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Nature Stress Test: Sectoral Assessment of the IBEX 35's Resilience to the Impact of Nature Degradation

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Foreword

Natural ecosystems form the essential infrastructure on which the economy operates. The availability and quality of water, soil productivity, ecosystem stability and habitat integrity support a wide range of productive activities. However, these dependencies have not always been systematically incorporated into business and financial risk analysis. Against a backdrop of increasing pressure on natural capital, understanding the economic implications of nature loss is becoming increasingly important for assessing the resilience of the business sector and the long-term sustainability of business models.

This issue is particularly relevant in Spain, the country with the greatest biodiversity in the European Union. Spain's wealth of natural capital is a strategic asset, but its conservation also presents challenges that affect the continuity of certain economic activities, the availability of raw materials, supply chains and, consequently, business competitiveness. Integrating nature into corporate strategy should therefore be understood not merely as an environmental or regulatory compliance matter, but as part of a broader consideration of risk management, value creation, economic resilience and strategic autonomy.

This perspective has also been highlighted by the Spanish Confederation of Business Organisations (CEOE) in its document "Priorities for Spanish Businesses. COP17 – United Nations Convention on Biological Diversity", published in October 2026. The publication sets out 23 business priorities that provide a framework for translating the nature conservation agenda into the realities of Spain's business sector. Its main lines of action include progressively integrating nature into corporate strategy, governance and risk management; identifying and assessing impacts, dependencies, risks and opportunities; developing high-quality biodiversity and natural-capital tools, methodologies and data; and mobilising investment for conservation and restoration. This approach underlines nature's potential as a driver of competitiveness, innovation and access to finance.

At the international level, progress in implementing the Kunming-Montreal Global Biodiversity Framework (the "Framework"), presented in the context of COP17, held in Armenia in October 2026, once again highlights, through Target 15, the important role of businesses and financial institutions in assessing, managing and disclosing their nature-related impacts, dependencies and risks.

From a sustainable-finance perspective, mobilising capital will also be essential to accelerate this process. In this regard, Target 19 of the Framework sets an objective of mobilising at least USD 200 billion annually from all sources by 2030. According to data reported by countries at COP17, cumulative private finance for biodiversity reached USD 32.8 billion between 2020 and 2023, a figure that illustrates both the growing role of private capital and the scale of the effort still required.

However, directing financial flows towards activities compatible with nature conservation remains a major challenge. Reliable and comparable data are still limited, and sufficiently robust and harmonised methodologies for translating interdependencies with nature into economic and financial variables are lacking. This gap hinders their effective integration into corporate and credit-risk analysis, highlighting the need to continue developing analytical tools capable of assessing and anticipating their potential financial implications. Advancing the implementation of this approach requires, among other things, improving our ability to understand how nature degradation can translate into financial variables. For companies, this means identifying vulnerabilities that may affect their operations and supply chains. For investors and financial institutions, it means developing a deeper understanding of sectoral exposures that could affect the creditworthiness of their counterparties and the resilience of their portfolios. In both cases, rigorous methodologies for analysing these interdependencies are a necessary step towards properly informed decision-making.

This study has been prepared in this context. It applies EthiFinance's Nature Stress Test model to the IBEX 35, Spain's benchmark stock market index. The analysis estimates the potential impact of the degradation of five natural assets on economic output and subsequently translates these impacts into probabilities of default for the different sectors represented in the index, under different scenarios and time horizons. The comparison with France's CAC 40 also provides context for the results and enables an exploration of how the sectoral characteristics of each market may influence exposure profiles.

The modelled results show that nature-related risks are not distributed evenly across sectors. Estimated exposure varies according to the economic activity and natural asset considered, highlighting the importance of differentiated approaches that reflect the characteristics of each sector and issuer. The analysis also points to initial credit quality as a relevant factor when assessing how different nature degradation scenarios could affect corporate creditworthiness. These estimates should be interpreted within the scope and methodological assumptions of the study, as a contribution to understanding potential risks rather than as a prediction of future defaults.

Integrating nature into the economy will require more than recognising its importance. It will also require the ability to translate that recognition into concrete decisions, investments and actions. By helping to identify sectoral differences in exposure to risks arising from nature degradation, this study seeks to enrich the debate on the systematic consideration of natural capital in economic and financial analysis.



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Executive Summary

Study Objective

This study aims to quantify **the impact of the degradation of five natural assets (atmosphere,** structural and biotic integrity, species, soils and sediments, and water) on **the probability of default (PD) of companies listed on the IBEX 35, Spain's** benchmark stock market index.

The study analyses the corporate composition of the IBEX 35 by grouping companies into broad families of economic activities. The analysis is based on outputs from EthiFinance's Nature Stress Test (NST) model (Pineau et al., 2024), which translates natural-capital degradation into production losses and subsequently into changes in credit quality.

