Practical Physical Risk Assessment

GARP EasyXDI Training & Assessment Overview

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SCR | Sustainability and Climate Risk

Project Overview

- Exclusively for the 2021 class of Sustainability and Climate Risk (SCR™) certificate holders
- Provides practical experience in assessing the physical risks that will arise from climate change
- A chance to connect with your peers
- Offered in partnership with XDI, the Cross Dependency Initiative.
- Taking place from February-March 2022
- 6 CPD credits for completing the project

XDI CROSS DEPENDENCY INITIATIVE

Introducing Rohan Hamden

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- CEO of XDI: The Cross Dependency Initiative
- Began his career as a fire fighter
- Multiple other roles in government; after nearly 15 years, his last role was as the Director of the Climate Adaptation Program for South Australia
- Designed and led the implementation of the States multi-award-winning climate change adaptation program on how communities and industries can work together to adapt to climate change
- Advisor to various state and national governments on their climate adaptation programs in Australia, Canada, USA and the UK

Today's Agenda

- EasyXDI - System Features, Methodology and Key Definitions
- How EasyXDI is used to assess asset risk
- Run through worked examples

Questions can be asked throughout via the Zoom Chat

Physical Risk

- Risks related to the physical impacts of climate change
- Property damage
- Increased insurance premiums
- Decrease in collateral value
- Business interruption for your firm and your counterparties/customers

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Climate Events

- What do we expect to happen?
- An understanding of the potential climate impacts to an asset
- Increased asset risk exposure to climate hazards over time
- Probability distribution of hazards

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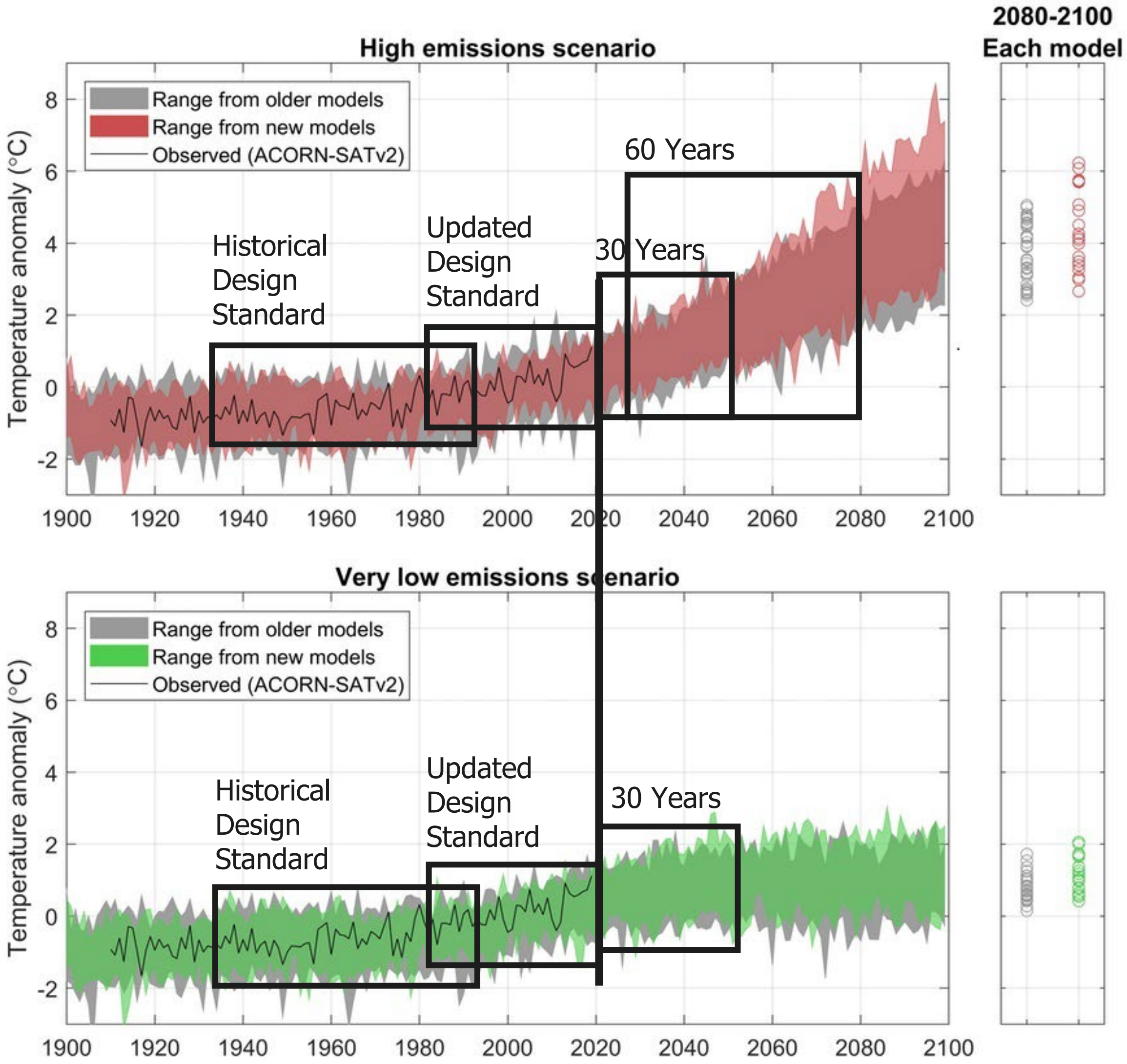
Design Standards Need to Keep Pace With the Changing Climate



