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Climate & Environmental Risks Physical Risk Quantification Framework

How Grant Thornton's approach can identify and measure Physical Risk and how such methodology can be utilized by institutions.

Introduction

Grant Thornton's Physical Risk Quantification Framework

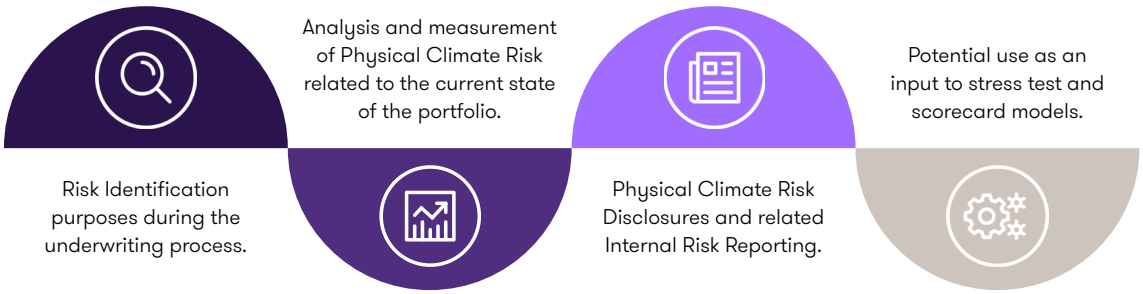
Grant Thornton (GT) has constructed a **Physical Risk Quantification Framework** in its effort to support financial institutions in identifying and measuring their Climate & Environmental (C&E) Risks.

In this publication, we present our methodology, implementation, and key benefits of the framework. We describe how the GT solution can support institutions, in better **understanding their Acute Physical C&E risk profile**, addressing key challenges, and **meeting regulatory expectations**.

Following our previous publications (e.g., the NGFS Series1[1]), and our extensive research, we have applied those principles in an attempt to capture **physical risks based on geolocation**, under different **climate scenarios**. According to TCFD2[2], scenario analysis is an important and useful tool for understanding the strategic implications of Climate-related risks. This is since the most significant effects of climate change are likely to emerge over the medium to long term and hence timing and severity are uncertain. Consequently, **scenario analysis** constitutes an important part of our framework, enabling **identification of potential shifts in risk profiles**, adoption of **strategic responses** and **informed decision-making**, which are vital for the management body of every institution.

For the purposes of this publication, we present the framework under the case of **Wildfires**, however Grant Thornton's approach is built on **a generic framework** which can be **applied to any physical risk** that an institution considers material (e.g., Floods, Droughts, etc.).

Methodology Use Cases



1 NGFS series: Climate scenarios – A range of plausible outcomes
2 The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities

Wildfires Risk Tool

An Overview – The case of Cyprus

Wildfires Risk Tool is a rating methodology whereby assets are ranked in terms of Physical Climate risk associated to wildfires in Cyprus.

This methodology makes use of **historical data** from a publicly available government source. As part of the preliminary analysis, the tool splits the map into more than 300 sub-areas to ensure **sufficient granularity**.

Each asset (e.g., real-estate collaterals) is assessed in terms of **frequency** and **severity** of historical wildfires, based on its geolocation. Currently, this rating methodology is built on regions of Republic of Cyprus (non-occupied area). The trained models are then **extrapolated** to the rest of the island of Cyprus, assuming representativeness of the remaining land.

Input Data Requirements

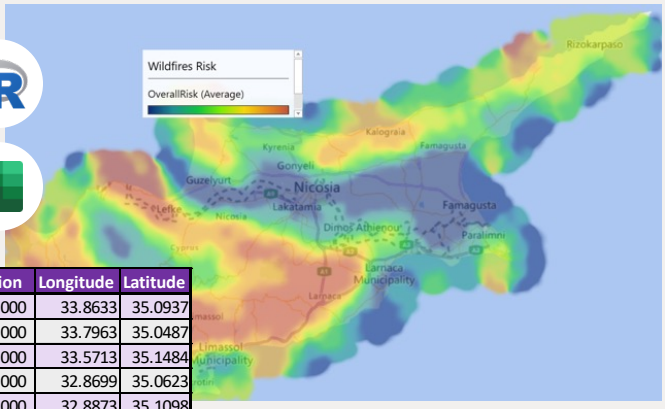
The tool only requires the location of the relevant assets. The location of the asset is identified based on geographical coordinates (longitude/latitude) provided by the user.

