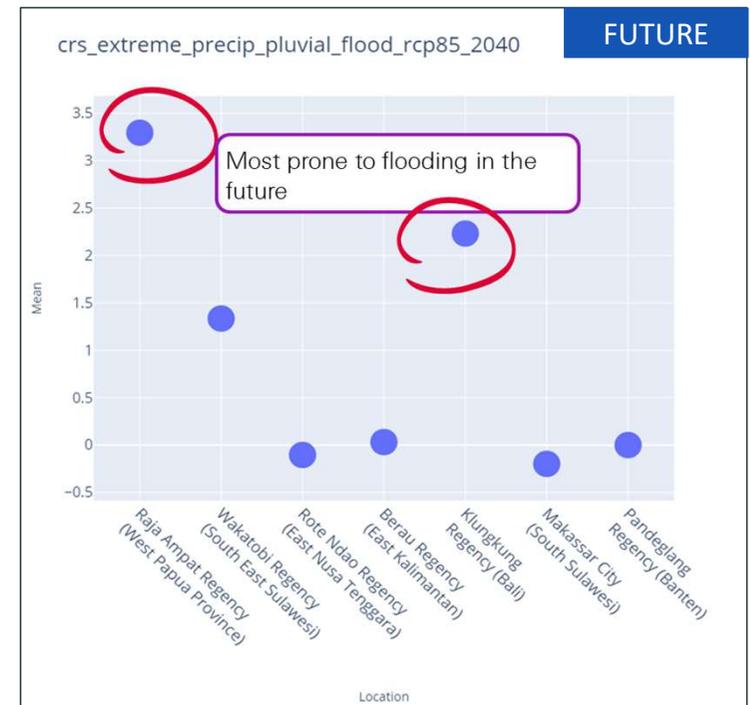
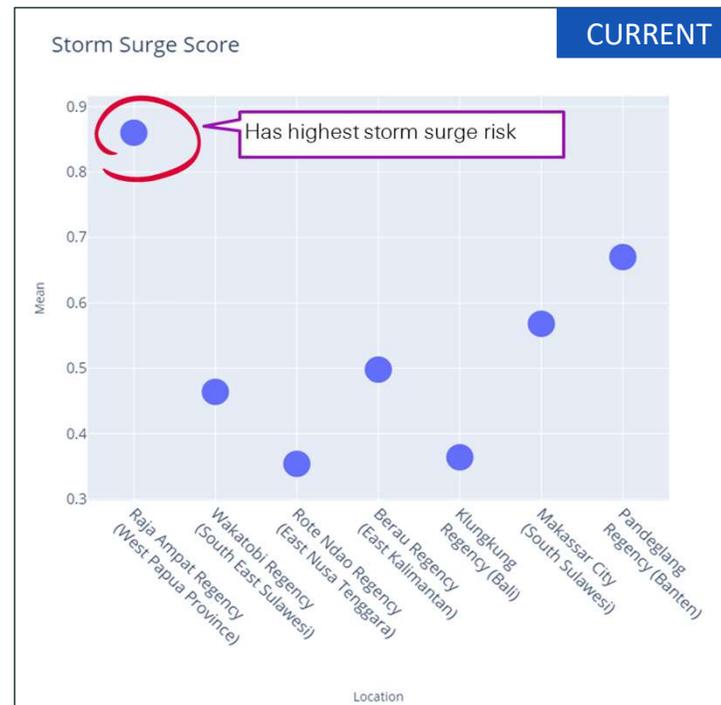
- Raja Ampat Regency currently has the highest storm surge risk and is most exposed to future flooding
- Klungkung Regency has little currently exposure to storm surge, but high risk of future flooding
- Pandeglang Regency currently has high exposure to storm surge, but future flood exposure is less compared to other sites

Notes:

- The *mean* values for current state represent a measure of intensity for the relevant hazard.
- The *mean* values for future state represent a measure of change in hazard in 2040 compared to 2020. The scores range from -10 to +10.

They can be used to gauge the “riskiness” of each area, so ranking of the reef sites could be used as a way to differentiate the reefs.