The study pursues four specific objectives:

1. **Identify the natural assets that generate significant financial risk** for IBEX 35 companies, establishing their hierarchy of impact and how this evolves over time to 2050.
2. **Quantify sectoral differences** in **vulnerability,** distinguishing the most exposed sectors (construction, energy and manufacturing) from the most resilient (telecommunications and technology).
3. **Quantify the increase in the probability of default (PD)** of IBEX 35 companies according to sector and their dependence on ecosystem services, assessed through natural capital.
4. **Assess the amplifying effect of credit rating deterioration** by analysing how a one- or two-notch downgrade changes the level of PD and what share of that increase is attributable to nature degradation.

The study also includes **a comparative analysis with France's CAC 40** to place the vulnerability of the IBEX 35 in a European context and identify risk-management practices relevant to both markets.

Key Concepts

Ecological Crisis

Nature degradation caused by human activities is reflected in the accelerating deterioration of ecosystems and loss of biodiversity. IPBES identifies five major direct drivers of pressure on nature: climate change, pollution, land-use change (including urbanisation and habitat fragmentation), direct exploitation of natural resources, and invasive alien species. The intensification of these pressures reduces ecosystems' capacity to provide services essential to economic activity, turning an ecological problem into a systemic risk to economic and financial stability.

Sectoral Dependencies on Ecosystem Services

Economic activities depend on four categories of ecosystem services: provisioning services (water, raw materials, fibers and genetic resources), regulating services (pollination, air quality, climate regulation and disease control), supporting services (soil formation and nutrient cycling), and cultural services (religion, recreation and ecotourism).

For each economic sector, the ENCORE database quantifies these dependencies using materiality scores from 0 to 5, ranging from "very low" to "very high". A high score indicates that disruption to an ecosystem service could cause a significant loss of functionality in production processes and ultimately generate financial impacts that could threaten companies' viability. This assessment considers two dimensions: the severity of the loss of functionality (limited, moderate or severe) and the magnitude of the potential financial losses.

Natural Capital

Natural capital comprises the components of nature regarded as stocks of assets capable of providing a continuous flow of benefits to people and the economy over time.

- **Species:** the biological diversity required for ecosystems to function. Species decline weakens ecological interactions and the associated ecosystem services.
- **Atmosphere:** supports climate balance and air quality. Its degradation is reflected in the accumulation of pollutants and changes in climate patterns, including extreme weather events.
- **Habitats:** terrestrial and aquatic ecological structures needed to maintain biodiversity. Habitat fragmentation increases as a result of urbanisation and land-use change.
- **Soils and sediments:** a form of natural capital whose quality can deteriorate rapidly through loss of organic matter, compaction and erosion, compromising agricultural production in both the short and long term.
- **Water:** a renewable but limited resource whose availability follows seasonal patterns and long-term trends linked to the hydrological cycle. In many regions, climate change and human pressure are increasing water scarcity and variability.
- **Terrestrial geomorphology:** the configuration of landforms and landscapes, which influences long-term soil stability and hydrological regimes.
- **Minerals:** non-renewable resources used by many industries, whose formation and evolution occur over timescales that may extend to thousands of years.
- **Ocean geomorphology:** shaped by long-term physical processes and influential in marine productivity and ocean-current dynamics.

Taken together, natural capital forms the material foundation for economic activity and the stability of value chains.

Definition of Risk

Risk is defined by the combination of three main components: hazard, exposure and vulnerability. Hazard represents the likelihood and intensity of a potentially harmful event. Exposure refers to the presence of assets, activities or populations that may be affected. Vulnerability expresses the propensity to suffer harm and depends both on sensitivity to the hazard and on adaptive capacity, namely the ability to anticipate, absorb or recover from its effects.

In this study, this framework is applied to biodiversity-related risks by combining a geolocated analysis of hazards and exposure, an assessment of sectoral sensitivity to pressures on nature, and an issuer-specific financial vulnerability parameter. The approach represents progress towards asset-level risk assessment, although future enhancements could incorporate the precise location of assets critical to production, adaptation measures for each hazard and the adoption of sustainable practices.

Risk Transmission Through Value Chains

The Nature Stress Test (NST) model incorporates a fundamental principle: risks arising from nature degradation may be both direct and indirect, transmitted through supply chains. A company may depend on ecosystems located beyond its own facilities, in the areas where its suppliers operate.

To represent these interdependencies, the methodology uses an input-output model that quantifies economic flows between sectors and countries. A disruption to a supplier's output caused by the degradation of local natural capital may cascade to companies that depend on its products or services. A company may therefore experience production losses even when its own operations are not directly affected, owing to shortages or higher prices for production inputs.

