PRI Principles for Responsible Investment

ASSESSING PHYSICAL CLIMATE RISK IN PRIVATE MARKETS: A TECHNICAL GUIDE

APRIL 2025

UN environment programme | finance initiative

United Nations Global Compact

An investor initiative in partnership with UNEP Finance Initiative and UN Global Compact

THE SIX PRINCIPLES

PREAMBLE TO THE PRINCIPLES

As institutional investors, we have a duty to act in the best long-term interests of our beneficiaries. In this fiduciary role, we believe that environmental, social, and governance (ESG) issues can affect the performance of investment portfolios (to varying degrees across companies, sectors, regions, asset classes and through time). We also recognise that applying these Principles may better align investors with broader objectives of society. Therefore, where consistent with our fiduciary responsibilities, we commit to the following:

1 We will incorporate ESG issues into investment analysis and decision-making processes.

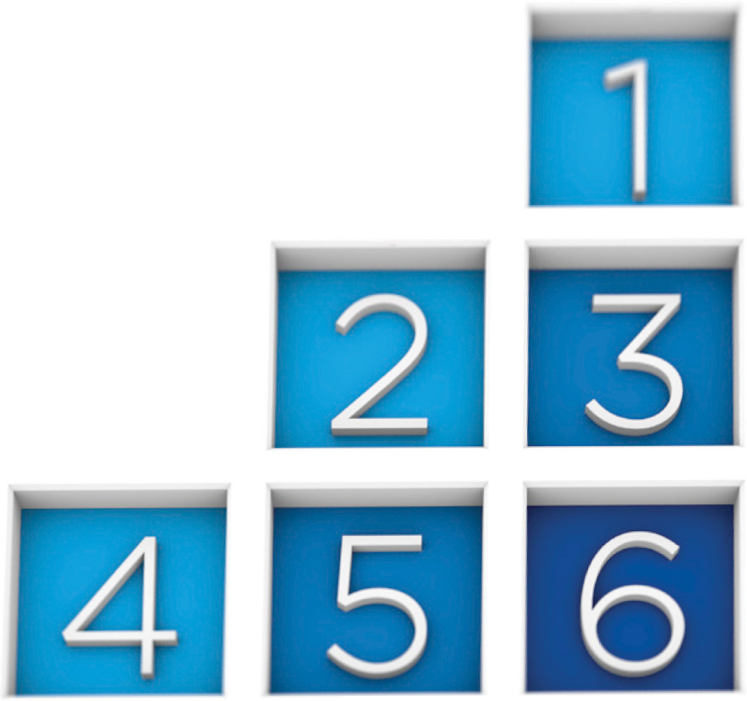
2 We will be active owners and incorporate ESG issues into our ownership policies and practices.

3 We will seek appropriate disclosure on ESG issues by the entities in which we invest.

4 We will promote acceptance and implementation of the Principles within the investment industry.

5 We will work together to enhance our effectiveness in implementing the Principles.

6 We will each report on our activities and progress towards implementing the Principles.



PRI's MISSION

We believe that an economically efficient, sustainable global financial system is a necessity for long-term value creation. Such a system will reward long-term, responsible investment and benefit the environment and society as a whole.

The PRI will work to achieve this sustainable global financial system by encouraging adoption of the Principles and collaboration on their implementation; by fostering good governance, integrity and accountability; and by addressing obstacles to a sustainable financial system that lie within market practices, structures and regulation.

CONTENTS

EXECUTIVE SUMMARY

The increased unpredictability of weather patterns and severity of weather events is changing how investors think about risk. As the link between physical climate risk and financial impact becomes more evident, climate risk assessment needs to become more sophisticated and embedded within the investment process.

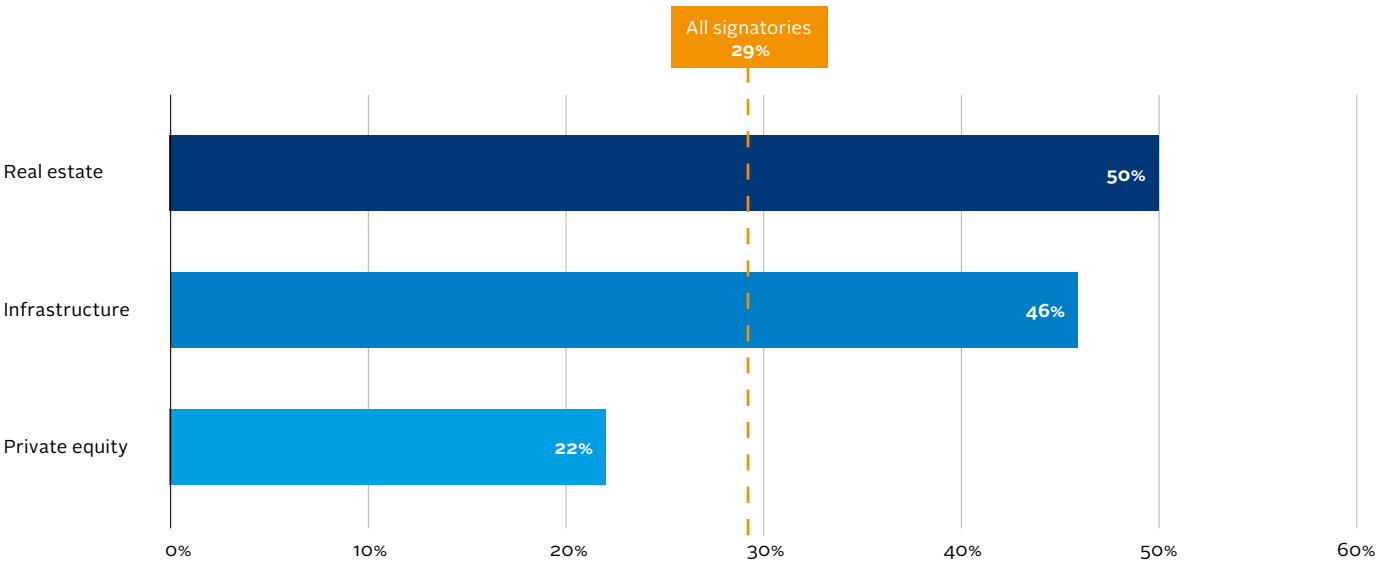
However, PRI reporting data from 2024 indicates significant gaps in the use and disclosure of physical climate risk metrics. While real assets investors, who are often on the sharp end of climate-related impacts, demonstrate more advanced practice in this regard, private equity and other investors are lagging (see Figure 1).

In response to signatory demand for clarity around assessing physical climate risk, the PRI developed this guide to:

- help private markets investors understand the core elements of conducting a physical climate risk assessment;
- explain how assessment results can inform critical next steps, such as integrating outputs into valuation models and/or working with investments to implement adaptation measures where appropriate;
- support less-advanced practitioners in developing a consistent process for assessing physical climate risk;
- provide a baseline of good practice against which more-advanced practitioners can assess their current processes and practices.

The guide begins by defining physical climate risk and the broad range of associated risks and opportunities. It underlines the relevance of the issue to private markets investors and then introduces three core elements of a process for assessing and taking action on physical climate risk. The guide incorporates case studies throughout to illustrate how signatories are carrying out these assessments and includes an extensive list of additional resources in the appendix.

Figure 1: Real assets investors lead in reporting on physical climate risk



Source: PRI Reporting Framework 2024, Indicator PGS 45: During the reporting year, which of the following climate risk metrics or variables affecting your investments did your organisation use and publicly disclose? (Physical climate risk was among the answer options.)

INFORMATION GATHERING

Investors must start from a well-informed position. We suggest three components of gathering relevant information:

Scoping: Top-down and bottom-up approaches to defining the scope of any assessment are reviewed.

Gathering data: Four types of data and how best to collect them are discussed.

- **Hazards**: Climate hazards should be analysed by considering the likelihood/frequency of the hazard occurring and its intensity.
- **Exposure**: Real assets and private equity investors may require different location-specific data to assess the exposure of their investments to climate hazards.
- **Vulnerability**: Assessing vulnerability helps investors understand what adaptation measures may already be in place or be required for individual investments or in the surrounding area.
- **Impacts**: By expanding the analysis beyond physical damage, investors gain a broader understanding of operational and financial impacts.

Identifying frameworks: Investors need to select climate models, climate scenarios and time horizons that will generate the most meaningful assessment for the investments concerned. Commonly used scenarios, and their limitations, are explored.

RISK ASSESSMENT

The most common starting point for private markets investors is to carry out a high-level assessment to obtain a quick view of where and what key risks may arise for their investment(s). These assessments are often carried out as part of due diligence in the initial stages of the investment process, or as a first review of potential risks within a portfolio.

The goal of the assessment is to inform potential investment and asset management decisions; highlight the need for more in-depth analysis of higher-risk investments; and build awareness and understanding of potential risks, both internally and at the investment level.

This type of assessment can be conducted by using either external tool providers or developing an in-house approach. A variety of outputs and metrics – and their limitations – are reviewed.