Climate models ‘Coupled Model Intercomparison Projects (CMIP6)’

- We use CMIP6 models to most accurately estimate climate impacts such as coastal inundation and extreme wind
- CMIP6 includes 100 distinct climate models being produced across 49 different modelling groups
- We use these models understand how the climate has changed in the past and may change in the future

What are XDI Asset Risk Ratings?

- FEMA* standards, which are used for pricing a large number of insurance premiums in the USA, are used for designating risk levels
- These provide a shorthand method to classify risk levels to A, B and C rankings
- Low (A) – Technically Insurable – less than 1:500 total risk
- Moderate (B) – Becoming uninsurable – between 1:500 and 1:100
- High (C) – Technically Uninsurable – Above 1:100

*FEMA – US Federal Emergency Management Agency

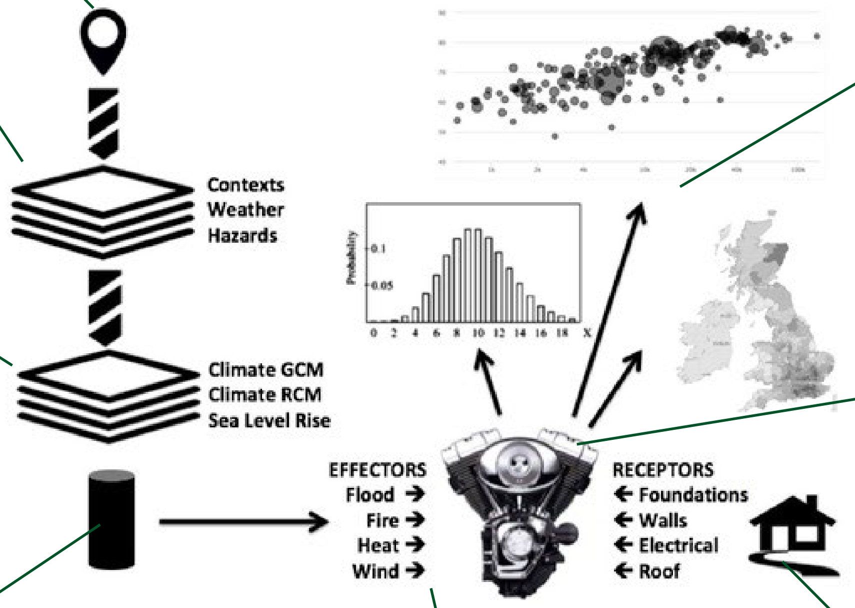
XDI Modelling Approach

1. Location for each asset defined.

2. Baseline extreme event frequency calculated from historical weather information.

3. Extreme event frequency recalculated under climate change scenarios.

4. Hazard data for each location parsed to climate risk engines.



5. Extreme events matched with relevant contextual information (flood maps, vegetation maps, wind zones, planning boundaries etc.)

6. Each asset's construction types, elements and materials defined.

7. Risk engines calculate failure probability and cost for each element and material for each hazard every year until 2100 using Monte Carlo statistical analysis.