- The hazard scores are representative of the risk across the entire 50km zone around the reef site. In lieu of exact site dimensions, they provide an approximate representation of the risk.
- For future projections, the impact on pluvial and fluvial flood is projected to be the same



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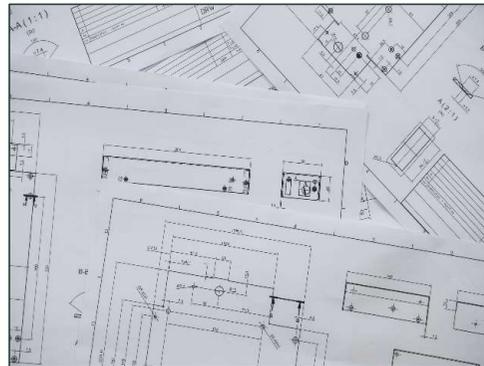
# The different roles of insurance and risk transfer

## Insights



**Understand climate and physical risks** and potential impacts to locations, assets and value chain

## Enablement



**De-risk and enable investment** by including insurance at planning stage to assure project delivery and returns

## Resilience Building



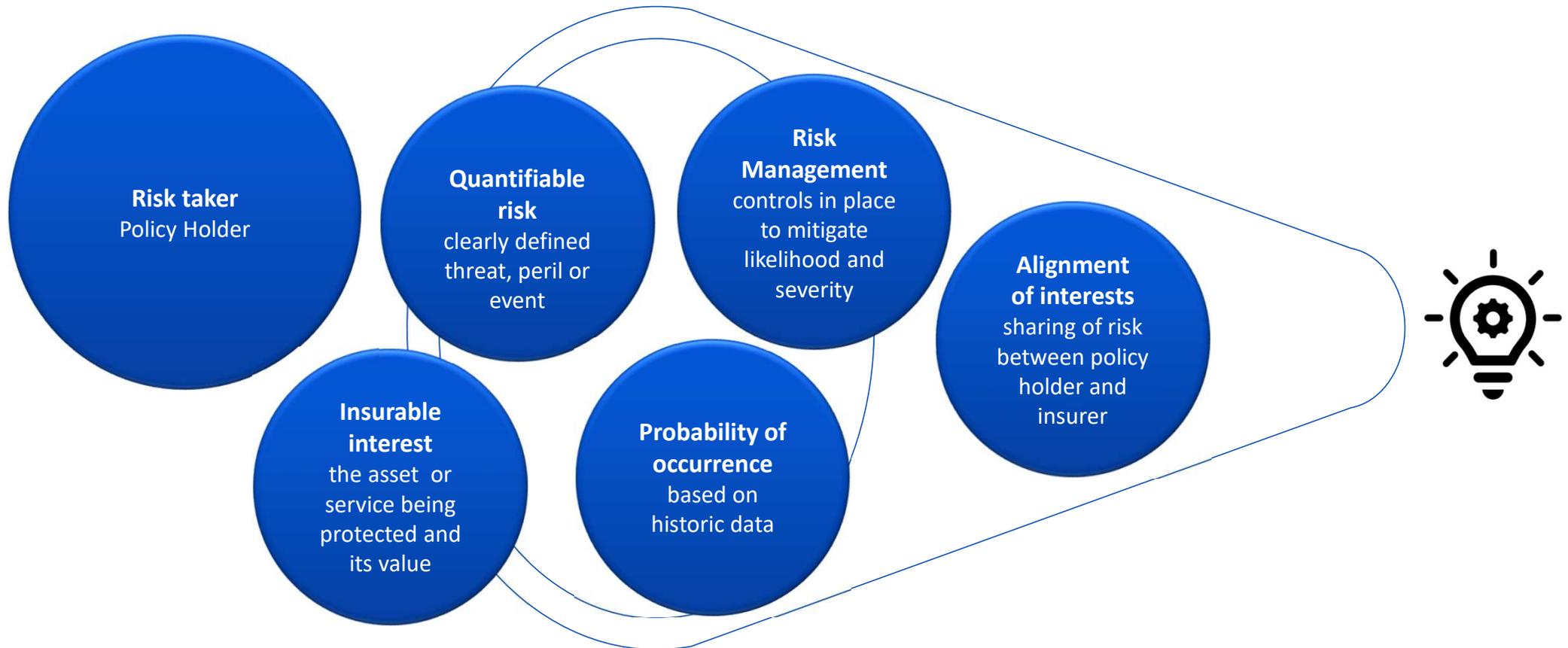
**Parametric insurance** index-based design, for early intervention, fast response post event, and recovery aid