An in-depth assessment may follow on from the previous approach, or it may be the starting point for higher-risk investments. An in-depth assessment may allow investors to:

- make more informed comparisons of potential or actual investments in different geographies or sectors;
- better identify existing or potential adaptation measures for a specific investment(s) where needed, and the impact of such measures on the investment's resilience and ultimately its financial performance;
- more accurately calculate associated financial assumptions – for example, in relation to potential capital or operational expenditure requirements – and as a result, make more-informed investment decisions.

These assessments typically depend on more in-depth engagement between investors and key stakeholders, such as the investment's management team, as well as site visits and input from technical consultants.

TAKING ACTION

Information from risk assessment can prompt a variety of responses. Investors may:

- alter investment strategies and decisions. This could be at the portfolio level, as investors better understand the overall risks and opportunities related to different asset types, sector(s) or geography(s). Or it may be at an individual investment level, by enabling investors to make more accurate investment valuations and to understand the need for and depth of insurance coverage;
- engage and/or work directly with investments to implement adaptation measures, where needed;
- improve disclosures and reporting to regulators, clients and other stakeholders.

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ABOUT THIS GUIDE

This guidance details how direct investors in private equity and real assets can develop a process to assess physical climate risk in their portfolios. Asset owners investing in private equity and real assets through external managers may also use the guidance to better assess those managers' understanding of and approaches to physical climate risk.

The guidance is intended for investors at different stages of understanding and practice on physical climate risk.

- For investors new or less familiar with the topic, it provides a general introduction to the importance of physical climate risk and breaks down the different elements of conducting physical climate risk assessments.
- For investors with an existing physical climate risk assessment process, the guidance can be used to review the current process against leading industry practices, and to learn from peers using the case studies and examples provided throughout the document.

Throughout the document, we use the terms "investors" or "private markets investors" to mean direct investors in private equity and real assets. The guidance also most directly speaks to majority or control investors; however, we reference considerations for minority or co-investors, where appropriate. Finally, where we refer to "investees" or "investments" we mean the underlying or potential portfolio company or asset.

The content in this guide is based on:

- desk research;
- an investor survey and workshops;
- interviews with investors and industry stakeholders, such as consultants;
- engagement sessions between physical climate risk tool providers and investors;
- feedback from the PRI's Physical Climate Risk in Private Markets Working Group.

BACKGROUND

This section explains what physical climate risks are and why they may be particularly relevant for private market investors. It also introduces three key elements for building an approach to physical climate risk assessment – information gathering, risk assessment and taking action.

WHAT ARE PHYSICAL CLIMATE RISKS?

Physical climate risks result from dynamic interactions between climate-related hazards and the human or ecological systems that are exposed and therefore are vulnerable to those hazards.

Physical climate risks can be event-driven (acute), such as the increased severity of climate-related hazards, e.g. cyclones, droughts, floods and fires. They can also be chronic, arising from longer-term shifts in precipitation, temperature, sea level and weather patterns.

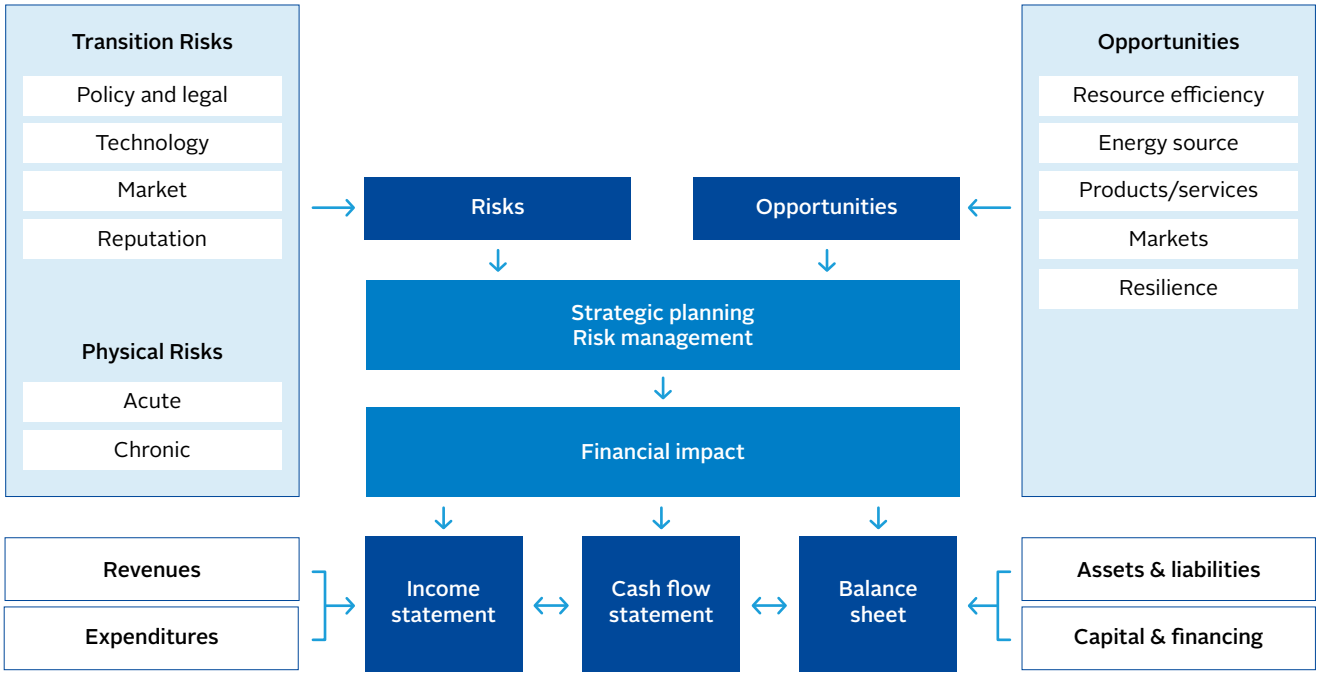
As global temperatures climb, and weather patterns become more unpredictable, climate-related risks are intensifying and their financial impact are becoming increasingly evident. The financial implications of the increased severity and frequency of climate hazards can be direct at the investment level (i.e. direct damage to physical assets and supply chain resilience) or indirect due to system-level risks (i.e. damage to economic, social, and natural systems may impact portfolio performance). These risks may affect investment values, liabilities, and the availability and cost of capital (see Figure 2).

RELEVANCE FOR PRIVATE MARKETS INVESTORS

Physical climate risk is of particular relevance to private markets, given the nature of the market itself and of its investors, who may:

- invest in physical assets, which may be particularly vulnerable to such risks because of their location-specific nature;
- have direct or majority ownership of investments, giving them a greater ability to assess climate-related risks and advocate for, or directly implement, adaptation measures to build resilience;
- have longer investment horizons, giving them both longer-term exposure to such risks, but also enabling short- and long-term approaches to addressing them.

Figure 2: Climate-related risks, opportunities and financial impact



Source: TCFD (2017), Recommendations of the Task Force on Climate-related Financial Disclosures

PHYSICAL CLIMATE RISK ASSESSMENT

Physical climate risk assessments should aim to identify and analyse the potential risks associated with the physical effects of climate change. They can be conducted at different levels of granularity, including at the physical asset, investment, portfolio, or regional level and across a range of climate scenarios and time horizons. A process for assessing physical climate risks and taking action can be distilled into three key elements[1], which will be explored in greater detail throughout this guide.

Information gathering

- Define the scope of the assessment
- Gather key data
- Identify climate models, scenarios and time horizon to conduct analysis.

Risk assessment

- High-level assessment
- In-depth assessment.

Taking action

- Use insights to inform investment strategy and decision-making
- Implement adaptation measures
- Support reporting and disclosure.

These elements can be integrated into different stages of a typical investment process for private markets investors (see Figure 3).

Figure 3: Physical climate risk assessment in the private markets investment process

Deal sourcing/acquisition	Investment decision	Ownership/management	Exit
■ Gather information to support understanding of physical climate risks. ■ Conduct risk assessments to identify potential exposure to physical climate risks during due diligence. ■ If appropriate, identify potential actions post-investment.	■ Use results from risk assessments to support the investment decision-making process. ■ Include actions related to physical climate risks in the investment/ shareholder agreement.	■ Continue to gather information and remain abreast of progress in climate models and scenarios. ■ Reassess physical climate risks through risk assessments as needed. ■ Take action to integrate findings into ongoing financial planning; engagement; adaptation measures; and reporting.	■ Articulate and realise value of taking action at exit/sale - for example, by securing a better price because of adaption measures in place. ■ Share findings of risk assessments with potential new owners.

Case Study

CBRE INVESTMENT MANAGEMENT

Engaging with managers on physical climate risk

Using Moody's Climate on Demand tool, CBRE IM assessed the potential exposure of its Indirect Private Real Estate portfolio to physical climate risk. It then engaged with managers of portfolio assets to explain the importance of understanding and managing such risks, especially for assets identified as falling into higher-risk categories. For those assets, we encourage managers of underlying assets to commission a detailed analysis to determine whether the asset has built-in resiliency or needs a mitigation plan to address any residual risk. As a signatory to the Task Force on Climate-related Financial Disclosures (TCFD), we also engage with managers of underlying assets to seek their alignment with that body's recommendations and to gain greater visibility on how managers are strategically incorporating climate risks into investment decision-making and risk management processes.

