Methodology Insights

Sustainable Investment | Fixed Income

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# Rethinking the sovereign environmental score assessment

## Sovereign ESG revisited

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AUTHORS

**Julien Moussavi, Ph.D.**
Senior Research Lead,
Sovereign ESG, Sustainable
Investment Research
julien.moussavi@lseg.com

**Astrid Sofia Flores Moya**
Senior Analyst, Sustainable
Investment Research
astridsofia.floresmoya@lseg.com

## Overview

This paper introduces comprehensive enhancements to the Environmental Pillar Score of the FTSE Russell Sovereign Risk Methodology, which is designed to measure financially material risk from environmental, social and governance (ESG) factors for sovereign issuers with data available for 151 countries from 1999 onwards.

The improvements focus on (1) better integration of forward-looking climate risks, including temperature alignment and physical risk; (2) enhanced data coverage and quality of the underlying metrics; (3) a wider distribution of scores to better differentiate between high performers and laggards; and (4) adjustments to eliminate income bias in Environmental scores.

These enhancements respond to various challenges with regards to sovereign ESG metrics that have been identified in comparative research conducted by the World Bank. These enhancements include a lack of transparency and harmonisation, high correlations with income level and a sometimes-significant lag in the availability of data.

# Contents

# 1. Rethinking the sovereign environmental score assessment?

The current sovereign ESG scoring framework is far from perfect. Disparate methodologies and assessment criteria have created different mixed sets of Environmental scores (E scores), resulting in difficulties when comparing and contrasting country rankings across ESG providers. What constitutes good and meaningful environmental assessment remains unclear, however, and it remains questionable whether assessment is being done accurately, rigorously and transparently. The World Bank's 2021 report "Demystifying Sovereign ESG"[1] examines these issues in the first-ever empirically based assessment of the product offerings of seven of the industry's leading sovereign ESG providers, including FTSE Russell/Beyond Ratings. This World Bank study provides an empirically based assessment of sovereign ESG as a sector, the way leading sovereign ESG providers compare and contrast with each other, and the way their respective sovereign ESG products contribute to the industry's increasing demand for being able to measure sustainability within different investments.

### Dissonance prevails

There is still a lack of harmonisation about which components should be used to assess environmental performance for sovereigns, as E scores are inherently ambiguous. Moreover, as themes and indicators are chosen either arbitrarily or use quantitative and qualitative evidence, environmental assessments are becoming increasingly heterogeneous.

### Limited data quality

While data quality is especially varied for environmental indicators, which are more dispersed, ESG data providers generally refer to international organisations such as the World Bank, for comparable datasets on social and governance metrics. However, sources may vary between private entities, university research centres and government organisations, resulting in significant differences in data quality. Inputs may be, for example, limited in historical or geographical coverage, or both, and moreover, environmental indicators have time lags that range on average from two to five years.

### Contrasting methodologies

Raw data is not treated uniformly across the market. Providers employ distinct methodologies to calculate E scores, which means that raw data will be transformed differently and statistical obstacles, such as data gaps and holes,[2] will be tackled using distinct approaches from agnostic to judgmental assessments. However, some methodological approaches have limited transparency, resulting in aggregated E scores sometimes being considered as outputs from a black-box or even misleading.

### Addressing materiality

The majority of ESG methodologies aim to balance financial materiality with environmental materiality. Environmental risks form a medium- to long-term threat, which tends to materialise over a longer time frame relative to typical investor investment horizons. In addition,

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[1] For more details, please see the World Bank's *Demystifying Sovereign ESG*.

[2] Data *Gaps and Holes*: In 2021, the Future of Sustainable Data Alliance (FoSDA)'s Data Council defined data *gaps* as instances where reporting frameworks exist, and datasets are requested and collected – but they are not always adequately populated. Data *holes* go beyond *gaps* and represent instances where there are limited reporting frameworks, guidance, or best practices, and where at times there is uncertainty about what exact data would be most useful and relevant for financial market actors.

environmental risks follow a nonlinear trend and worsen over time relative to the past.[3] However, indicators used in sovereign ESG assessments are predominantly backward-looking, showing historical trends that denote a country's ranking in each metric category, which is an approach commonly used in financial risk analysis. In other words, historical data, in isolation, is not the most appropriate type of information to analyse a country's resiliency and degree of vulnerability to climate change, for example.

## Challenges for investors

Current sovereign ESG scoring frameworks appear to be less adequate when it comes to informing investment purposes. The European Securities and Market Authority (ESMA) notes in its 2022 report[4] that despite the limited financial materiality of environmental factors, a good industry practice would be to explain why given factors are or are not accounted for in sovereign ESG analyses. This proposed approach is particularly relevant for countries that are heavily exposed to ESG risk or are resilient to ESG risk. In July 2021, the European Commission also indicated in its "Strategy for Financing the Transition to a Sustainable Economy"[5] that stakeholders continue to express concerns around the lack of transparency on how credit rating agencies incorporate sustainability factors in their methodologies. Such lack of clarity can harm investment outcomes and further complicate the understanding of sovereign ESG's impact transmission channel to fostering sustainability.

[3] For more details, please refer to *Central banking and financial stability in the age of climate change*.