Our team can also support with the identification of geographical coordinates in cases where these are not available, e.g. based on property address, registration identifiers.

Other optional information can also be provided by the user (e.g., asset identifier, loan identifier, loan balances and asset valuations) for further analysis.

Flexible Implementation

GT has built the models in R and implemented an API-style framework which can be called by any other tool (e.g., Excel) acting as interface, taking input and presenting the output as well. As a proof-of-concept, GT has built an Excel Tool which can be replaced by any platform, if requested.



Asset ID	Loan ID	Label	Loan Balance	Asset Valuation	Longitude	Latitude
463	463	ACHERITOU	100,000	150,000	33.8633	35.0937
487	487	ACHNA	100,000	150,000	33.7963	35.0487
464	464	AGANTEIA	100,000	150,000	33.5713	35.1484
165	165	AG. EPIFANIOS SOLEAS	100,000	150,000	32.8699	35.0623
267	267	AG. GEORGIOS SOLEAS	100,000	150,000	32.8873	35.1098
266	266	AG. NIKOLAOS SOLEAS	100,000	150,000	32.8729	35.1010
158	158	AG. THEODOROS SOLEAS	100,000	150,000	32.9328	35.0312
276	276	AGIA	100,000	150,000	33.5595	35.1133

Indicative Input & Heat Map

Wildfires Risk Tool Facts

Tailored Rating Approach

The tool assigns Frequency and Severity Ratings (A-F) on an asset-level granularity.

Explainable Results

Risk Metrics are assigned to each asset based on a distance-weighted approach taking into consideration the centres of adjacent sub-areas.

Single Metric Risk Differentiation

The Overall Risk is a function of Frequency and Severity risk measures.

Easy Extrapolation

Assets across the island (occupied and non-occupied areas) can be ranked based on the proposed methodology.

Model Outputs

After specifying the inputs and running the calculation, the user will receive the granular results alongside summary tables, enabling easy transfer to reporting templates as well as any other uses that the institution might require. Examples of summary aggregations are, the number of assets in the pool, number of loans, total loan balance, total asset valuation, etc. The tool can also capture errors which are reported to the user to take the necessary actions.

Our solution returns the frequency, severity and **overall risk** associated with each asset. Overall risk is a function of both the severity and frequency aiming at measuring the **expected coverage of area to be burnt around the geolocation specified**. The higher the frequency and severity, the higher the overall risk will be.

The tool classifies the assets in an "A-F" ("A" referring to low wildfire risk while "F" to high wildfire risk) **rating system** that is **fully customizable** to suit the client needs.

Customizable Summary Statistics

Summary

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Indicative Customizable Summary Tables

# of assets	492
# of Loans	492
Total Loan Balance	46,600,000
Total Asset Valuation	69,900,000
# of Errors	-

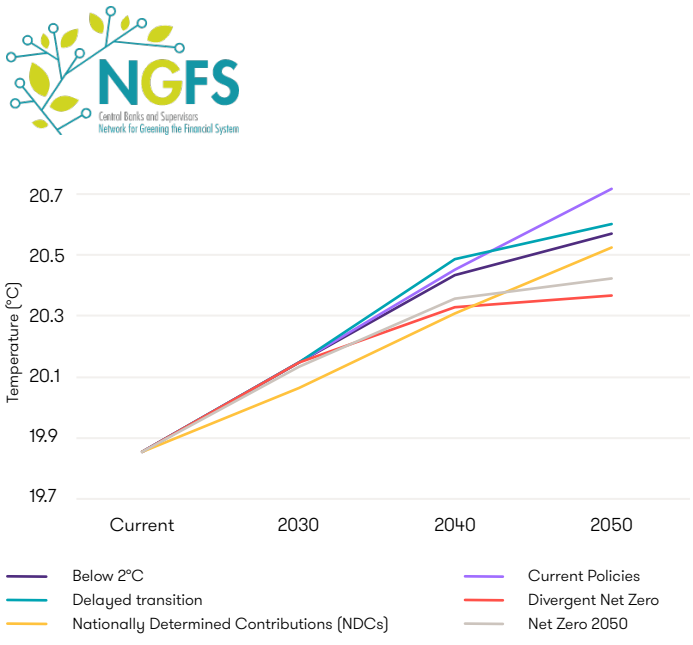
	Base Case	
Overall Risk	# of Assets	Asset Valuation
A	288	39,450,000
B	117	17,550,000
C	36	5,400,000
D	33	4,800,000
E	12	1,800,000
F	6	900,000

Measure of both Severity and Frequency of a wildfire around a geolocation.