1 These elements should ideally align with an investor's approach to the measurement and disclosure of greenhouse gas emissions as part of an integrated approach to climate-related risks and opportunities. The Global GHG Accounting and Reporting Standard developed by the Partnership for Carbon Accounting Financials (PCAF) provides helpful guidance on this topic.

INFORMATION GATHERING

Information gathering

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Risk assessment

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Taking action

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- Implement adaptation measures
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This section details the three elements of information gathering needed to conduct a physical climate risk assessment:

- **Scoping** which investments to cover in any assessment – this may be individual investments, a subset of investments (based on sector or geography) or all investments in a fund or portfolio.
- **Gathering data**, specifically in relation to climate hazards, and an investment's potential exposure and vulnerability to such hazards.
- **Identifying and selecting climate models, climate scenarios and time horizons** to better understand the likely evolution of the investor's climate-related risks and associated impacts.

SCOPING

Investors may first seek to define which investments they wish to include in any assessment. Many take a top-down approach, which usually involves conducting a baseline risk assessment across a portfolio to identify investments which may be more exposed and/or vulnerable to climate hazards. These investments may then become the focus of in-depth analysis and actions.

Investors can also adopt a bottom-up approach, where assessments are conducted as part of due diligence on potential investments or on investments that meet specific materiality criteria. These criteria may include:

- **Existing risk**: investments already tangibly impacted by physical climate risk;
- **Sector or geographic focus**: investments flagged as potentially at higher risk based on existing knowledge or research. See, for example, the SASB Climate-related risk sector and industry map for sectors and the IPCC's Sixth Assessment Report for geographical risks;
- **High value**: investments that may disproportionately impact financial performance due to their high value within a portfolio or other factors.

VALUE CHAINS AND OTHER CONSIDERATIONS

Investors may also need to include other material considerations in the scope of their assessments, such as their investment's value chain or the local area surrounding a physical asset.

This analysis may cover elements such as:

- how physical climate risks might impact physical assets and/or services in the value chain and/or the local area surrounding an investment;
- how demands on natural resources and other materials can shift, and the potential for supply shocks and/or associated price fluctuations;
- whether key suppliers, partners, public services and local communities are resilient to climate events;
- whether suppliers can be diversified to reduce risk.

This broader analysis will provide more depth to any assessments and subsequent actions, but it will also require more time and resources, particularly to map out key elements of the value chain and local communities across all the investments in scope. In reality, a staged approach is most practical, with an initial focus on elements of the value chain whose relationship with an investment is most critical or where material risks are highest. Using the scoping criteria listed above can again help focus initial efforts in this regard.

Case Study

SCHRODERS

Mapping supply chain risks for apparel companies

Schroders mapped the supply chain footprint of six global apparel brands across four cities in Asia[2], assessing the exposure of each company's physical assets by 2030 and 2050 to flooding and heat stress (with data from over 10 climate models). The analysis calculated the financial impacts of decreased worker productivity and disruptions at factories due to these climate impacts.

Vietnam was identified as a location facing significant physical climate risks, particularly from flooding. Further site visits and engagements with apparel firms in the country revealed a general lack of risk assessment and adaptation strategies within the industry. In response, Schroders has developed specific engagement questions for investors to ask to encourage companies in high-risk areas like Vietnam to enhance their resilience to physical climate risks.

DATA REQUIREMENTS

The basic data requirements for physical climate risk assessment are the same across all asset classes. However, the nature of much private markets investing gives investors the opportunity to gather and assess data at a more granular level than their public markets counterparts, as discussed under the four categories below.

HAZARDS

Potential climate-related events that may cause harm to people, property, and the environment.

Hazard data can be obtained from climate models and/or based on observational records. Not all hazards will be relevant for all investors to assess; relevant hazards should be identified by their materiality, geography or sectoral relevance, although this is likely to be easier when conducting assessments on a single investment or a subset of a portfolio. For portfolio-wide assessments, investors may focus on a broader range of hazards initially, and then focus on specific hazards, if needed, in a more in-depth assessment.

Some investors ensure they assess the hazards suggested by a particular regulatory framework, for example, the hazards in the EU Taxonomy classification of climate hazards.

Hazards should be analysed by considering the likelihood/frequency of the hazard occurring and its intensity (for example, rainfall amounts and temperature extremes). Some hazards can be assessed in different ways, depending on the use case. For example, a real estate investor may wish to assess extreme heat in terms of the likely increase in annual maximum temperatures to factor such considerations into its building designs. The same investor may also assess how many days an investment may be exposed to temperatures above a certain threshold to better understand the potential impact on the construction workforce and schedule.

Investors should therefore take care to understand how different hazards are assessed in different climate models and tools so that their analysis is the most appropriate for their particular circumstances.

2 CFRF (2024), CFRF AWG Adaptation Finance-Related Case Studies, p.5

EXPOSURE

The presence of people, assets and ecosystems in areas that could be negatively impacted by climate hazards.

Private markets investors are well-placed to understand the exposure of their in-scope investments to relevant hazards, given the fixed nature of real assets, and the greater insight that control investors may have into the physical assets related to an investment. Key exposure data requirements for real assets and private equity investors are highlighted in Figure 4.

Figure 4: Location requirements by asset class

Real estate
Depending on scope, asset-location coordinates for: ■ physical assets ■ value chain assets ■ surrounding area
Infrastructure
Same as real estate requirements with the potential addition of shape files for linear assets
Private equity
Depending on scope, asset-location coordinates for: ■ physical assets owned or occupied by the portfolio company ■ value chain assets ■ surrounding area

Where specific location data is unavailable or difficult to obtain – potentially more likely for private equity investors – investors should first engage with their investments to gather relevant information.

Where engagement with an investment and other research does not provide all the necessary information needed, investors can still conduct an initial analysis at a general country- or regional-level, although this will necessarily result in the analysis being less accurate for individual investments. Another alternative is to use an external tool provider who may have databases listing the physical assets of a given company, though this is often available for large public companies only (these providers are explored in more detail below).

Linear assets

When assessing risks to linear assets, such as power lines or roads, the infrastructure investors consulted by the PRI highlighted:

- assessing exposure at multiple points along the asset's trajectory to calculate an average overall score for the asset;
- assessing exposure at specific, strategically important locations along the asset – for example, junctions/intersections and toll booths in the case of toll roads – so that key risks are not overlooked because of the average score generated for the whole asset.

VULNERABILITY

The potential for climate risk to adversely affect an investment. Vulnerability captures an investment's sensitivity to harm – based on the characteristics and/or business model of the investment – and its adaptive capacity, or how well it can adapt, anticipate, respond to and recover from a given climate hazard.

Vulnerability analysis is a crucial element of the assessment that helps investors understand what adaptation measures may already be in place or be required for individual investments. Investors consulted for this guidance highlighted how it helps provide a more comprehensive view of the likely financial (and other) impacts on an investment and/or across a portfolio. Without the vulnerability analysis element, any findings from a physical climate risk assessment will likely only be indicative of the potential risks.

A full vulnerability analysis typically only takes place as part of an in-depth assessment as it requires a level of resource, asset-specific data (see Table 1 for examples), and technical knowledge that is not feasible during an initial high-level assessment.

Table 1: Examples of data points used in vulnerability analysis

Sources of vulnerability	Data points
Physical asset	■ building characteristics (i.e.: property type, age, materials used, elevation, number of floors, locations of critical equipment such as electrical utility units and HVAC units) ■ building energy ratings ■ local building standards ■ existing and planned adaptation measures
People	■ population density of surrounding area ■ community resilience programmes and awareness
Local infrastructure	■ planned or existing local adaptation and resilience measures (for example, sea walls) ■ the breadth and reliability of surrounding infrastructure
Business activities	■ characteristics of business activities/operations ■ business continuity plans ■ insurance coverage ■ supply chain robustness ■ market sensitivity to price shifts ■ stability of local ecosystem(s) on which the asset/investment may depend

However, some vulnerability data may also be built into tools that support high-level assessments. Investors should seek to gather this data on an ongoing basis, from a range of potential sources, including:

- from investments – whether from assets owned and operated directly by real estate and infrastructure investors or through engagement with portfolio companies and/or third-party managers and operators;
- by comparing similar asset types within the same geography to consider how and if they have similar vulnerabilities;
- through insurance companies, which have historically assessed the vulnerability of different asset types to certain hazards to determine likely risk levels and set premiums accordingly;
- through external tool providers, who typically include some – generally still limited – coverage of vulnerability in their products. Some tools give users the option to select from a pre-existing list of vulnerability data points and/or potential adaptation measures that can be factored into their risk analysis. Other tools offer users the ability to input these data points or potential adaptation measures for different investments or asset types.