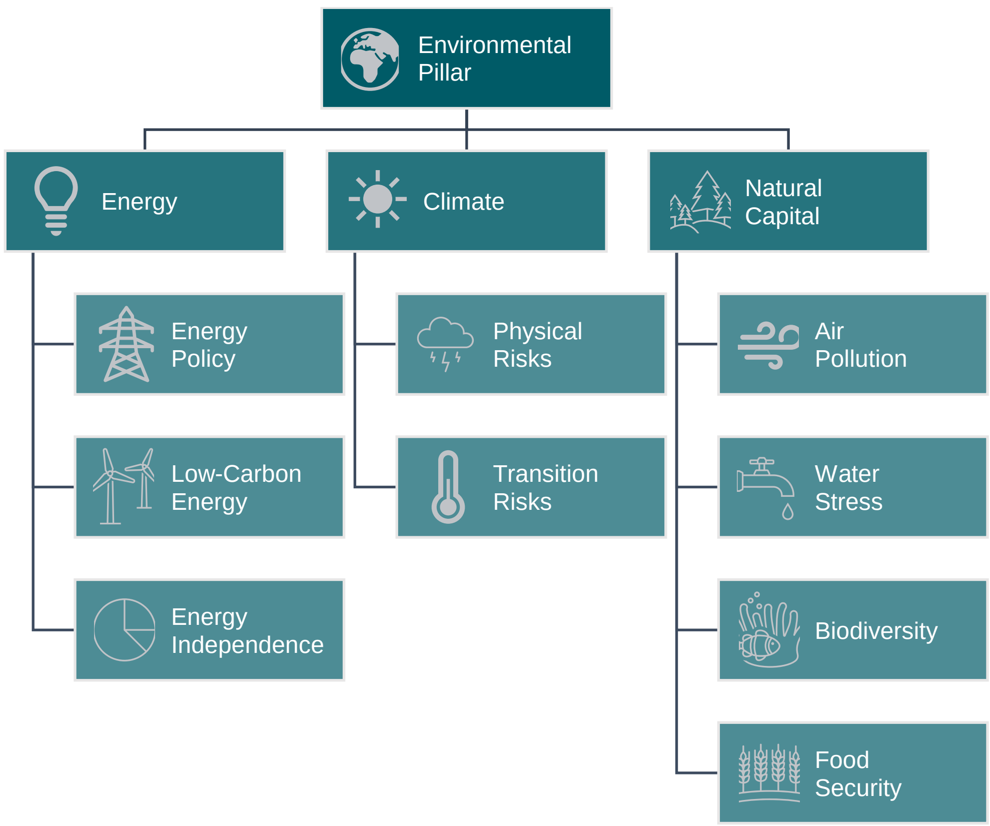
[4] For more details, please refer to the report *Text Mining ESG Disclosures in Rating Agency Press Releases*.

[5] For more details, please refer to *Strategy for Financing the Transition to a Sustainable Economy*.

## 2. The enhanced Environmental pillar

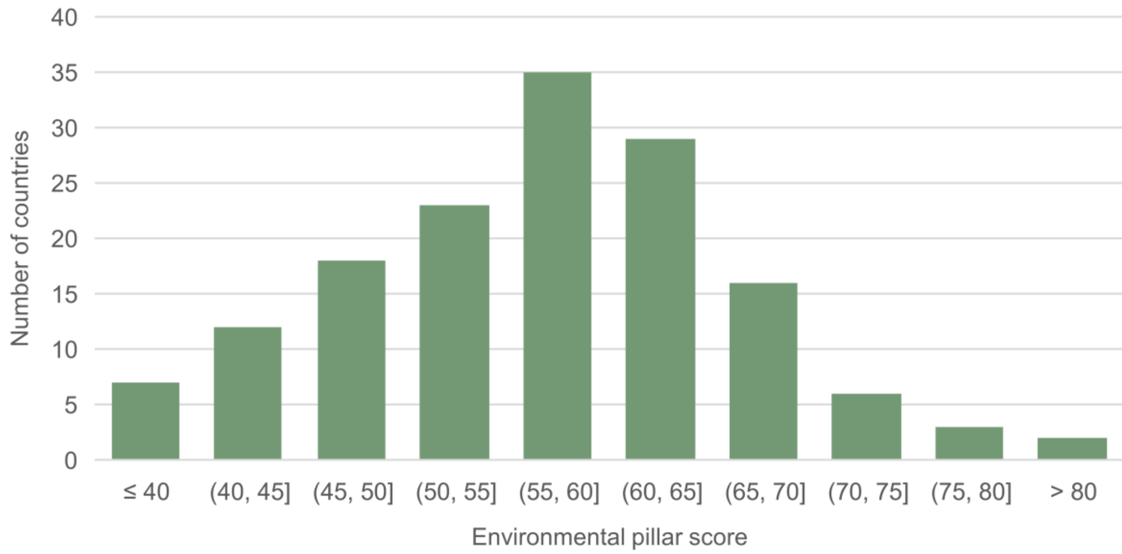
In response to market participants' feedback, extensive research and the World Bank's recommendations, the redesigned Environmental pillar of the FTSE Russell/Beyond Ratings Sovereign Risk Methodology is adapted to meet the future needs of the sovereign ESG market and it aims to efficiently integrate environmental risk analysis into sovereign risk prediction. Within this framework, Energy, Climate and Natural Capital reflect risk themes and are considered as sub-pillars.