Indicative Asset-level Output

Input

							Base Case			Below 2°C		
Asset ID	Loan ID	Label	Loan Balance	Asset Valuation	Longitude	Latitude	FrequencyRisk	SeverityRisk	OverallRisk	Below 2°C_2030	Below 2°C_2040	Below 2°C_2050
463	463	ACHERITOU	100,000	150,000	33.8633	35.0937	1	1	1	1	1	1
487	487	AGIA	100,000	150,000	33.7963	35.0487	1	1	1	1	1	1
464	464	AFANTEIA	100,000	150,000	33.5713	35.1484	1	1	1	1	1	1
165	165	AG. EPIFANIOS SOLEAS	100,000	150,000	32.8699	35.0623	3	3	2	3	4	6
267	267	AG. GEORGIOS SOLEAS	100,000	150,000	32.8873	35.1098	2	2	1	1	2	3
266	266	AG. NIKOLAOS SOLEAS	100,000	150,000	32.8729	35.1010	3	3	2	2	4	5
158	158	AG. THEODOROS SOLEAS	100,000	150,000	32.9328	35.0312	3	3	1	2	4	5



Climate Scenarios

In our previous publication (NGFS Series: Climate Scenarios – A range of plausible outcomes), we highlighted the importance of the work performed by NGFS in partnership with an expert group of climate scientists and economists to design a set of plausible scenarios (NGFS Phase Climate Scenarios) reflecting a variation of climate futures. Scenarios intend to show the way climate changes under varying policies and technological trends, throughout the years.

NGFS Climate Scenarios aim to support central banks, supervisors and banks in investigating any economic and financial system effects.

The figure on the left presents the six developed scenarios for the Predicted Temperature in Cyprus. As a result, the projections provided by NGFS can form the basis of Scenario Analysis. In the following slides, we present the functionality implemented in our Wildfires Risk Tool to account for the possible futures.

Scenario Analysis – NGFS Scenarios

According to TCFD, Scenario analysis is an important and useful tool for understanding the strategic implications of climate-related risks.

The most significant effects of climate change are likely to emerge over the medium to long term and hence timing and severity are uncertain. Consequently, understanding the importance of scenario analysis in the case of C&E risks, we have incorporated such functionality to our Wildfires Risk Tool, enabling identification of potential shifts in risk profiles.

Overall Risk	Base Case		Current Policies					
			2030		2040		2050	
	# of Assets	Asset Valuation	# of Assets	Asset Valuation	# of Assets	Asset Valuation	# of Assets	Asset Valuation
A	288	39,450,000	213	28,800,000	166	22,350,000	121	15,900,000
B	117	17,550,000	91	13,050,000	51	6,900,000	56	7,800,000
C	36	5,400,000	67	10,050,000	50	7,200,000	31	4,350,000
D	33	4,800,000	43	6,450,000	50	7,350,000	21	3,000,000
E	12	1,800,000	20	3,000,000	41	6,150,000	36	5,100,000
F	6	900,000	58	8,550,000	134	19,950,000	227	33,750,000