Case Study

LEGAL & GENERAL

Using vulnerability data points to enhance physical climate risk assessments

Legal & General's approach to understanding physical climate risks and their impact on the real estate equity assets in its Private Markets division has evolved over time. In particular, it has worked to build better asset-level data, such as existing resilience measures, into its climate database and modelling, especially for properties at medium-to-high flood risk. This has included factors such as asset type, structural design and existing adaptation measures for extreme wind and flood risks. Re-running physical climate risk assessments, originally conducted in 2022, with these additional data points resulted in reductions in the risk scores for many of these previously high-risk assets for both 2030 and 2050. A series of next steps are planned, including:

- expanding modelling to include risks to assets from other climate hazards, such as soil subsidence;
- developing new guidance on asset-level adaptation;
- taking more data-driven decisions on how to further improve the climate resilience of real estate equity portfolios.

IMPACTS

Physical climate risk analysis often focuses on the potential physical damage to investments; by understanding how and where broader impacts may occur, investors can conduct a more nuanced assessment and gain a fuller view of potential risks (see Table 2).

Similar to vulnerability, understanding potential impacts is likely to be an iterative process – some may only become apparent during a more in-depth analysis – and will likely require engagement and coordination between the sustainability, risk and investment teams internally and management at the investment itself.

To see how the four categories of data we have outlined complement each other, consider a railway operating in an environment facing increasingly extreme temperatures. This railway operation is subject to the:

- hazard of extreme heat
- exposure of its location
- vulnerabilities of its operations, such as the quality/ manufacture of the railway tracks

These three data points feed into the fourth area, helping to highlight the range of potential impacts on railway operations (and ultimately financial performance). For example, physical damage to the tracks may in fact be low, because the tracks have been designed to withstand extreme temperatures. On the other hand, the risk of lower revenues may be higher because fewer people travel during extreme heat events to avoid a lack of adequate air-conditioning in the train carriages.

Table 2: How extreme heat can impact railway operations

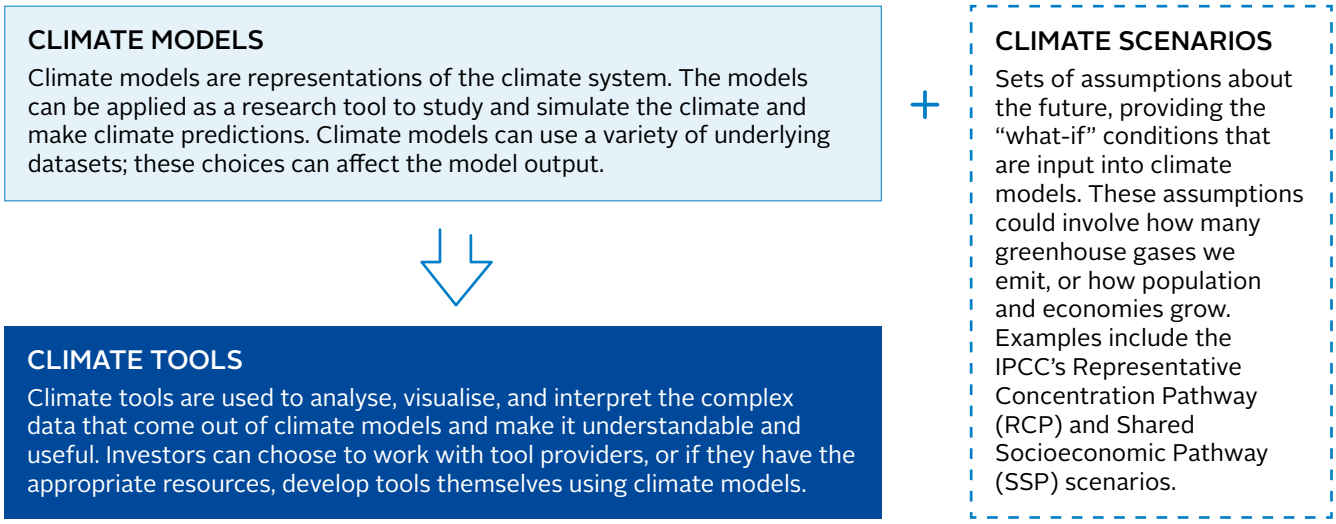
Sample impacts on operations/services	Sample impacts on stakeholders
Railway tracks buckle	Heat stress for passengers and employees
Imposition of speed restrictions causing delays and disruption	Cost of additional services (for example, extra air-conditioning)
Associated services (e.g. overhead power lines) operate less efficiently	Lower passenger numbers
Inability or delays to carrying out essential maintenance	Changing work patterns (night shifts to avoid heat)
Subsidence issues undermine track stability	

CLIMATE MODELS, SCENARIOS AND TIME HORIZONS

Investors need to select the climate models and climate scenarios that will underpin their assessments. Climate models use scientific principles to provide a representation of the climate system and make baseline climate predictions, while climate scenarios introduce a variety of future variables (emissions change, population growth, economic performance etc) that can be inputted into climate models to see how they might affect those baseline predictions.

In a typical physical climate risk assessment, climate tools – whether developed in-house or from commercial providers – are used to analyse, visualise and interpret the data described above using different climate models and scenarios.

Figure 5: Relationship between climate models, tools and scenarios



CLIMATE SCENARIOS AND TIME HORIZONS

Scenario analysis, or understanding how risks and impacts change under different climate scenarios and time horizons, is particularly relevant for many infrastructure and real estate investors, given their typically long holding period. Some real assets investors report assessing risks up to the year 2100. However, private equity investors should also include such considerations in their analysis. Even if physical climate risk is considered low during the investment holding period, higher risks beyond the holding period could have an impact on valuations and/or the ability to find buyers for investments at exit. The EU's Corporate Sustainability Reporting Directive (CSRD), for example, requires firms to report on their assessed material sustainability risks (which may include physical climate risk) over three terms: short (the current year); medium (up to 5 years); and long (up to 10 years).

Commonly used climate scenarios

There is no single source or definitive set of climate scenarios to use. Ideally, investors should conduct analysis across at least two different scenarios. This should include one scenario that aligns with global climate change mitigation goals, reflecting significant policy action to reduce carbon emissions by 2050; and a further scenario(s) which reflects more pessimistic or worst-case climate developments. Where possible, scenario analysis should also consider socio-economic factors to ensure that a fuller array of potential risks and impacts are considered.

Investors consulted for this guidance commonly use a range of the IPCC's Representative Concentration Pathway (RCP) scenarios that represent different greenhouse-gas concentration trajectories and/or the IPCC's Shared Socioeconomic Pathway (SSP) scenarios that integrate socioeconomic factors with climate projections. The most recent IPCC scenarios, from the Coupled Model Intercomparison Project Phase Six (CMIP6), link RCPs to SSPs to improve the robustness of climate projections. In total, CMIP6 provides eight climate scenarios that may be used in scenario analysis depending on an investor's circumstances.

The Network for Greening the Financial System (NGFS) scenarios are also used by some investors. These scenarios were designed to provide financial institutions and authorities a common set of scenarios for analysing climate risks to the economy and the stability of the financial system.

The UK Financial Conduct Authority (FCA)'s approach to climate scenario selection

The UK FCA's Climate Financial Risk Forum sought advice from the scientific community on which climate scenarios and datasets should ideally be used by the finance sector for scenario analysis over different timescales.

The group has recommended investors use the Aim-Build-Contingency (ABC) framework to develop their approach to climate-related financial risks and opportunities. The ABC options are:

- A: Aiming for average global warming of 1.5°C (proxy: IPCC's SSP1-1.9 scenario, using the median climate response).
- B: Building and budgeting for 2°C of average warming by 2050 (proxy: IPCC's SSP2-4.5 scenario, using the median climate response).
- C: Contingency planning for 2.5°C of average warming by 2050 (proxy: IPCC's SSP3-7.0 scenario, using the 95th percentile of the climate response).

Limitations

Assessing physical climate risks against long-term time horizons and different scenarios inevitably entails certain limitations, despite the advances in climate science in recent years. For example:

- Most scenarios are likely to underestimate risk, as models generally do not capture tail risk and tipping points.
- Longer-term time horizons, particularly beyond 2050, inevitably contain inherent uncertainties or unknowns that cannot be accurately modelled.
- The climate outcomes labelled "most likely" may give a false sense of security, as it is plausible that without an acceleration in ambition on decarbonisation, warming could reach catastrophic levels of beyond 3°C.

Such limitations do not diminish the importance of carrying out climate scenario analysis. However, they serve to emphasise the point that physical climate risk assessment should be a dynamic process, updated as the climate science and associated climate models change, and also likely to rely on qualitative assessment and judgements as much as quantitative analysis.

Data sources

These resources collate some of the data sources available to investors for climate hazard indicators and scenario modelling. Where possible, investors should consider using both local (for example: Met Office UK climate projections) and global (for example: IPCC ARG WG1 interactive atlas) tools and datasets.