**Figure 1. An overview of the enhanced Environmental pillar**




Source: Beyond Ratings.

**Figure 2. Breakdown of Environmental pillar scores, Q4 2020**




Source: Beyond Ratings.

Figure 2 shows the distribution of the Environmental pillar scores in Q4 2020, illustrating that this statistical distribution is very close to a normal distribution. Despite the broad range of the risk themes included in the Environmental pillar, we observe a significant dispersion in the scores.

## 2.1. A tailored framework for Environmental assessment

### Essential risk themes

Risk themes[6] and associated indicators are designed as a simple, explicit, and thus transparent piece of information. The Energy, Climate and Natural Capital sub-pillars are constructed to allow for more heterogeneity in scores, which penalises the worst performers and rewards the best performers.

### Data quality is boosted

Existing and new indicators have been chosen using a minimum threshold of 60% for geographical and historical coverage to ensure the continuity of data and to minimise gaps and holes. Moreover, having introduced new themes, such as Biodiversity and Food Security, allows consideration of critical life-supporting ecosystem services that are vital in ensuring the communities' resilience to climate change.

### Tackling the income bias

Although the income bias is less prevalent across E scores, the new Environmental pillar aims to tackle this bias because it is inherent in sovereign ESG scores.[7] All indicators have been tested for the income bias and, in most cases, this bias has been minimised; a few exceptions remain

[6] Risk themes refer to groups of indicators within a sub-pillar. For example, the risk theme "Transition Risk" belongs to the sub-pillar "Climate" which belongs to the pillar "Environmental". For more details, please see Figures 3, 5 and 7 within this paper.

[7] For more details, please refer to *Dealing with income bias in sovereign ESG scores - Sovereign ESG revisited*.

due to the inherent bias of some themes (e.g., Food Security). This approach allows for a relatively pure measure of sovereign environmental performance that is weakly impacted by countries' level of economic development.

### Innovative forward-looking indicators

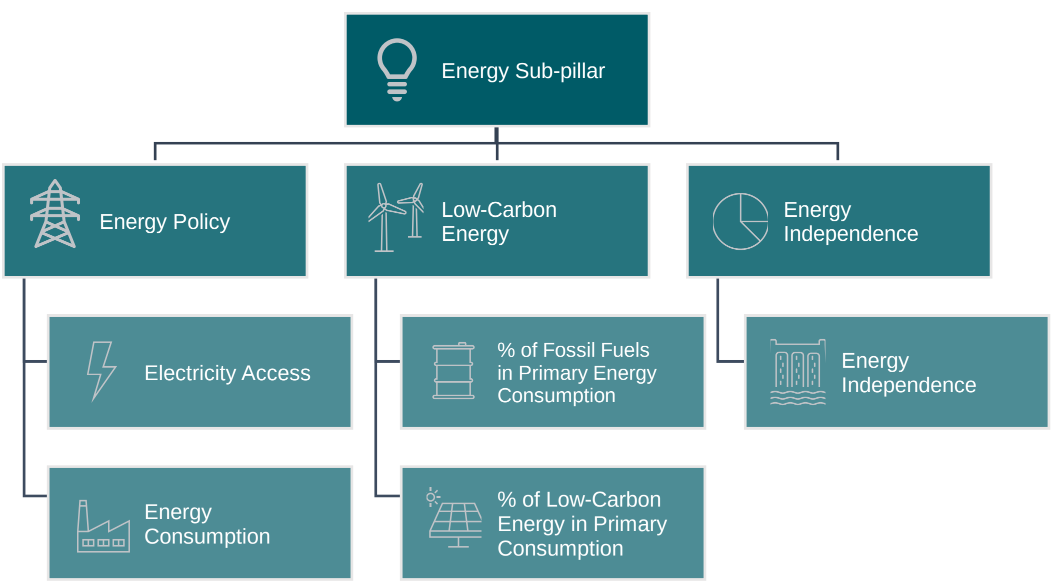
The new Environmental pillar includes a series of innovative, forward-looking physical risk and transition risk indicators that were developed in-house by Beyond Ratings, creating a better understanding of countries' vulnerability levels between 2030 and 2050 (given different scenarios). For example, country-level Physical Risk scores[8] have been integrated to depict how seven main climate hazards have historically impacted and will impact countries in 2050, based on their agricultural, industrial and service sector vulnerabilities. Likewise, Implied Temperature Rise, which is a transition risk indicator, assesses countries' implied global warming temperatures based on their national commitments concerning climate change mitigation,[9] as stated in their Nationally Determined Contributions (NDCs) submitted to the United Nations Framework Convention on Climate Change (UNFCCC).

## 2.2 The new Environmental pillar deconstructed

The new Environmental pillar is composed of its Energy, Climate and Natural Capital sub-pillars. The Energy sub-pillar focuses on energy to notably capture a relatively more global view of the domestic energy supply. The Climate sub-pillar prioritises exposure and vulnerability measures by using backward- and forward-looking indicators to analyse physical and transition risk. The Natural Capital sub-pillar is made up of four single themes and integrates two new themes: biodiversity and food security.