8. Outputs available in a variety of formats to support decision making.

Hazard Definitions

Extreme Heat

- Extreme heat and hotter ambient temperatures can affect the operation of infrastructure assets through overheating failures

Coastal Inundation

- Sea water flooding due to high tides, wind and waves that can damage land and property
- Increased due to higher sea levels and wind events

Soil Movement

- Buildings cracking due to shifting foundations in contracting clay soils
- Changes in rainfall patterns and drought may increase the risk to some properties

Riverine Flooding

- Riverine or other inland fresh water flooding can damage infrastructure
- Increased frequency of extreme rainfall may increase frequency of floods

Extreme Wind

- Extreme windstorms can damage buildings and facilitate water damage
- Altered due to changes in wind regimes and wind speeds

Forest fire

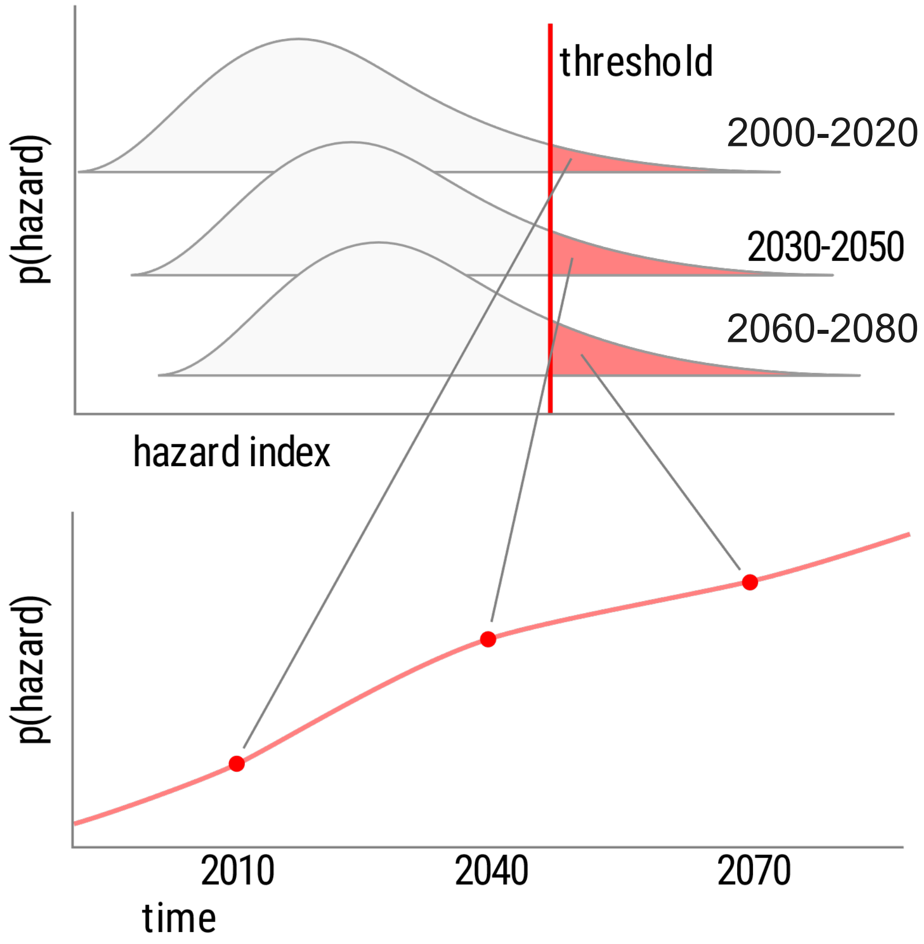
- Burning vegetation can damage or destroy buildings through direct flame or intense heat
- Increased due to increased temperatures, dryness and wind

Freeze thaw

- Frequent freezing and thawing of the ground causes ice crystals to form in foundations and external cladding leading to spalling and cracking
- Changes due to warming winter temperatures

How do we use climate projections to create forward looking weather event probability metrics?

- Calculate annual indices, e.g.
  - Rainfall: max 24-hour precipitation
  - Temperatures: # days over Hot Dry Windy threshold
- Estimate distributions of indices over 20 year periods (legacy)
- Bias correct distributions with historical weather observations
- Calculate annual probability of weather events exceeding damaging thresholds
- Calculate trends in those probabilities