- World Bank's Climate Information Resources: a list of tools and resources which can be used to identify key climate and disaster risks to a project location, including:
  - Climate Risk Country Profiles: a high-level assessment of physical climate risk for a number of different countries;
  - The Knowledge Portal: a hub of climate-related information, data and tools.
- Environmental Change Institute's Climate Data 111+°: a synthesis of hazard data sources.
- United Nations Environment Programme Finance Initiative's (UNEP FI) Climate Risk Dashboard: a database of more than 60 climate-related-risk tool providers.

RISK ASSESSMENT

Information gathering

- Define the scope of the assessment
- Gather key data
- Identify climate models, scenarios and time horizon to conduct analysis.

Risk assessment

- High-level assessment
- In-depth assessment.

Taking action

- Use insights to inform investment strategy and decision-making
- Implement adaptation measures
- Support reporting and disclosure.

This section outlines different approaches to physical climate risk assessment, covering both high-level and in-depth assessments. It describes the different ways in which these be conducted and explains the potential outputs. It also explores the role of external tool providers in the risk assessment process and includes a list of questions to help investors when choosing a provider.

Investors should consider what type of physical climate risk assessment – whether high-level or in-depth – may be most appropriate for the investments in scope. Table 3 summarises the characteristics of these two approaches; more details on each approach follow.

Table 3: High-level or in-depth: Comparing two approaches to risk assessment

	High-level assessment	In-depth assessment
Use for...	▪ Single investment, subset of portfolio or whole portfolio	▪ Most likely for single investments or subset of portfolio
When conducted	▪ During due diligence ▪ Periodically during the holding period – either at set intervals or in response to specific events	▪ More often during the holding period ▪ Potentially pre-investment, particularly for higher-risk investments
How conducted	▪ Potential to develop in-house tools/ methodologies (likely with support of external consultants) ▪ External tool providers	▪ Likely led by specialist consultants ▪ Requires active input from investment and other relevant stakeholders
Core focus	▪ Exposure of investments to climate hazards (with vulnerabilities included to the extent possible)	▪ More nuance on exposure and hazard analysis ▪ In-depth vulnerability and impact analysis
Likely outputs	▪ Risk scores for each investment or other visual representation of risk (such as heat maps) ▪ Indicative financial metrics ▪ High-level recommendations for next steps	▪ Detailed recommendations on adaptation measures ▪ More accurate financial metrics and projections
Other considerations	▪ Likely first step for many investors, builds capabilities and awareness ▪ Less time- and resource-intensive	▪ In most cases, more realistic for majority or control investors to conduct

HIGH-LEVEL ASSESSMENT

A high-level assessment provides investors with a quick view of where and what key physical risks may arise for their investment(s). This type of assessment is likely to be a first step for many investors and their investments. It is often carried out as part of due diligence in the initial stages of the investment process, or as a first review of potential risks within a current portfolio. The goals include informing potential investment and asset management decisions; highlighting the need for more in-depth analysis of higher-risk investments; and building awareness and understanding of potential risks, both internally and at the investment level.

These assessments use the available hazard, exposure, and vulnerability data previously gathered to determine the potential risks for each investment(s). The analysis should then be repeated using different climate scenarios and time horizons to give investors both a baseline view of current risks and projections of future risks.

High-level assessments should also be conducted on a periodic basis through the holding period, either on an agreed schedule (for example, an annual review), or in response to specific events such as:

- when underlying climate models and data supporting the analysis are updated;
- when insurance coverage is renewed;
- after adaptation measures have been implemented to assess for their impact;
- in response to major climate events.

APPROACHES

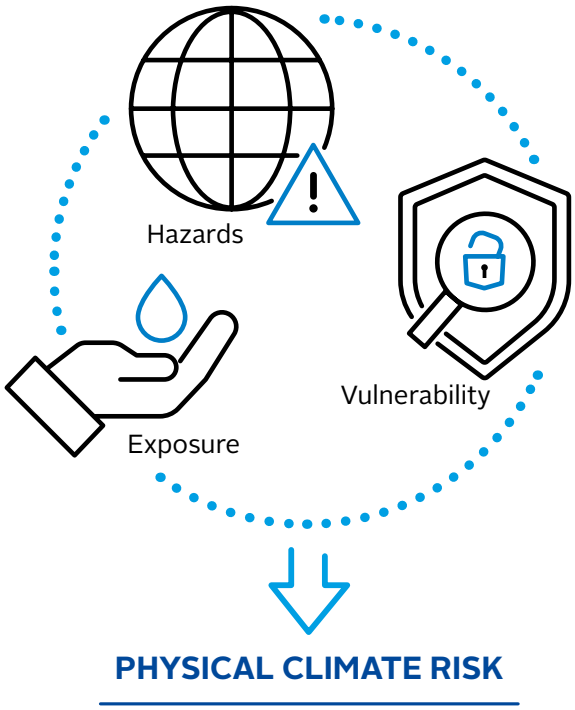
In-house

Some investors seek to build in-house tools or methodologies, often with the support of an external consultant, to conduct the analysis. This is likely to be an iterative process: investors can build their knowledge and capabilities over time and leverage the findings of initial assessments run by external providers to help with that process.

Working in-house has the benefit of ensuring that any analysis may be more closely integrated with the investor's broader risk assessment and overall investment process, with outputs better able to be tailored according to the investor's specific requirements. More challenging components, such as vulnerability data or value chain considerations, may be more easily built into an internal methodology than into an externally developed tool.

This work may also help build greater alignment between sustainability, investment and risk management teams, and other relevant internal teams (such as procurement and legal and compliance), as each will likely rely on information and analysis from the others to complete the work.

Figure 6: Assessing physical climate risk



Case Study

EQUITIX AND MOTT MACDONALD

Developing an in-house tool to analyse portfolio-wide risks

Equitix, an infrastructure investment manager with a diverse and global portfolio, identified data availability as a significant challenge to integrating physical climate risk and resilience considerations into active asset management processes. To address this, it partnered with Mott MacDonald, an engineering consultant, to develop a top-down tool for assessing risk and resilience across its portfolio.

This tool incorporates several factors, such as the vulnerability characteristics inherent to each sector and the local geographical context, ensuring that assessments yield actionable insights for investment and asset management processes. Following the portfolio-wide assessment, the findings enabled a more comprehensive analysis of 20 priority sites identified for their high financial materiality and climate risk exposure. Through dialogue with underlying asset teams and tailored surveys, a review was conducted to establish the climate resilience measures for these shortlisted projects.

External tool providers
External tool providers are commonly used by investors to conduct high-level physical climate risk assessments.

Tool providers' offerings on climate-related risks typically include:

- access to a range of climate databases, including public, private and proprietary databases, and expertise in data analysis and modelling;
- the option to assess against different climate scenarios and time horizons;
- a range of outputs, including risk ratings/scores, financial metrics, adaptation and resilience measure recommendations and climate risk reports;
- data export functionality, so that investors can use the data directly within their investment and/or risk models.

Tool providers generally require investors to provide detailed information about the physical locations of assets in order to conduct their analysis. However, in some cases, these providers can assist in identifying the locations of assets owned or occupied by investments.

Some providers also incorporate vulnerability data to provide a more granular assessment. Data can come from the investors themselves, from comparable companies used as proxies or from an archetype of particular assets. However, in general, obtaining detailed vulnerability data and some exposure data, such as value chain information (if in scope), remains a challenge and is a focus for further research and product development by tool providers.

Choosing a tool provider
The number of physical-risk tool providers in the market has grown substantially in recent years. Selection of a tool provider by an investor is an important decision because, despite the broad commonalities of their products and outputs, the underlying methodologies and coverage of the providers remains varied – investors should thoroughly review potential providers' methodologies and services to ensure that they choose one that best serves their particular needs and circumstances.

Table 4 provides a list of relevant questions investors may find beneficial.

The Climate Risk Dashboard from UNEP FI presents a detailed overview of more than 60 climate-related risk tools, highlighting their features, methodologies and common applications, with updates provided quarterly. UNEP FI's 2024 and 2023 Climate Risk Landscape Reports provide a comparison of selected providers.