## 2.2.1 The Energy sub-pillar

**Figure 3. Structure and components of the Energy sub-pillar**



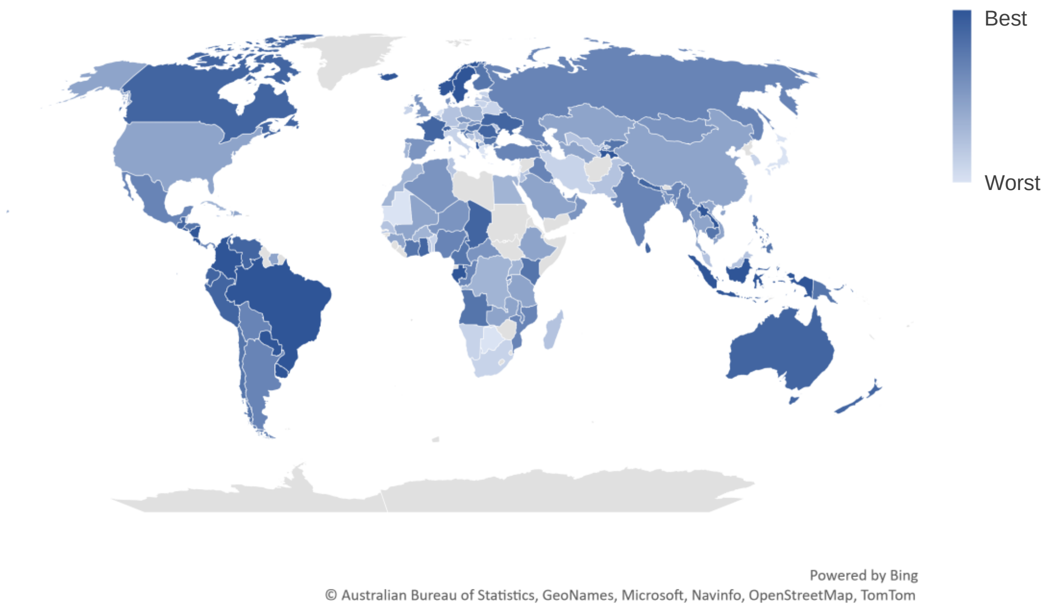

Source: Beyond Ratings.

[8] For more details, please see Appendix 2.

[9] For more details, please see How to measure the temperature of sovereign assets | FTSE Russell.

The Energy sub-pillar is made up of three risk themes: (i) energy policy, (ii) low-carbon energy and (iii) energy independence. Energy policy accounts for access and consumption as key policy measures. The Low-Carbon Energy sub-pillar focuses on the polluting aspects of the power supply. Using our two new indicators “Brown Proxy” and “Green Proxy”, we study how reliant countries are on carbon-intensive and renewable energy sources. The former analyses the percentage of fossil fuels in primary energy consumption, while the latter investigates the percentage of low-carbon energy in primary consumption. Energy independence provides a more global view of the resources directly available to a country’s energy system.

**Figure 4. Energy risk scores, Q4 2020**

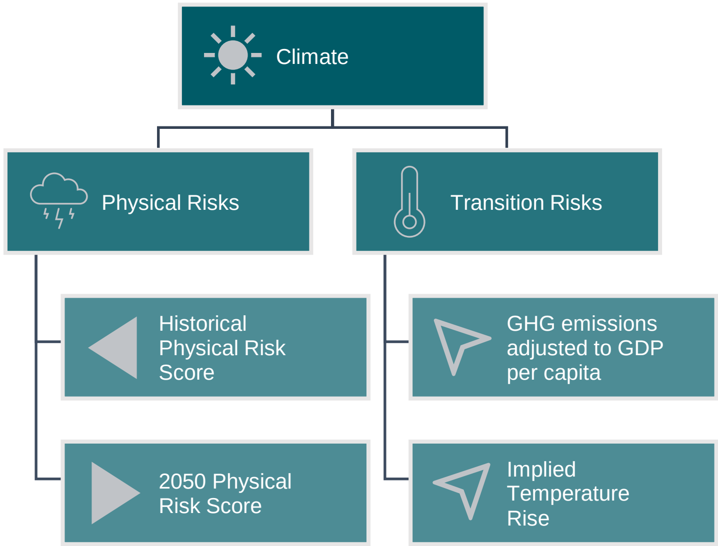



Source: Beyond Ratings.

Notes: Scores have been grouped by decile in Q4 2020 to better discern shades between countries.

## 2.2.2 The Climate sub-pillar

**Figure 5. Structure and components of the Climate sub-pillar**




Source: Beyond Ratings.

The Climate sub-pillar studies (i) physical and (ii) transition risks, and to achieve this we include an exposure and vulnerability indicator for each risk to account for both past and future conditions, respectively. While the exposure indicator measures countries' current degree of exposure, the vulnerability indicator uses climate models and government policies to forecast countries' capabilities in mitigating and adapting to climate change risks.