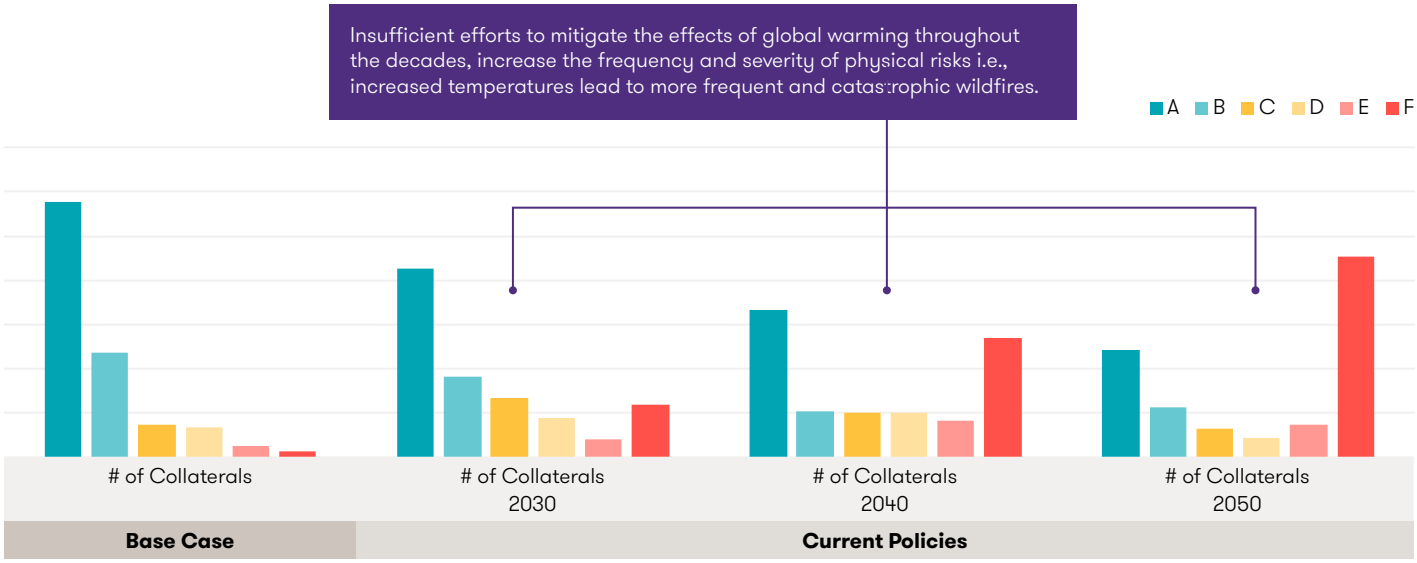
Indicative Risk Profile Shifts Base Vs "Current Policies" Scenario

The NGFS scenarios can be used to evaluate current exposure and assess the viability of existing business models, financial risks, and any other climate-sensitive operations of any institution. Consideration of such scenarios can be applied to either short- or long-term horizons.