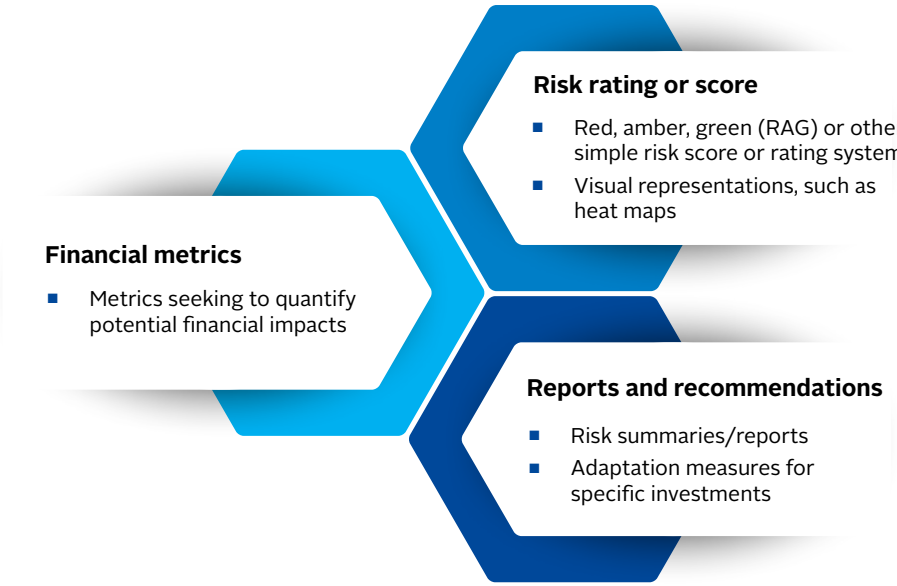
Table 4: Questions to consider when choosing a tool provider

How does the provider support my strategic objectives?
■ How can the provider's outputs be integrated into the investment process and strategic business decision-making? ■ Does the provider offer education to investment teams to ensure they can interpret outputs correctly?
How do the provider's services/outputs support my physical risk assessment process?
■ What types of assets are covered? ■ Are all hazards I want to evaluate covered? Are the hazards they cover material to my specific sectors or industries? ■ Does the provider's data cover my geographic area of focus? ■ Does the selection of climate scenarios align with my strategic objectives, reporting, and risk assessment needs? ■ Does the provider use open-source, private or proprietary data, or a combination? ■ Does the provider offer transparent information about the underlying climate models and methodologies and the frequency of updates? Is the data of high quality and the appropriate granularity? ■ Does the provider have the capabilities to assess linear assets, if applicable? If so, how does it conduct these assessments? ■ Does the provider's risk assessment methodology include consideration of vulnerability data? If so, how? ■ Does the provider's risk assessment methodology take into account non-physical damage impacts of climate events? If so, how?
What outputs, including financial metrics, does the provider generate?
■ What financial metrics are generated, and what are the assumptions behind the calculation of those metrics? Can the underlying data/assumptions be supplied separately so that they can be plugged directly into our own financial/risk assessment models? ■ How are risk scores defined and calculated? ■ Will the outputs support my reporting and disclosure requirements? For example, LP reporting and/or ISSB disclosures?

Source: Adapted from the Urban Land Institute's decision-making framework supplemented with research findings

OUTPUTS

The analysis described above – whether conducted in-house or through an external provider – generates a range of information that needs to be distilled into outputs that are manageable and can serve a range of purposes for investors. These outputs may include:



Risk rating or score

An initial output may be risk rating(s) or score(s) for each investment or a visual representation of risk, such as a heat map, which can help communicate the spatial distribution of potential risks in relation to investments. These ratings/scores are typically generated automatically by climate risk tools. However, we recommend a sense check of findings to see if they correlate with the experience and understanding of different internal teams and with the investment itself.

Ideally, investors are able to see these ratings/scores presented in different ways:

- An overall rating/score for each investment, based on (weighted) averaging or totalling the rating/score for each risk assessed for each investment. This provides a simple view of the potential risk to a single investment, and an easy comparison across a subset of investments or for a whole portfolio.
- A rating/score for the individual components of assessment for each investment, such as hazard type and/or the type of impact on the investment. This enables investors to better understand the underlying drivers behind the overall rating/score, and also to identify potential higher risks or nuances that may be obscured by the overall rating/score.
- Overall and individual ratings or scores for the same risks and investments under different climate scenarios and time horizons.

For portfolio-wide assessments or assessments of a subset of investments, the rating or score for each investment can be averaged or totalled for an overall view of potential risk.

Figure 7: Examples of risk rating/score outputs

Hazard ratings	
Flooding	Low
Wildfire	High
Heat stress	Low

Overall risk rating/score = Medium

Exercise repeated under different scenarios/time horizons to see how ratings/scores may change

Impact ratings	
Physical damage to structures	Low
Equipment damage	Medium
Electricity outage	High
Worker productivity	Medium

Financial metrics
In addition to the risk ratings/scores, various metrics may be used to estimate the financial impacts of physical climate risks. The metrics indicate which investment(s) may suffer the greatest loss or damage or have a disproportionate financial impact on a portfolio if a significant climate event were to occur, or seek to capture the total financial impact across a portfolio. The metrics can also potentially be built into investment analysis models, or used in reporting to clients (although limitations relating to their use are noted below).

Commonly used metrics include:

- **Average Annual Loss (AAL)**: the expected average annual financial loss related to physical climate risks over a defined period of years.
- **Annualised Damage Rate (ADR)**: the expected financial damage per unit of exposure. For example, the financial damage potential per $1,000 value of an asset or portfolio.
- **Climate Value at Risk (CVaR)**: forward-looking estimates of the total loss or gain an investment or portfolio may experience under different climate scenarios, within a given time horizon, at a particular probability. It is expressed as a percentage and/or as a value in a selected currency.

Reports and recommendations
A final output of the high-level assessment may be a general risk report and/or initial recommendations for taking further action. These outputs can be used in different ways, such as to support specific disclosure requirements and to share with investments and with internal teams to raise awareness and build buy-in for further action, where appropriate.

Some tool providers provide automatic report outputs which include a summary and detailed analysis of portfolio- and investment-level risk profiles. Tool providers and/or external consultants may also be able to help investors with insights and initial recommendations for possible adaptation measures that can help manage these risks and build long-term climate resilience. Ideally, these recommendations should also include broad indications of implementation costs and potential returns on investment.

LIMITATIONS

High-level assessments can yield inconsistent or incomplete results due to differences in the underlying data sources, variability in the availability of data, data processing techniques and climate models used. For example:

- Key inputs such as hazards and vulnerability data may be analysed differently in different climate models.
- Different combinations of time horizons and climate scenarios will result in different risk ratings/scores and associated financial metrics.
- Financial metrics such as AAL and CVaR take different angles and should not be conflated.

The variability of assessment methodologies and outputs can lead to potentially significant differences in risk ratings/scores and associated financial metrics for the same investments. For example, an institutional real estate manager compared three tool providers and shared the findings with the Urban Land Institute, a real estate industry association, as depicted in Table 5.

Table 5: Tool providers' physical risk assessments vary

Investment	State	Vendor A	Vendor B	Vendor C
A	California	High	Very Low	Low
B	District of Columbia	Medium	Very Low	Low
C	Florida	Low	Medium	Very Low
D	Illinois	Medium	Very Low	High
E	New York	Very high	Low	Medium
F	Texas	Medium	Very Low	Low
G	Virginia	Medium	Very Low	None

Source: Urban Land Institute

As a result, investors have concerns about the quality and reliability of outputs from physical risk assessments, including:

- lack of consensus in the industry as to the best single financial metric to use. When using financial metrics, particularly when reporting to clients, investors should ideally provide a narrative to explain the underlying assumptions and methodologies used in calculations.
- a focus on physical damage to fixed assets to the exclusion of a broader range of potential impacts from climate events, such as business interruption. As such, outputs may not give a total view of risk.
- an incomplete view of the vulnerability of individual investments, resulting in an underestimated or overestimated picture of risks.
- lack of transparency in the methodologies used by tool providers to calculate risk scores/ratings and financial metrics.

It is important that these limitations do not stop investors from conducting physical climate risk assessments. Rather, the limitations serve to highlight the importance for investors of understanding the key inputs to any assessment, so that the analysis and its outputs are as appropriate and accurate as possible for their particular investments. Moreover, climate science, models and commercial tools are consistently evolving and improving. Therefore, the quality of assessments will also improve over time.

In the meantime, any outputs – particularly financial metrics – should be considered as indicative rather than definitive; to help inform rather than fully define the next steps of the decision-making process.

It is important that these limitations do not stop investors from conducting physical climate risk assessments. Rather, the limitations serve to highlight the importance for investors of understanding the key inputs to any assessment...

IN-DEPTH ASSESSMENT

A high-level assessment may convince investors of the need for a more in-depth risk analysis of an investment or set of investments. If conducting an in-depth assessment is not feasible for minority investors, they should influence their co-investors to do so, where appropriate.

Some investors may also go straight to this stage, for example where certain risk factors may be considered so material to an investment that they merit an immediate detailed assessment.

The in-depth assessment is likely to focus on both a deeper evaluation of an investment's vulnerability to climate hazards, and a more granular assessment of how different hazards may impact an investment.

For an investment's vulnerability, the assessment will seek to identify existing adaptation and resilience measures. These may include:

- structural measures or features in place at the investment, such as the use of particular building materials and designs, and in the surrounding area, such as flood barriers;
- non-structural measures, including any relevant systems, processes and capabilities implemented by the investment to manage physical climate risks.

For hazards, the assessment will seek to identify the very local characteristics of how particular hazards materialise in relation to an investment. For example, how the surrounding area – open space, built-up or covered in vegetation – may impact wind speeds or the intensity of floodwaters. This is unlikely to be captured by climate models.

PURPOSE

An in-depth assessment allows investors to:

- develop a more comprehensive and accurate view of risks to an investment(s), and allow for more informed comparisons of potential or actual investments in different geographies or sectors;
- better identify existing or potential adaptation measures for a specific investment(s) where needed, and the impact of such measures on the investment's resilience and ultimately its financial performance;
- more accurately calculate associated financial assumptions – for example, in relation to potential capital or operational expenditure requirements – and as a result, make more-informed investment decisions.