There are six acute and chronic climate hazards that are considered when building physical risks scores:

1. heatwaves
2. droughts
3. water stress
4. riverine floods
5. coastal floods
6. temperature[10]

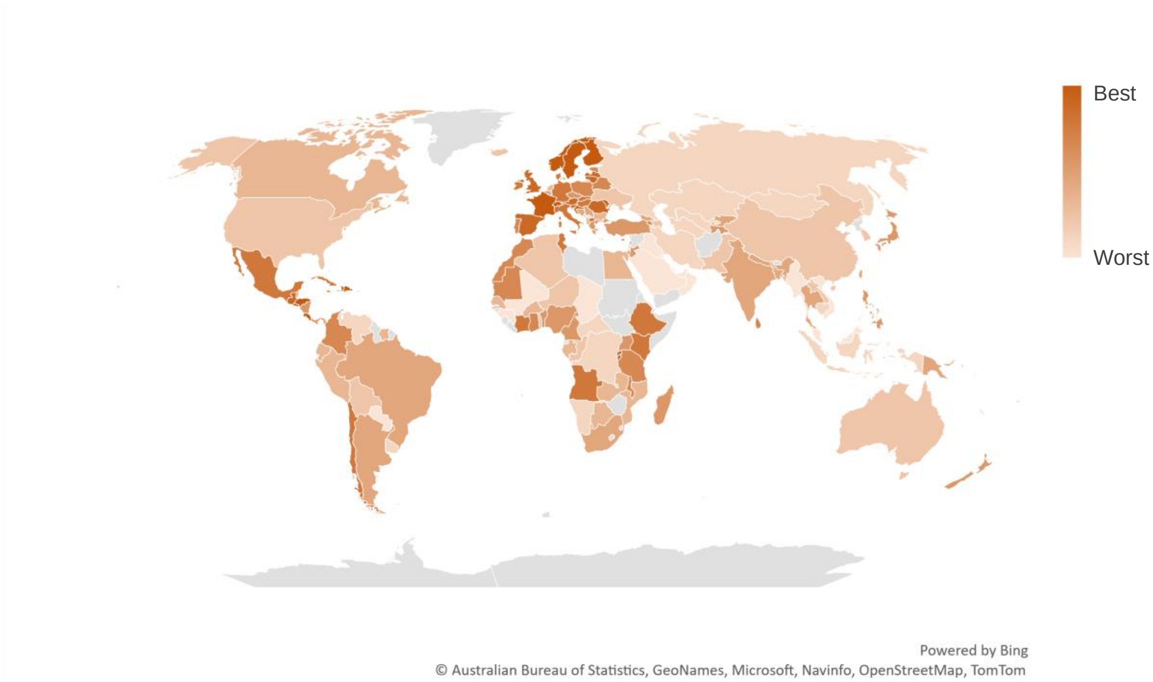
Such hazard scores are combined with sectoral vulnerability scores (Agricultural, Industry and Services) to calculate one aggregated historical risk score and one aggregated forward-looking risk score for each country. Historical exposure will indicate countries' exposure to harmful climate conditions while forward-looking exposure will shed light on countries' vulnerability to strong changes in climate conditions. For further information on our physical risk score methodology, please refer to Appendix 2.

[10] The temperature hazard can only be included in the 2050 Physical Risk scores analysis. Please refer to Appendix 2, op. cit., for more information.

In the case of transition risks, consumption-based GHG emissions (i.e., territorial plus imported, minus exported emissions) represent the most fitting measure for sovereign footprint as outlined by the Partnership for Carbon Accounting Financials (PCAF).[11] The measure is adjusted to gross domestic product (GDP) per capita to provide a relative view, helping to more accurately represent an exposure to transition risks as it indicates whether countries are over-emitting or under-emitting GHG emissions relative to their level of development.

The forward-looking indicator is represented by the Climate Liabilities Assessment Integrated Methodology (CLAIM) indicator *Implied Temperature Rise.*[12] This indicator assesses countries' implied global warming temperatures based on their national commitments to climate change mitigation, in line with their Nationally Determined Contributions (NDCs) submitted to the UNFCCC in the framework of the Paris Agreement. We use a temperature equation that reflects the scientific consensus on the relationship between GHG emissions and temperature dynamics, which provides an output measured in degrees Celsius.

**Figure 6. Climate Risk score, Q4 2020**




Source: Beyond Ratings.

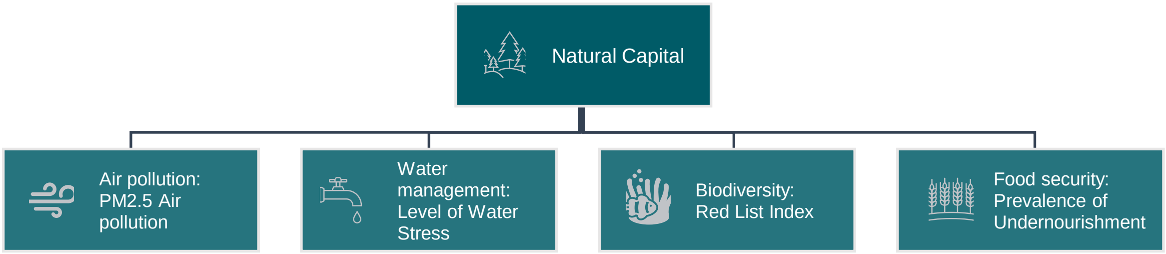
Notes: Scores have been grouped by decile in Q4 2020 to better discern shades between countries.