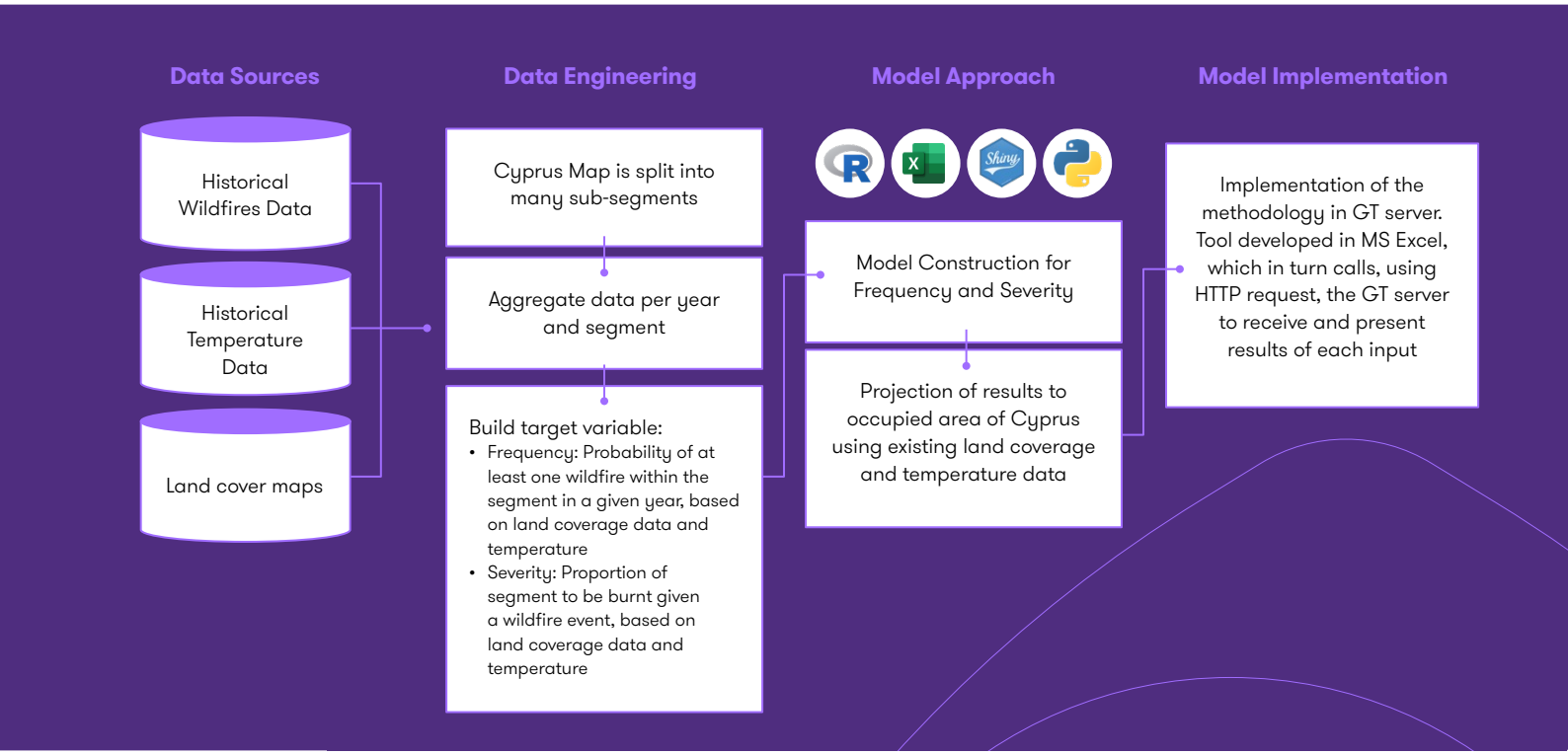
Our implementation of the Wildfires Risk Tool is able to utilize NGFS Scenarios, incorporating projections of temperature under each climate scenario. These are applied to the current levels of temperatures, which are then used to predict changes in the frequency and severity of wildfires associated to each asset in the input list.

Below, we present an indicative example of how the portfolio distribution across the wildfires risk ratings can shift to worse ratings after application of the current policies climate scenario. The impact in shorter and longer term are different. This can be particularly useful in understanding that despite the risk currently not being material, if strategy does not account for future changes, there is the possibility of experiencing unwanted events.

Wildfires Risk Rating Distribution – Base Vs Current Policies



Technical Aspects and Key Benefits



Note: The Tool is currently developed in MS Excel but due to its flexibility and the API-style implementation, it can be transferred to any platform.