Stress-Test Exercise

A stress test is a forward-looking exercise that simulates adverse but plausible scenarios to assess the ability of a financial system or a portfolio of companies to withstand extreme conditions. Applied to biodiversity-related risks, it makes it possible to analyse how the ecological crisis may affect production, value chains and, ultimately, companies' financial soundness.

This exercise is particularly relevant to the IBEX 35, whose sectors depend directly or indirectly on ecosystem services. The analysis identifies the natural capital that creates the greatest vulnerabilities, the most exposed sectors and the potential amplification of default risk over the medium and long term. It therefore provides a framework for strategic risk management and preparedness for future regulatory requirements.

In this context, probability of default (PD) is a central indicator. It represents the likelihood that a company will fail to meet its financial obligations over a specified time horizon, generally one year. The indicator is widely used in credit-risk models and prudential exercises to assess counterparty creditworthiness.

In this study, changes in PD translate the potential economic consequences of biodiversity degradation, such as higher production costs, supply disruptions or loss of revenue, into a summary measure of financial risk. PD thus establishes a methodological link between ecological pressures and their consequences for corporate creditworthiness, facilitating the integration of biodiversity-related risks into financial-analysis frameworks.

Methodology and models used

The analysis is based on the **Nature Stress Test (NST)** methodological framework developed by EthiFinance (Pineau et al., 2024), which comprises four interconnected modelling blocks: (1) projected degradation of natural assets under socioeconomic and climate scenarios; (2) translation of that degradation into production losses through sectoral dependencies on ecosystem services; (3) propagation of those losses through value chains using an input-output model; and (4) conversion of production losses into credit-risk metrics[1].

Unlike the European Central Bank approach, which assumes a direct relationship between production losses associated with species loss and changes in PD (Boldrini et al., 2023), the NST explicitly incorporates the economic and financial transmission channels.

EthiFinance's Nature Stress Test (NST) methodological framework is structured around four interconnected modelling blocks:

Natural-Asset Degradation Model

The degradation of each natural asset is quantified using specific indicators, all projected under three scenarios combining Shared Socioeconomic Pathways (SSPs) and Representative Concentration Pathways (RCPs) (Riahi et al., 2017; van Vuuren et al., 2011): optimistic **(SSP1-RCP2.6),** intermediate **(SSP2-RCP4.5) and pessimistic** (SSP5-RCP8.5). The shock to each asset is defined as the relative change in the indicator compared with its reference value (Pineau et al., 2024).

- **Structural and Biotic Integrity:** the Ecoregion Intactness Index (EII) (Beyer et al., 2020), which measures habitat-integrity loss based on habitat area, quality and fragmentation. Under the NST methodology, the optimistic and pessimistic EII projections are derived from its statistical relationship with each country's Mean Species Abundance, using a linearly extrapolated intermediate scenario (Pineau et al., 2024).
- **Water:** the Aqueduct Water Stress (WS) indicator, which measures the ratio between water demand and the renewable water resources available in each sub-basin (Kuzma et al., 2023; World Resources Institute, 2020).
- **Species:** the Mean Species Abundance (MSA) indicator from the GLOBIO model, which compares species abundance under altered conditions with abundance in an undisturbed state (PBL Netherlands Environmental Assessment Agency, 2020; Schipper et al., 2020).
- **Atmosphere:** Air Quality (AQ), measured through PM2.5 concentrations according to the CMIP6 project models (Eyring et al., 2016).
- **Soils and Sediments:** soil quality measured through Soil Organic Carbon (SOC) in medium-turnover pools, also sourced from CMIP6 (Eyring et al., 2016).

Economic Transmission Model Using Input-Output Analysis

The direct impact on the output of each geosector is obtained by multiplying the asset shock by the sector's dependence on the ecosystem services linked to that asset, using ENCORE materiality **scores (Natural Capital Finance Alliance, 2020).** These direct losses are propagated through supply chains using a Leontief model (Leontief, 1936), in which **the loss of productive** capacity in each geosector changes the matrix of technical coefficients and, consequently, the production equilibrium of the economy as a whole (Pineau et al., 2024).

[1] The credit ratings used in this analysis are based on publicly available ratings from 2025. Where an issuer has two or more credit ratings with different assessments, the model uses the lowest rating to ensure a conservative approach.

The methodological paper presents results using Eurostat's FIGARO database **(Remond-Tiedrez and Rueda-Cantuche**, 2019), while also supporting other databases such **as EXIOBASE (Stadler et al., 2018).**

In the output data used in this report, each issuer is characterised by its headquarters country, NACE code, FIGARO sector and EXIOBASE sector. Companies sharing the same EXIOBASE sector, country and rating have exactly the same PD across all assets, scenarios and downgrade levels. Consequently, heterogeneity among companies within the same NACE section arises solely from differences in EXIOBASE sector, headquarters country or rating.