[11] For more details, please see the PCAF'S New Methods for Public Consultation.

[12] For more details on the CLAIM Implied Temperature Rise indicator, please see *How to measure the temperature of sovereign assets.*

## 2.2.3. The Natural Capital sub-pillar

**Figure 7. Structure and components of the Natural Capital sub-pillar**




Source: Beyond Ratings.

The Natural Capital sub-pillar is made up of four themes, represented each by one indicator. The Air theme is measure by the average level of exposure of a nation's population to concentrations of suspended particles measuring less than 2.5 microns in aerodynamic diameter.[13] The water theme is represented by the World Bank's indicator, Level of Water Stress, measuring the degree of which there is an over- or under-withdrawal from currently available freshwater resources.

The Natural Capital sub-pillar also includes the Biodiversity and Food Security risk themes. Given biodiversity's historical degradation, including it as a risk theme will help highlight the stability of a country's ecosystem services. This approach is especially relevant for economies, which have high dependence on such systems to generate revenue, that will see their fiscal space reduced in the future. We chose the Red List Index, used to track the Sustainable Development Goal of Life on Land (Goal 15), to show trends in overall extinction risk for species; governments also use the index to track their progress towards targets for reducing biodiversity loss.

Although Food Security[14] is traditionally included in the Social pillar, the enhancement integrates it into the Environmental Pillar. Given the current increasing trends in population growth and environmental stressors, there will be an undeniably significant, yet uncertain, impact of climate change on food security that will threaten communities in the short and long term. Considering the multidimensional and complex aspects of how Food Security is measured, we have chosen an outcome variable:[15] the Prevalence of Undernourishment in the population (PoU) indicator. This indicator serves as a proxy for the Prevalence of Moderate or Severe Food Insecurity in the World Bank's population indicator (PFI).[16]

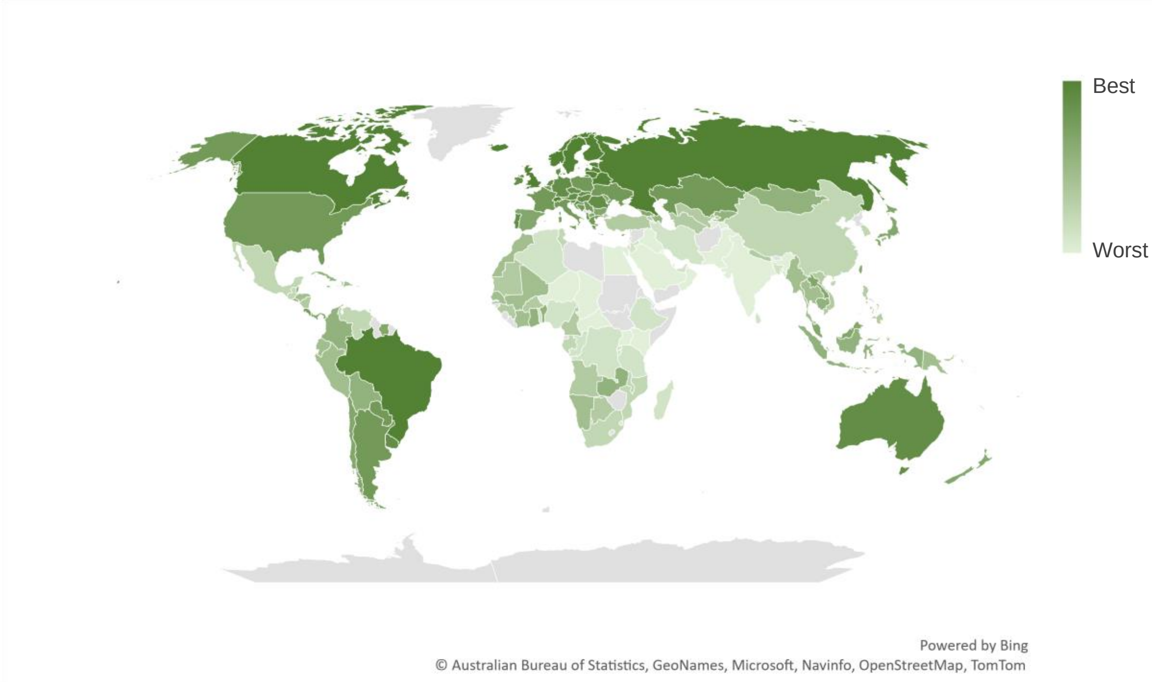
[13] These particles are capable of penetrating deep into the respiratory tract and causing severe health damage. The guideline set by the World Health Organization (WHO) for PM2.5 is that annual mean concentrations should not exceed 10 micrograms per cubic meter.

[14] Food security is included to account for physical, social and economic access to sufficient, safe and nutritious food that is necessary to maintain an active and healthy life.

[15] An outcome variable is one that represents the result of various factors' impact on a given subject. Food Security is traditionally impacted by land cultivation, crop diversity, affordability and quality standards, amongst other conditions.