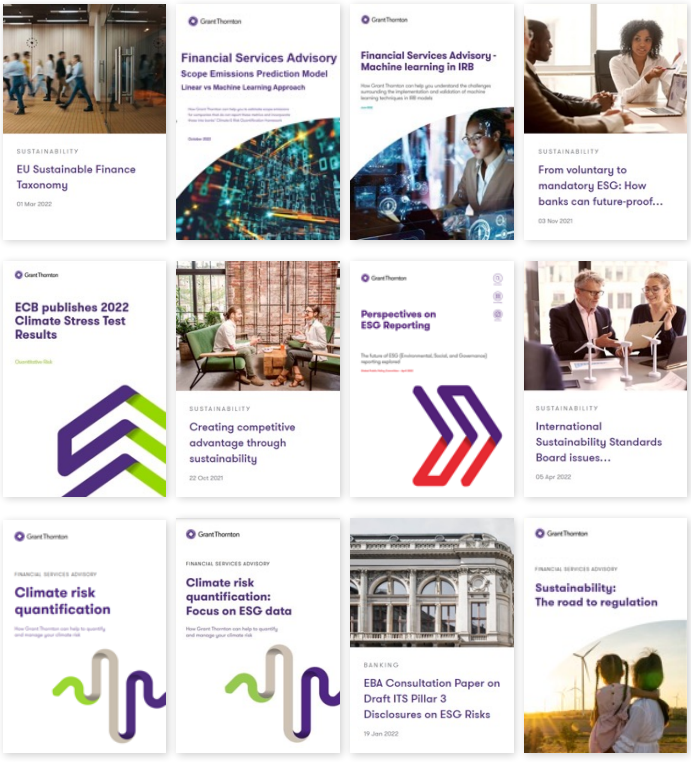
Key Benefits

The methodology utilizes geospatial information on different types of physical coverage of the Earth's surface. As a result, features characterizing each sub-area of Cyprus are constructed and predictive models are fitted. Climate conditions are further taken into account during the model development process.

This, enables:

i. estimation of Physical Risk in areas for which historical wildfires data are available, as well as, areas where historical files are not present, but their characteristics can be identified;
ii. easy replication of the framework/methodology to other regions;
iii. projection of Physical Risk under different Climate Scenarios on a long-term horizon;
iv. addressing regulatory expectations such as Risk Identification, Stress Testing and use of outputs for the purposes of Disclosures;
v. utilization of outputs for the purposes of strategy monitoring through KPIs/KRIs e.g., concentration in certain high-risk areas.

Grant Thornton's Recent Publications



How GT can support you

We have extensive experience in supporting clients across their end-to-end Climate Risk Frameworks

1 **Capability Assessment**

We can assess your climate risk quantification capabilities against industry practice and regulatory requirements. We will develop a target state tailored to your business model and strategy and design a detailed enhancement plan to help you achieve that state.

2 **Data**

We can perform data deep-dives to understand existing climate data gaps, with emphasis on key risk variables tailored to your particular portfolio composition. We will work with you to design and implement data remediation, including the collection and integration of third-party supplementary data.

3 **Model Development**

We can develop and implement climate risk quantification models that simulate your financial performance under a range of climate scenarios. Where models already exist, we can develop an automated execution environment that integrates separate models and methodologies.

4 **Governance & Controls**

We can identify any infrastructure, governance and control gaps in your climate risk processes, working with you to design and implement enhancements, ensuring a structure that will withstand regulatory scrutiny and provide a robust Climate Risk framework.

5 **Scenario Generation**

We can work with you to develop both macroeconomic climate scenarios and business driven climate scenarios, ensuring expansion is appropriate and in-house scenarios are representative of vulnerabilities and risks that your specific business model faces.

6 **Embedding**

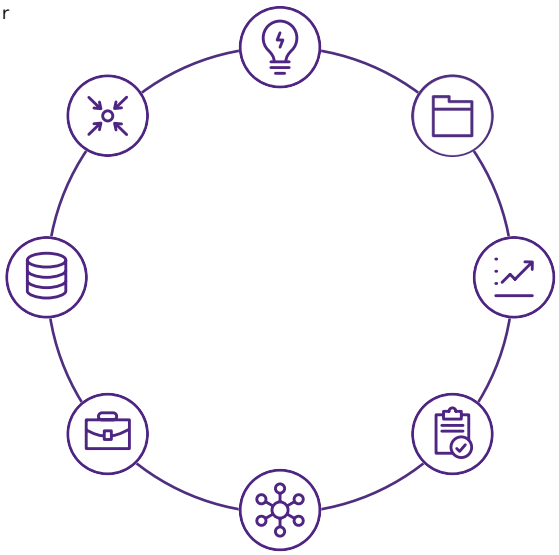
Using our industry knowledge of market practice, we can help determine areas where Climate Risk models can be embedded in wider processes such as financial/strategic planning, risk appetite and portfolio management.

7 **Model Validation**

We can provide a cost-effective, independent model validation service across all model types. Validations will be tailored to align to internal policies and regulatory requirements. Where there are gaps in policies we can implement comprehensive validation policy framework, covering all model types and materialities.

8 **Resource and Planning**

We can work with you to develop and enhance your climate response and planning platform, using our industry knowledge to help guide on best practices. Through this, we can help identify and remediate your key gaps and pinch points.



Contact

Our team would be delighted to discuss your challenges and opportunities in any aspect of climate risk. Our services are flexible and efficient, designed to facilitate and support your business model. Contact us today to discuss.

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