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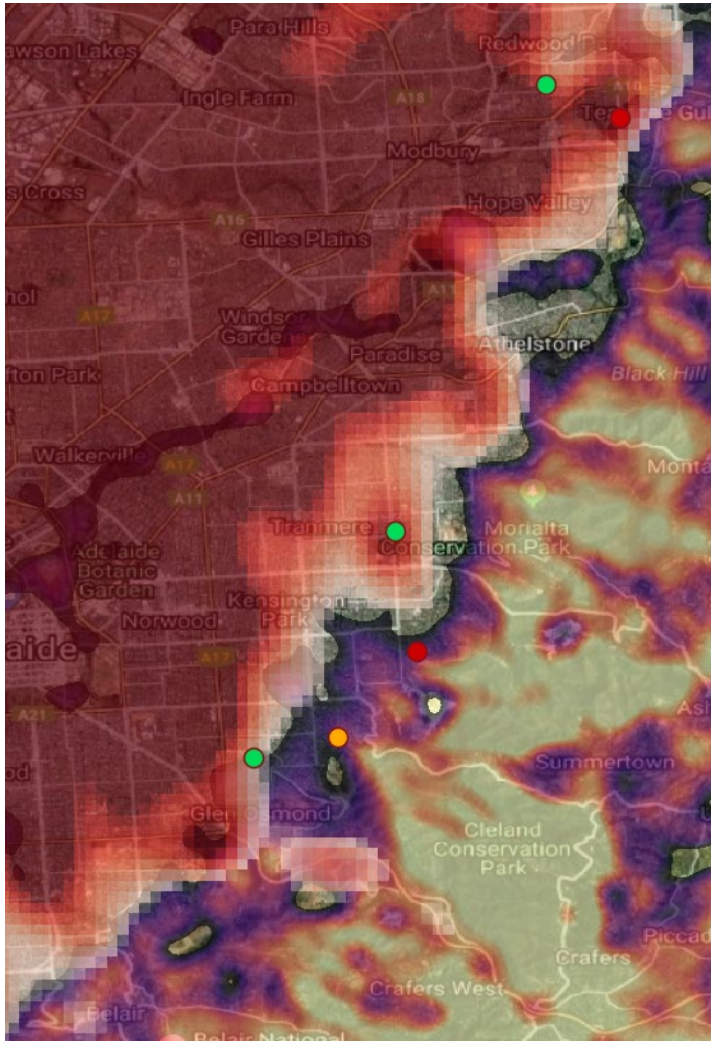
Contextual data to understand hazards



- High-resolution spatial data that provides information about the asset-level local context
- Each hazard can use any number of context layers
  - Flood: fluvial flood maps with severity and return frequency
  - Coastal inundation: digital elevation model, astronomic tides model, recorded tide gauge data, tectonic land movement data, storm surge and wave setup model
  - Forest fire: forest cover maps, urban density maps (exclusion) – see figure
  - Soil movement: soil composition maps
  - Heat, Freeze-Thaw, Wind: no context layers

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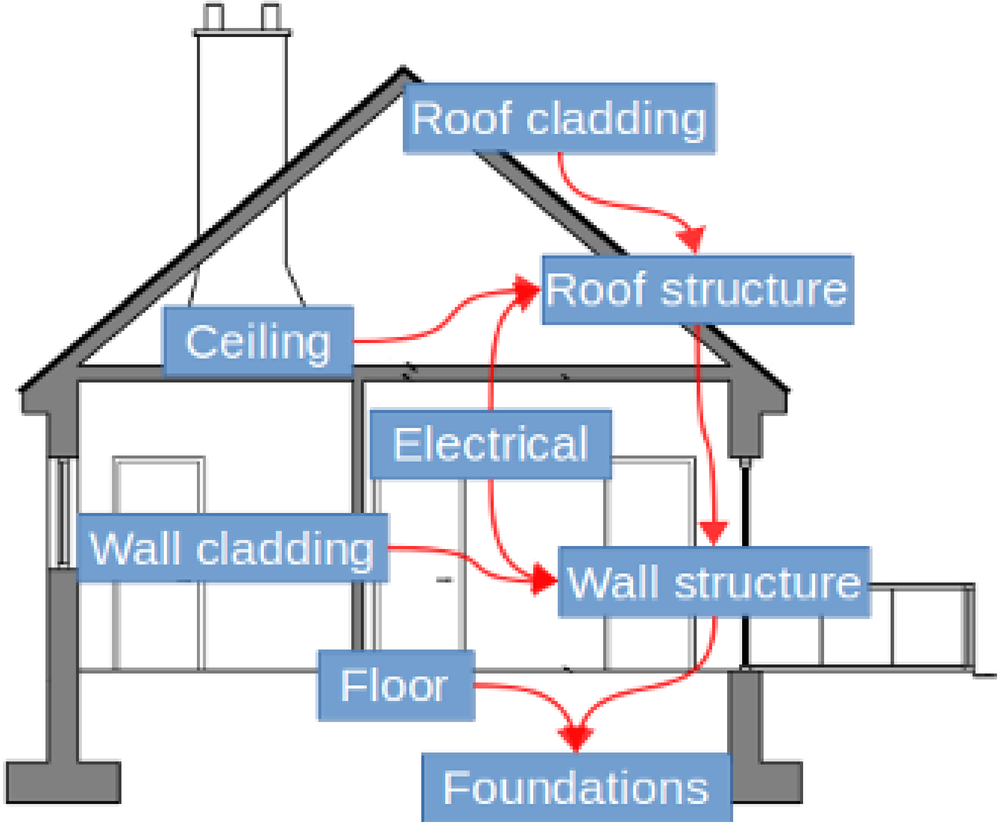
Receptors: Archetypes and Asset data