[16] PFI could not be used directly due to its limited historical coverage (5 years of available data) that would have resulted in low score for accuracy. In contrast, PoU had a longer historical coverage, with data starting in 2000 until the year 2020. To verify whether the PoU indicator served as a proxy for the PFI indicator, a series of correlation tests between the PoU and PFI were carried out. The results showed the correlation for a selection of 103 out of 151 countries to be an average of 69% and the correlation across time, from 2015-2020, averaged 84%, allowing us to conclude the variable an ideal proxy for food security measurement.

**Figure 8. Natural Capital risk score, Q4 2020**




Source: Beyond Ratings.

Notes: Scores have been grouped by decile in Q4 2020 to better discern shades between countries.

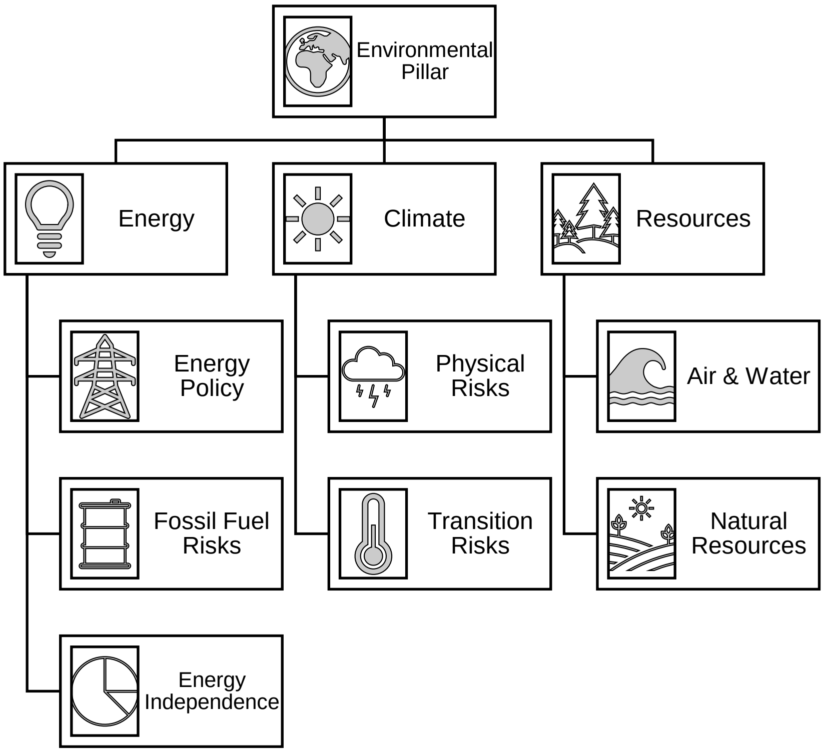
# Conclusion

FTSE Russell/Beyond Ratings’ new Environmental Pillar — based on data with minimal lags and holes, increasing score accuracy across countries and time — has features that clarify and facilitate investors’ alignment to diverse investment strategies. Including backward- and forward-looking dimensions permits a more efficient calculation of climate change exposure and vulnerability. Furthermore, the plethora of indicators accounted for together are representative of today and tomorrow’s most critical environmental risks. The new Environmental pillar and its clear and transparent Environmental assessment create an opportunity for investors to inform and formulate sovereign ESG investment decisions more efficiently and effectively.

The new Environmental Pillar presents a step forward in advancing the evolution of the Sovereign ESG framework and taxonomy. It is only a building block to support the wider reformulation of the Sovereign Risk Monitor (SRM) methodology to the Sustainable Sovereign Risk Monitor (SSRM or 2SRM) methodology, which responds to gaps identified in current sovereign ESG scores. Among such advancements is the creation of income-adjusted sovereign E, S and G scores that will tackle the inherent income bias, and the creation of momentum ESG scores that will more adequately address investors’ distinct investment horizons.

# Appendix

## 1. Original design of the Environmental pillar of the Sovereign Risk Monitor (SRM).




Source: Beyond Ratings.

## 2. Calculation of Physical risk scores

### Data processing and calculation of scores

When building physical risks scores, **seven climate hazards** are considered: **heatwaves, droughts, water stress, intense precipitations, riverine floods, coastal floods and average temperature.**

**For each hazard**, we use raw climate data to calculate specific indicators that will describe a hazard's frequency and/or intensity. We analyse both historical and forward-looking exposures[17] to climate hazards for each country. Historical exposures are computed from the absolute values of climate indicators (e.g., the frequency of warm days), whereas forward-looking exposure is defined by the change in climate conditions, calculating the difference between future and historical climate indicators (e.g., additional warm days). This distinction allows us to highlight countries' exposure to potential harmful climate conditions as well as the strong climate changes for which countries might not be prepared.

[17] For the average temperature, only forward-looking data are considered, as the hazard lies in the temperature change and not in the baseline conditions.

Forward-looking data is based on the IPCC SSP5-8.5 climate scenario, following a 'hope for the best, plan for the worst' type of approach. It is worth noting that 1) before 2050, the chosen scenario is not the main driver of climate uncertainty, since the different scenarios start to diverge mainly around the middle of the century, and that 2) the choice of scenario has a low impact on the countries' rankings.

### Hazard scores

In order to describe current and future climate hazards, we calculate indicators directly from climate data, for instance, raw data mapping to daily maximum temperatures are processed into a frequency of heatwaves. **For each country and each indicator**, we first calculate the country average for each climate model and then aggregate the different models to create a **multi-model average value** (see the

Data sources section for more details on the models).