Assessing climate risk for infrastructure investors
The Institutional Investors Group on Climate Change (IIGCC) has created a methodology to help infrastructure investors and project partners evaluate the operational, commercial and financial materiality of physical climate risk. The Physical Climate Risk Assessment Methodology (PCRAM) also lets investors integrate the value of climate resilience in decision-making. PCRAM aims to support investors in looking beyond single financial metrics, such as CVaR, to consider the benefits of resilience across an asset's lifecycle. PCRAM can be applied broadly across different infrastructure assets, financing and ownership models and geographical locations – each facing different climate risks. The second phase of this methodology is currently underway – PCRAM 2.0 – which will offer broader coverage across infrastructure and real estate assets.

In-depth assessments are typically carried out with the support of specialist consultancies and/or engineering firms, and as such can entail a significant cost. Depending on the case, investors may choose to bear the cost themselves or pass it on to the investment. Either way, the decision to proceed with an in-depth assessment should ideally be mutually agreed and based on the needs of each investment.

Case Study

HELIOS INVESTMENT PARTNERS

Comparative climate risk analysis

Helios Investment Partners, the largest Africa-focused private investment firm based in London, considered investing in a leading vertically integrated agrifoods business in North Africa. The Investment Committee (IC) expressed concerns about potential negative impacts of climate change on the business under various climate scenarios. Members sought to understand the comparative yield potentials of three different crop varieties across competing markets and countries, with a particular focus on future water availability.

To address these concerns, Helios engaged a specialist consultancy to conduct a comprehensive analysis, which included:

- **Qualitative literature review**: This review assessed analyses of the impacts of climate change and relevant adaptation measures, incorporating expert insights on how climate-related risks might differentially affect various crop varieties.
- **Quantitative Climate Change Risk Assessment (CCRA)**: The CCRA evaluated projected changes in key climate variables – maximum and minimum temperatures, precipitation, solar radiation, relative humidity and wind speed – using the SSPs. Specifically, it used SSP2-4.5 as the middle-of-the-road scenario (with warming limited to 3°C) and SSP5-8.5 as the worst-case scenario (with warming exceeding 4°C) for the years 2030, 2040 and 2050. This assessment included projected yield changes to determine how climate change could impact future production for the agrifood company's operations and in other competing countries and markets.
- **Qualitative commentary on water availability**: This analysis focused on how climate change might affect precipitation patterns and water availability in the company's primary country of operation.

The findings indicated that the company's main country of operation was not significantly more exposed to physical climate risk compared to other competing regions. Potential yield reductions could be mitigated through adaptive production practices, improved growing methods, water conservation strategies and the adoption of climate-resilient crop varieties.

APPROACH

These assessments are likely to be conducted through a combination of approaches, including site visits (in person or remotely), document reviews and stakeholder engagement.

Key activities may include:

- gathering information from stakeholders at the investment, including through workshops and interviews with management and key personnel;
- reviewing relevant national or local government adaptation plans or any planned or actual measures implemented, for example, in industrial development zones or business districts;
- where relevant, conducting property manager or third-party-operator surveys;
- engaging with key stakeholders outside of the investment, such as community groups, business associations, and local authorities to better understand the local environment, response and adaptation capabilities and the appropriateness of different adaptation measures for the local context;
- reviewing contracts to understand how the risks are allocated between stakeholders to enable an understanding of net risk;
- reviewing insurance contracts and coverage

Some investors have found that the same asset types can have similar vulnerabilities and therefore similar adaptation and resilience measures might be applied. Lessons from one (or a handful of) assessment(s) may therefore be applied across a larger number of investments, without the need for conducting in-depth assessments at each, saving time and money. However, it should be noted that learnings gained will likely apply only for investments in similar geographies and exposed to the same climate hazards.

OUTPUTS

The key output from this process is likely to be a detailed report including:

- a detailed assessment of the current and future risks to the investment, including both physical impacts to the investment and broader business impacts (such as impact on workforce, operational disruption etc);
- recommendations for the type of adaptation and resilience measures needed, if any, and their potential to mitigate the risk to the investment;
- detailed financial calculations, including estimated financial loss or damage, the capital and operational expenditures associated with implementing recommended adaptation and resilience measures, and potential returns on investment – to the extent feasible – after these measures are implemented.

Case Study

BBGI

Climate-related risk analysis on infrastructure investments

BBGI Global Infrastructure, an infrastructure investment manager, modelled risk exposure against eight climate hazards across three time periods (2020, 2050 and 2100) for a portfolio of 56 brownfield infrastructure assets. It then conducted a more-targeted analysis of 20 assets in the portfolio.

A specialist consultancy helped develop a tailored approach to assessing the physical and financial vulnerabilities of each asset. The in-depth analysis further included detailed scenario analysis for the 20 assets, factoring in the impact of existing or potential adaptation measures on the risk scores and associated financial metric (in this case AAL) for each asset.

The assessment has informed BBGI's climate-related risk strategy, ensuring that these risks are integrated into investment decision-making and ongoing monitoring. Additionally, BBGI created bespoke climate factsheets for each physical asset, which are shared with stakeholders to encourage proactive risk management and adaptation efforts.

TAKING ACTION

Information gathering

- Define the scope of the assessment
- Gather key data
- Identify climate models, scenarios and time horizon to conduct analysis.

Risk assessment

- High-level assessment
- In-depth assessment.

Taking action

- Use insights to inform investment strategy and decision-making
- Implement adaptation measures
- Support reporting and disclosure.

Investors can use findings from physical risk assessments to:

- inform investment strategies and decisions;
- engage with investments and implement adaptation measures;
- improve disclosures and reporting to regulators, clients and other stakeholders.

INVESTMENT STRATEGY AND DECISION-MAKING

Physical climate risk assessments can inform decisions around an investor's overall strategy and/or the investment process.

At a strategic level, the assessment can:

- contribute to decisions on particular asset types, sector(s) or geography(s) through understanding the relative financial impact of physical climate risks on actual or potential investments across different markets and geographies;
- (particularly for private equity investors) highlight products and technologies that may support greater resilience both for their investments and potentially at a system level.

For an individual investment(s), the findings can:

- support more accurate investment valuations by highlighting potential risks, the associated costs and benefits of mitigating risks, and impacts on cash flows and discount rates;
- prompt deeper investigations, notably on insurance coverage, to assess gaps in current policies or the need for additional coverage to safeguard against identified risks;
- support a go/no-go decision on potential investments, taking into account factors such as the potential for physical asset stranding and/or discounting, for example, due to the lack of affordable insurance coverage[3] and/or damage and other impacts resulting from climate-related events.

3 Khoo and Yong (2023), Too hot to insure - avoiding the insurability tipping point, p37

IMPLEMENTING ADAPTATION MEASURES

Adaptation measures – where needed – should be included in investment-level action plans (or equivalent) for investments with the aim of achieving more resilient and sustainable businesses or assets (see Table 6 below). These measures can be implemented either directly, where real assets investors own and operate assets, or through engagement and in collaboration with investments and other stakeholders (such as third-party operators or managers of real assets) as appropriate.

Adaptation measures can be "hard" – for example, design and engineering solutions or nature-based solutions – or "soft" – such as business continuity and crisis management plans, product innovations and consideration of how to adapt to changing market conditions.

A formal plan should be developed based off an initial register or summary of key risks. This plan would detail the necessary actions and their associated costs (and benefits), supporting an analysis of their impact over the lifetime of the investment and beyond. The plan should ideally be developed in conjunction with relevant stakeholders – whether the management team at the investment, third-party operators or managers of real assets, engineering, procurement and construction (EPC) contractors or others. This engagement is critical to ensure that the most appropriate measures are put in place, to help build buy-in and to be better able to monitor progress against key milestones and targets.

Case Study

SAVILLS INVESTMENT MANAGEMENT

Building resilience to heat stress in Spain

During the acquisition process for a residential asset in Valencia, Spain – Sky Homes – the Savills IM investment team collaborated with ecologists and sustainable development consultants to conduct a comprehensive ecological assessment. The findings revealed the opportunity to leverage the power of nature by implementing a range of green infrastructure measures to combat heat stress, a key climate risk in the region. A green roof will act as a natural insulator, reducing indoor temperature fluctuations and providing additional thermal comfort to residents. The future installation of a natural vertical garden, in collaboration with experts in ecological restoration, will contribute to the property's cooling capacity and will provide shade as well as facilitate evaporative cooling through transpiration. These innovative installations will not only shield the building from direct solar radiation but also absorb and dissipate excess heat, thus mitigating the urban heat island effect prevalent in many cities like Valencia.