The elements a simple house archetype may contain, and the dependencies between them

- A schematic model of a standard representative asset is defined using archetypes
- Includes building elements (e.g. roof, walls, foundations, electricals), and the materials they're made of (e.g. brick, timber, steel, plastic)
- Each element/material has different exposures and vulnerabilities
- These are defined from engineering standards and material failure probabilities
- Elements are inter-dependent; failure and damage cascade up chain of dependencies

How Risk Cost is Calculated

1	Material or Asset Sensitivity (Vulnerability)	x	Probability of exceeding failure point	=	Failure Probability (stops working)		
2					Damage Probability	x	Proportion of value assigned to that material asset proportion = Value at Risk (Risk Fraction)
3							Value at Risk (Risk Fraction) x Full replacement cost = Technical Insurance Premium (TIP) ($)

An example

An ambulance station's full replacement cost is a total $1,000,000.

The roof represents 30% of that overall cost and is vulnerable to wind damage, and the walls represent 20% of the value and are prone to flood damage.

If, in a given year, there is a 0.5% chance of a damaging wind event, and there is a 1% chance of a flood, then the TIP equation for that year will be as follows:

$$TIP = \$1{,}000{,}000 \times (0.3 \times 0.005 + 0.2 \times 0.01) = \$3{,}500$$

Elements of a risk assessment

Identify Problem	▸ Scale of risk by hazard ▸ Impacts on service delivery ▸ Timing ▸ Risk tolerance ▸ Supply chain cross dependency
Discuss Options	▸ Develop adaptation pathways ▸ Change materials and engineering thresholds ▸ Develop cost benefit analysis
Recommend a solution	▸ Demonstrate optimal risk reduction ▸ Demonstrate optimal cost benefit

Examples

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Examples

4449 N Bay Rd, Miami Beach

- Archetype: Freestanding House
- Adaptation: Adjust Floor height above ground to 1.0 m (0.5 m default)

27 Vantage Way, Crafers

- Archetype: Freestanding House
- Adaptation: Forest Fire Protection – Heat/Ember Attack (none / normal default)

Benefits of Multiple Asset Analysis

Large Site Analysis – Used for assessing physical impacts to large estates such as airports, commercial estates, factories, etc.

Cross Dependency Analysis – Physical risk assessment of power, water, comms and transport supply chain infrastructure

Single Company Climate Physical Risk Reports – Analysis of 100's to 10,000's of assets for listed equities

Multi-Company Portfolio Climate Physical Risk Reports – Portfolio level information incorporating analysis across 1000's of companies and millions of assets

Land Use Planning Assessment – Set planning policy for large regions

Residential Mortgage Analysis – Physical risk assessment of mortgage portfolios across 100,000's of sites

Project Details

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Timeline

8th February
Virtual Kickoff Meeting

→

9th – 28th February
Hands-on Self-assessment

→

1st March
Virtual Assessment Workshop

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Next steps

- Begin using the EasyXDI platform to get familiar with it
  - You'll receive a link in the follow up email
  - You'll need to create an account the first time you sign in
- Complete your assignment by 28th February
  - You'll be able to access all relevant information via the project webpage: https://climate.garp.org/xdi/
- Join us for the Virtual Assessment Workshop on 1st March
- Log your Continuing Professional Development points
- Celebrate with the SCR community!

Questions?

Project details webpage: https://climate.garp.org/xdi/

Contact XDIproject@garp.com

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Any questions?

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GARP | Global Association of Risk Professionals

ABOUT GARP | The Global Association of Risk Professionals is a non-partisan, not-for-profit membership organization focused on elevating the practice of risk management. GARP offers the leading global certification for risk managers in the Financial Risk Manager (FRM®), as well as the Sustainability and Climate Risk (SCR®) Certificate and on-going educational opportunities through Continuing Professional Development. Through the GARP Benchmarking Initiative and GARP Risk Institute, GARP sponsors research in risk management and promotes collaboration among practitioners, academics, and regulators.

Founded in 1996, governed by a Board of Trustees, GARP is headquartered in Jersey City, N.J., with offices in London, Beijing, and Hong Kong. Find more information on garp.org or follow GARP on LinkedIn, Facebook, and Twitter.

For more information on GARP's work on sustainability and climate risk, please see climate.garp.org

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