## Compensation



**Traditional indemnity insurance** provides compensation for loss or damage post event

## Fundamental Requirements for an insurance product



# Potential Way Forward

## Risk Management Approaches for Natural Coastal Assets



<p><b>Asset</b> Coral reef, mangroves, seagrass</p>			
<p><b>Hazard</b> Natural or man-made, direct or secondary</p>			
<p><b>Risk Management Approach</b> Holistic risk management incorporates all three approaches</p>	<p><b>1. Avoid</b></p> <ul style="list-style-type: none"> <li>Hazards are moved or redirected away from the site</li> <li>Insights and systems to better understand and inform planning and early warning</li> </ul>	<p><b>2. Recover and Restore</b></p> <ul style="list-style-type: none"> <li>Funds from an insurance pay out, triggered by an agreed threshold or post event, can be used to repair and rehabilitate</li> <li>Cover business interruption and loss of earnings due to a disaster event</li> <li>Restoration financed by government and third parties</li> </ul>	<p><b>3. Adapt</b></p> <ul style="list-style-type: none"> <li>Funds from an insurance pay out, triggered by an agreed threshold, can be used for early intervention and 'build back better'</li> <li>Upfront investment in risk reduction measures reduce the impact of future hazards</li> </ul>

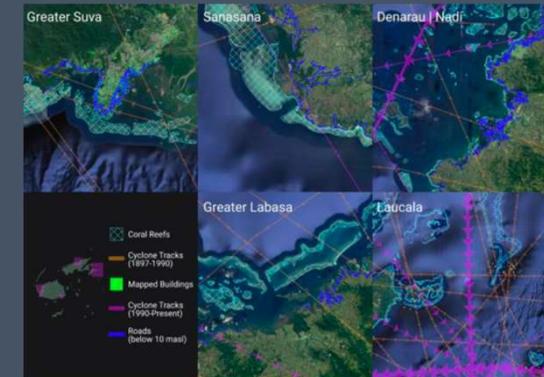
## Prioritization approach

### Objective:

- To develop a holistic, systematic, transparent and easy to apply approach to select 2 'high opportunity' sites from proposed 'candidate' sites in each country.
- Then conduct further analysis on the 2 sites
- Then agree on one site for each country for product development

### Candidate sites

- Indonesia = 7 sites
- Fiji = 5 sites
- Philippines = sites to be confirmed
- Solomon Islands = 1 site



### Prioritization Approach

- Identified 17 broad but mutually exclusive factors covering 4 themes
- Apply a scoring approach – out of 5 for each factor
- Draw upon: ADB Country Reports, Swiss Re models, marine databases/atlasses & national consultants
- High opportunity site selection based on the scores and a country workshop

Criteria	Risks				
	Storm Surge	Fluvial Flooding	Cyclones	Anthropogenic Disturbances	Natural Disturbances
<b>Description</b>	Current hazard score for storm surge	Current hazard score for river flooding (risk related to discharge of sedimented freshwater into coral reef area)	Risk of hazard from cyclones	Local threats to coral reefs from the following human activities: overfishing and destructive fishing, coastal development, watershed-based pollution, marine-based pollution and damages - Plus maritime traffic.	Temperature stress (bleaching) and ocean acidification.
<b>Data Sources</b>	Swiss Re CatNet data	Swiss Re CatNet data	Swiss Re CatNet data	ResourceWatch for anthropogenic disturbances plus Global Maritime Traffic data	NOAA Coral Reef Watch Thermal History Products & WRI ResourceWatch
<b>Who to do</b>	Swiss Re	Swiss Re	Swiss Re	Swiss Re (for shipping info) / Sustain Value to do overall assessment	Swiss Re bleaching / Sustain Value do acidification & aggregated
<b>Very Low = 1</b>	Zero or lowest hazard score – whichever is appropriate or where no cyclones occur			Low level of threat from anthropogenic disturbances	Low level of threat from natural disturbances
<b>Low = 2</b>					
<b>Medium = 3</b>	Moderate			Moderate	Moderate
<b>High = 4</b>					
<b>Very High = 5</b>	Highest hazard score (where cyclones are relevant)			High level of threat from anthropogenic disturbances	High level of threat from natural disturbances