Table 6: Sample elements of an adaptation plan

Adaptation measures	▪ Summary of the assessment findings, highlighting key vulnerabilities and risk areas. ▪ Detail of the specific adaptation measures planned to mitigate identified risks.
Roles and responsibilities	▪ Define roles and responsibilities for coordinating, implementing and monitoring actions.
Financial plan	▪ Estimate both human and financial resources required for the adaptation measures. ▪ Identify potential funding sources and allocate budget for planned adaptation expenditures. ▪ Conduct analysis of how measures may influence insurance premiums and coverage options.
Monitoring and evaluation	▪ Establish a clear timeline for the implementation of adaptation measures, with specific milestones and deadlines to track progress. ▪ Define specific indicators that align with the adaptation objectives to measure the effectiveness of the implemented measures
Engagement	▪ Actively engage all relevant stakeholders through established communication channels to ensure buy-in and support for the adaptation initiatives. This should include regular updates and feedback loops to incorporate stakeholder insights into the adaptation process.

DISCLOSURE AND REPORTING

Investors can incorporate results from their physical climate risk assessments into their reports to regulatory bodies and stakeholders, including:

- corporate and investor disclosure requirements mandated by financial authorities and regulators, as well as requirements of voluntary initiatives and standards;
- LP/asset owner reporting requirements;
- other reporting, such as public sustainability reports.

Disclosure requirements
Requirements to disclose physical climate risk come from a range of bodies and can apply to both corporates and investors (Table 7).

More than 30 countries have now implemented the International Sustainability Standards Board (ISSB) standards or are currently doing so, meaning that listed companies, including listed investors, will need to report on physical risk.

While many current disclosure frameworks emphasise broad themes, such as governance and targets, investors who have an established risk assessment process in place can choose to report on the actions they are taking to manage identified risks. Investors may opt to disclose details of their[4]:

- physical risk assessment approach
- physical climate-related risks and opportunities identified
- degree of exposure to physical risks
- climate governance and risk management processes
- targets used to manage climate-related risks and opportunities
- adaptation and resilience approach, objectives, planning efforts, and capital allocation (whether directly for real assets, or through engagement with investments)
- policy engagement efforts.

Table 7: Examples of disclosure requirements

For corporates
■ International Sustainability Standards Board (ISSB) ■ Corporate Sustainability Reporting Directive (CSRD) **Note:** Investors may also be subject to corporate disclosure requirements, given listing rules and the application of sector-specific requirements for the financial sector (e.g. with the ISSB and forthcoming requirements for the CSRD).
For investors
■ Net Zero Asset Owner Alliance Target Setting Protocol ■ Net Zero Investment Framework ■ PS21/24: Enhancing climate-related disclosures by asset managers, life insurers and FCA-regulated pension providers (UK) ■ Regional instruments such as the Australian Regulatory Guide 228 - Prospectuses: Effective disclosure for retail investors

4 IGCC (2024), Investor expectations of companies' physical climate risk management and resilience (pilot version), p3

Asset owner due diligence and reporting
During due diligence or a review process, asset owners should discuss climate risk with external investment managers. Similarly, investors in direct private equity and real assets should address these risks with their investments. IIGCC has developed a list of questions to aid these discussions (see Table 8).

Where respondees include financial metrics related to physical climate risks in their responses, these should ideally be accompanied by a narrative detailing the assumptions and methodologies used to calculate the metrics, particularly given their potential limitations, as previously noted.

Table 8: Examples of questions for investees and asset managers

Element	Question
Governance	▪ Can you describe how you manage the physical impacts of climate change? ▪ Who is responsible for assessing and managing the physical risks associated with a changing climate? ▪ Have you engaged with key stakeholders to understand their views on climate change-related risks?
Risk analysis process	▪ How do you identify climate change-related risks and opportunities, and what risks have you identified? ▪ What is the scope of your risk assessment? ▪ What datasets do you use to understand these risks? ▪ Do you use climate scenarios to inform your business scenarios (strategy or risk assessment processes)? If yes, what climate scenarios do you use? ▪ How do you define or assess the significance of these risks and opportunities?
Risk management	▪ Can you describe the major actions you are taking to respond to the physical impacts of climate change and improve asset resilience? ▪ What steps have you taken with your suppliers to ensure they are aware of and responsive to the need to adapt to climate change?
Monitoring and review	▪ What indicators or measures are you using to monitor the investment implications of the physical impacts of climate change? ▪ Have you established a structured process to monitor and review climate physical risks over time?

Reporting	▪ What information do you report on the implications of the physical impacts of climate change? Do you report on:
	  ▪ the investment implications of these impacts
	  ▪ the actions you have taken to mitigate these impacts
	  ▪ the effectiveness of the actions you have taken
	▪ How often do you report this information? If you do not currently report, do you have plans to start reporting?

Source: IIGCC

APPENDIX - RESOURCES

The list of additional resources below is intended to highlight some of the most relevant sources of information for practitioners looking to learn more about physical climate risk and how to conduct physical climate risk assessment. Practice on this issue is evolving and advancing, therefore the key resources may also evolve and other materials may become available with time. The list is divided into sections and subsections that mirror the structure of the paper.

Section	Sub section	Resource list
Background	What are physical climate risks?	■ PRI (2022), Achieving climate commitments in multi-asset portfolios ■ UNEP FI (2024), Climate-related risk: An investor resource guide ■ IIGCC (2020), Understanding physical climate risks and opportunities ■ IIGCC (2020), Addressing physical climate risks: key steps for asset owners and asset managers
Information gathering	Data requirements	■ ARUP (2024), Universal Taxonomy for Natural Hazard and Climate-related risk and Resilience Assessments ■ Umwelt Bundesamt (2023), How to perform a robust climate-related risk and vulnerability assessment for EU taxonomy reporting ■ Equator Principles (2023), Guidance Notes on Climate-related risk Assessment ■ EBRD (2019), Advancing TCFD guidance on PCRs and opportunities ■ ISO (2021), Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment ■ British International Investment (2024), TCFD Implementation toolkit
	Climate models, scenarios and time horizons	■ IIGCC (2024), Navigating Climate Scenario Analysis – A Guide for Institutional Investors. ■ Carbon Brief (2018), Q&A: How do Climate models work ■ NGFS (2023), Compound Risks: Implications for Physical Climate Scenario Analysis ■ UK Financial Conduct Authority (2024), Resilience Working Group: Short-Term Scenarios ■ OECD (2023), Paris-consistent climate change mitigation scenarios: A framework for emissions pathway classification in line with global mitigation objectives ■ GIC (2024), Integrating Climate Adaptation into Physical Risk Models
Risk assessment	High-level assessment	■ AIGCC (2021), Riding the wave of physical risks: A compendium of tools and service providers for investors in Asia ■ UNEP FI (2024), The climate data challenge: the critical role of open-source and neutral data platforms ■ UKGBC (2022), A Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets ■ ResReal (ongoing), Physical climate risk assessment and resilience certification for real estate in Japan
Taking action	Implementing adaptation measures	■ Better Buildings Partnership (2022), Climate Resilience Guide ■ WBCSD (2024), The Business Leaders Guide to Climate Adaptation & Resilience ■ ARIC (2024), Adaptation & Resilience Impact: A measurement framework for investors ■ IIGCC (2021), Building Resilience to a Changing Climate: Investor Expectations of Companies on Physical Climate Risks and Opportunities ■ BCG, Global Resilience Partnership and USAID (2023), From risk to reward: the business imperative to finance climate adaptation and resilience ■ CFRF (2024), Mobilising Adaptation Finance to Build Resilience ■ UNEP FI Principles of Responsible Banking, the Resilient Planet Finance Lab (2024), Adaptation Targets and Metrics
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The Principles for Responsible Investment (PRI)

The PRI works with its international network of signatories to put the six Principles for Responsible Investment into practice. Its goals are to understand the investment implications of environmental, social and governance (ESG) issues and to support signatories in integrating these issues into investment and ownership decisions. The PRI acts in the long-term interests of its signatories, of the financial markets and economies in which they operate and ultimately of the environment and society as a whole.

The six Principles for Responsible Investment are a voluntary and aspirational set of investment principles that offer a menu of possible actions for incorporating ESG issues into investment practice. The Principles were developed by investors, for investors. In implementing them, signatories contribute to developing a more sustainable global financial system.

More information: www.unpri.org

PRI Principles for Responsible Investment

The PRI is an investor initiative in partnership with UNEP Finance Initiative and the UN Global Compact.

United Nations Environment Programme Finance Initiative (UNEP FI)

UNEP FI is a unique partnership between the United Nations Environment Programme (UNEP) and the global financial sector. UNEP FI works closely with over 200 financial institutions that are signatories to the UNEP FI Statement on Sustainable Development, and a range of partner organisations, to develop and promote linkages between sustainability and financial performance. Through peer-to-peer networks, research and training, UNEP FI carries out its mission to identify, promote, and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

More information: www.unepfi.org

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United Nations Global Compact

The United Nations Global Compact is a call to companies everywhere to align their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption, and to take action in support of UN goals and issues embodied in the Sustainable Development Goals. The UN Global Compact is a leadership platform for the development, implementation and disclosure of responsible corporate practices. Launched in 2000, it is the largest corporate sustainability initiative in the world, with more than 8,800 companies and 4,000 non-business signatories based in over 160 countries, and more than 80 Local Networks.

More information: www.unglobalcompact.org

United Nations Global Compact