We then **normalise** these physical indicators to obtain a **score from 1 to 100** (1 being the lowest and 100 the highest hazard level), using two thresholds to exclude the extreme decile[18] to avoid a strong effect of outliers on the normalisation.

### Sectoral risk scores

With the same level of exposure to a climate event, the potential impact on a specific economic sector depends on its vulnerability to the hazard. For example, while the agricultural sector is highly vulnerable to droughts or water stress, the industrial sector may be more impacted by flood damages on its assets. We determine qualitative sectoral vulnerabilities to each hazard, based on a literature review.

Using a geometric average, we combine the hazard scores from the previous section with the sectoral vulnerability scores, and then we apply a second normalisation operation to obtain the **sectoral risk scores** for each sector, country and hazard, on a scale from 1 to 100.[19] Subsequently, for physical consistency, risk scores are automatically set to 0 if no hazard was identified (i.e., if the raw value of the climate indicator was 0).

### Country risk scores

We combine the sectoral risk scores with the sectoral GDP breakdown, using a weighted average to obtain the **final risk scores for each country and each hazard**. At this stage, the outputs consist of one aggregated historical risk score and one aggregated forward-looking risk score for the country, available **for each hazard**.

### Final aggregation

For the final step, we create a single, multi-hazard piece of information that summarises the country's overall physical climate risk level. This synthetic score is calculated from the average of the three highest hazard-specific scores for each country to 1) highlight the countries highly exposed to at least one hazard, 2) discriminate further countries that are highly exposed to several hazards and 3) avoid as much as possible a smoothing effect that would occur if we used a simple average across all hazards.

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[18] For most indicators, $thr1_{is}$ = 0 and $thr2_{is}$ corresponds to the 90$^{th}$ percentile for the historical data; and $thr1_{is}$ and $thr2_{is}$ correspond to the 5$^{th}$ and 95$^{th}$ percentile for the forward-looking data.

[19] $thr_{min}$ = 5, which corresponds to the geometric average between the lowest hazard rating and a low sectoral vulnerability, $thr_{max}$ = 86.6, which corresponds to the geometric mean between the highest hazard rating and a high sectoral vulnerability.

For a direct use in the Sustainable Sovereign Risk Monitor (2SRM), we **invert** the scale and expand these indicators to obtain a **score from 0 to 100** (0 being the worst-case score and 100 the best).

**For each of the 151 countries** of the Sustainable Sovereign Risk Monitor, except for Taiwan,[20] the final output consists of **two 'country physical risk scores':**

**The historical score** linked to the absolute level of risk for the recent period (1995–2014).

**The forward-looking score** is linked to the risk caused by the relative change in climate, comparing the historical period to the mid-century range (2041-2060).

## Data sources

### Climate data

Raw climate data are issued from global climate models or specific models for floods and water stress (see Table 1 and

[20] As of today, Taiwan is not covered by sectoral GDP breakdown data.

Table 2 below for data types and sources). It is important to note that long-term average values are required to adequately represent historical and future climate conditions. Here we use averages over 20-year time segments: the climate indicators for the historical and 2050 periods are the result of the average over 1995-2014 and 2041-2060, respectively.

**Table 1. Sources of climate projections**

| Data | Source |
|---|---|
| Temperature | CMIP6 climate modelling initiative<br>Download from Earth System Grid Federation (ESGF) platform (see Table for details of the models) |
| Precipitation | CMIP6 climate modelling initiative<br>Download from ESGF platform (see Table 2 for details of the models) |
| Water stress | World Resources Institute |
| Riverine floods | World Resources Institute |
| Coastal floods | World Resources Institute |

Source: Beyond Ratings.

**Table 2. List of climate models used for climate projections**

| Data | Source |
|---|---|
| CMCC-ESM2 | Centro Euro-Mediterraneo sui Cambiamenti Climatici (Italy) |
| MPI-ESM1-2-HR | Max Planck Institute for Meteorology (Germany) |
| NorESM2-MM | Norwegian Meteorological Institute and NORCE Norwegian Research Centre AS (Norway) |
| EC-Earth-3 | 30 research institutes from 12 European countries |
| HadGEM3-GC31-MM | Met Office Hadley Centre (UK) |
| MIROC6 | Center for Climate System, University of Tokyo, Japan Agency for Marine-Earth Science and Technology, and National Institute for Environmental Studies (Japan) |

Source: Beyond Ratings.

### GDP data

Referencing World Bank-compiled data, we use a classic GDP breakdown into three major economic sectors:

1. The primary sector includes forestry, hunting and fishing, as well as crop cultivation and livestock production.
2. The secondary sector includes mining, manufacturing (also reported as a separate subgroup), construction, electricity, water and gas.
3. The tertiary sector includes wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, healthcare, and real estate services. Also included are imputed bank service charges, import duties and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling.

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**EMEA**
+44 (0) 20 7866 1810

**North America**
+1 877 503 6437

**Asia-Pacific**
Hong Kong +852 2164 3333
Tokyo +81 3 6441 1430
Sydney +61 (0) 2 8823 3521