Criteria	Corals		
	Extent of corals	Biodiversity value	Condition of coral
<b>Description</b>	Size of coral area	Quality of biodiversity in terms of diversity, abundance, iconic species & rarity	Extent to which corals are in good condition (based on live coral cover %)
<b>Data Sources</b>	Coral GIS maps (Allen Coral Atlas)	Literature + Local knowledge	Baseline report (have for indonesia + some for Fiji) + Literature + Local Knowledge
<b>Who to do</b>	Sustain Value to do	NCs to help find data	Sustain Value plus National Consultants to help find data
<b>Very Low = 1</b>	Smallest area (relative scoring: 0-first interval)	Low biodiversity	Poor condition based on % of live hard coral (fixed intervals: bottom quintile)
<b>Low = 2</b>			
<b>Medium = 3</b>	Moderate	Moderate	Moderate
<b>High = 4</b>			
<b>Very High = 5</b>	Largest area (relative scoring: 5th interval - Max score)	High biodiversity	Good condition based on % of live hard coral (fixed intervals: top quintile)

Criteria	Socio-economics				
	Coastal Protection Value	Local population in area	Tourism value	Diving/ snorkelling value	Fisheries value
<b>Description</b>	Relative value of shoreline protection provided by coral reefs	Number of people living in the area - both city populations and coastal communities	Extent of hotels & restaurants etc at the location - and overall value of tourism	Importance (extent) of diving and snorkelling in the vicinity to the local economy	Importance of commercial and subsistence fisheries in the vicinity
<b>Data Sources</b>	ResourceWatch Index of Coral Reef Protection	Baseline Report / WorldPop	ResourceWatch + Supplemented by local knowledge (national consultants)	Dive.site registered dive sites used as proxy.	ResourceWatch + Literature + National/Local Statistics (national consultant views)
<b>Who to do</b>	Sustain Value	Sustain Value	NCs provide info/insights + checked by Sustain Value (e.g. count hotels on GE & use ResourceWatch)	Sustain Value to review frequency of dive sites	Sustain Value on ResourceWatch NC to help with other data
<b>Very Low = 1</b>	Mainly low protection value	Smallest population (relative scoring: 0-first interval)	Minimal local coastal tourism	Minimal/few dive centres and diving/snorkelling	Minimal local fisheries
<b>Low = 2</b>					
<b>Medium = 3</b>	Moderate	Moderate	Moderate	Moderate	Moderate
<b>High = 4</b>					
<b>Very High = 5</b>	Mainly high protection value	Largest population (relative scoring: 0-first interval)	Considerable local coastal tourism	Many dive centres/divers and snorkellers using the site	Extensive local fisheries

Criteria	Governance			
	Similar insurance products being investigated	Stakeholder/Gov support for a scheme	Organisations set up to implement it	Protected area/coastal management status
<b>Description</b>	Similar insurance products being investigated in area	Degree of stakeholder & government support	Extent to which organisations at the site/ region interested/ able to implement it	Extent to which protected area or coastal zone management (CZM) system in place covering the site
<b>Data Sources</b>	National govt. / local contacts	National govt. / local contacts	National govt. / local contacts	Baseline report + PA database + local info on CZM status
<b>Who to do</b>	ADB/Swiss Re	ADB/ National Consultants	ADB/ National Consultants	Sustain Value do PAs National Consultants investigate effectiveness of MPAs and CZM status
<b>Very Low = 1</b>	Other schemes being investigated	Opposition from local stakeholders & government	No/very few organisations likely to be interested	No protection (including paper MPAs only) and no CZM
<b>Low = 2</b>				
<b>Medium = 3</b>		Moderate (neutral - no support)	Moderate	Moderate
<b>High = 4</b>				
<b>Very High = 5</b>	No other schemes known of	Full stakeholder & gov support	Many interested organisations	Enforced & comprehensive PA and/or effective CZM in place

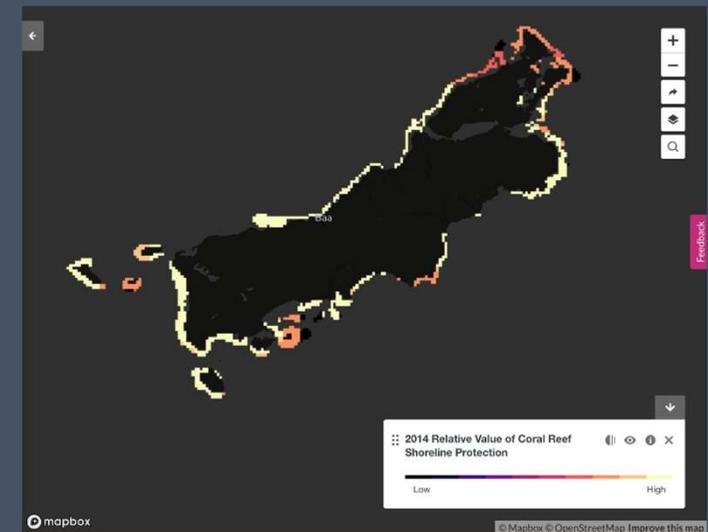
## Coast Protection Approach – Example

- **Description:** Applying an index of relative coast protection value provided by coral reefs through reduction of wave height and wave energy.
- **Layer:** Relative value of coral reef shoreline protection, from 'Resource Watch'
- **Source:** TNC, WRI, University of Cambridge, data from Spalding et al (2016).

- **Scoring Approach:**

- 1 = Mainly low
- 2 = Mainly low – medium
- 3 = Mainly medium
- 4 = Mainly medium
- 5 = Mainly high

Sites	Score
Raja Ampat	3
Wakatobi	4
Rote Ndao	5
Berau	3
<u>Klungkung</u>	4
Makassar	5
Pandeglang	4



## Status & Next Steps

1. Complete Fiji and Indonesia scoring
2. Waiting for final Philippine site options confirmation
3. Country prioritization workshops to be arranged
4. Select two 'High Opportunity' sites for Fiji and Indonesia during workshops  
(based on matrix scores and workshop discussion with stakeholders)
5. For High Opportunity sites:
  - a. Undertake coral reef valuation
  - b. Conduct restoration cost-benefit analysis
  - c. Swiss Re modelling
6. Select one final site in each country for design of risk financing solutions



## Approach to Coral Valuation & Cost Benefit Analysis

### Main coral values to determine:

1. Tourism & recreation: Direct and indirect values
2. Fisheries: Direct and indirect values
3. Coast protection?
4. Conservation/non-use value?
5. Cultural/traditional values – qualitative only?

### Cost benefit analysis:

- Costs of restoration /enhanced management – and to whom
- Benefits of restoration /enhancement management – and to whom
- Values estimated and compared over 30(?) years in ‘with’ and ‘without’ scenarios
- Factor in trends such as climate change, population growth and economic development

## Example Information Needed – relatively straight-forward

### Tourism

- Number of coral reef related activities per year – e.g. diving & snorkeling
- Average spend per reef activity
- Number of tourists to site per year
- Average tourist spend
- Dependence of activities and tourism on coral extent and condition
- Number of dive/tour operators, hotels, other businesses affected

### Fisheries

- Number of fishers using coral reef area – directly and indirectly
- Average fish catch (volume and value) per year
- Dependence of fish catch on coral reef extent and condition

## Example Information Needed – methodologies undecided

### Coast protection – approach yet to be determined

- Various options with differing data/resource requirements – budget constrained
- Areas flooded under different storm ‘return periods’ (e.g. 1 in 100 year event)
- Estimated value of flood damages caused per storm return period
- Degree of coast protection provided
- Possibly a detailed asset inventory - or average damages linked to land use?

### Conservation/non-use & cultural traditional values

- Total tourist and resident numbers
- Locals’ uses and opinions
- Tourist use and opinions
- ‘Willingness to pay’ per tourist/resident per year for the coral protection?



## National Consultant Input and Valuation Surveys

Requirements based on:

- Which sites selected
- Nature of the insurance products/sustainable financing mechanism
- Discussions with Swiss Re, Landell Mills, national consultants and ADB
- Budget & resources available

1. National consultants to collect readily available data for site prioritization
2. Questionnaire(s) developed for national consultants to administer & collect info

Potentially covering some of the following information:

- Tourism related user activities
- Fisheries activity
- Tourist & local resident opinions
- Willingness to pay
- Coastal assets at risk from flooding ?



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Thank you



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