Merton-Vasicek Financial Transmission Model

Production losses are treated as profit losses and translated into a systemic credit-quality factor through a linear econometric relationship with changes in equity values (Pineau et al., 2024; Pineau and Zuñiga, 2024). This factor shifts rating transition matrices using the one-parameter representation developed by Belkin et al. (1998), based on the Merton-Vasicek model (Merton, 1974; Vasicek, 2002), causing PD to respond non-linearly to the shock. In the methodological paper, the relationship between the systemic factor and macro-financial variables is calibrated using historical transition matrices for US corporate issuers and the S&P 500 index (Pineau et al., 2024). Each company's capacity to absorb shocks is conditioned by its credit rating, which serves as an indicator of financial resilience.

Credit-Deterioration Amplification Model

The study includes a rating-sensitivity analysis that simulates the impact of a one- or two-notch downgrade in companies' credit ratings while holding all other factors constant, including the degradation of the five natural assets. This approach isolates the amplifying effect of financial fragility on the risk associated with economic activities' dependence on ecosystem services.

Conclusions

Hierarchy of nature-related risks

The analysis reveals a clear hierarchy of natural assets based on their impact on the credit risk of IBEX 35 companies:

- **Structural and Biotic Integrity (EII)** is the natural asset with the greatest impact. Under the intermediate scenario at the 2050 horizon, stressed PD in the construction sector ranges from 0.93% to 1.27% for BBB-rated companies and from 4.12% to 4.45% for BB-rated companies.
  Spain has one of the greatest diversities of ecosystems in Europe. It is particularly notable for the variety of its terrestrial and marine habitats, resulting from its geographical position, topography, climatic conditions and island territories. According to Spain's Ministry for the Ecological Transition and the Demographic Challenge (MITECO), Spain hosts 118 of the 231 habitat types of Community interest identified under the Habitats Directive[2]. Consequently, degradation affecting species or other forms of natural capital can have a substantially amplified effect on habitat integrity.
- **Water Stress** (WS) and **Mean Species Abundance** loss (MSA) have very similar impacts, both substantially lower than that of EII. At the 2050 horizon under the intermediate scenario, stressed PD for BBB-rated companies ranges from 0.14% to 0.18% for WS. Under the same conditions, stressed PD for MSA is slightly lower, at 0.14% to 0.17%. The two natural assets therefore jointly occupy second place in the hierarchy.
  Spain also has structurally high levels of water stress owing to its climatic characteristics and the uneven distribution of water resources. The projected increase in water stress must therefore be interpreted against already adverse starting conditions. Its relative change may be less pronounced than in geographies with lower initial water pressure, potentially resulting in a more limited incremental impact on the output of the sectors analysed. This interpretation nevertheless needs to be qualified according to sectoral and geographical exposure, since high initial water pressure does not necessarily imply lower sensitivity to further increases in water scarcity.
- **Atmosphere** (AQ) and **Soils and Sediments** (SOC) do not generate significant financial increases over the horizon analysed to 2050. The very limited degradation of these natural assets therefore produces no material direct impact on PD, which remains driven primarily by the baseline credit rating.

Sectoral vulnerability

Vulnerability within the IBEX 35 is highly concentrated:

- **Construction** and **Infrastructure** is the most affected sector. Under the pessimistic scenario, stressed PD for BB-rated companies reaches between 5.67% and 6.23%.
- The **Energy** sector is highly vulnerable primarily to Structural and Biotic Integrity (EII) and Water Stress (WS), particularly in gas production and renewable power generation. Under the intermediate scenario, stressed PD ranges from 0.37% to 0.68% for EII and from 0.14% to 0.18% for WS.
- **Manufacturing and Steel** shows sensitivity to Water Stress (WS) similar to that of the other sectors. However, WS-stressed PD is four to six times higher for BB-rated companies, at 0.75%–0.80%, than for BBB-rated companies, at 0.14%–0.18%.
- **Telecommunications and Technology** is the most resilient sector. Under the intermediate scenario at the 2050 horizon, EII-stressed PD ranges from 0.21% to 0.28% for BBB-rated companies.

[2] Natural habitat types of Community interest

- Finally, despite its low direct dependence, **Financial Services** shows relatively high stressed PD under the intermediate scenario for BBB-rated issuers, at 0.52%–0.65%, representing a material risk compared with other sectors.

Amplifying effect of credit downgrade

The analysis of credit rating deterioration yields one of the study's most important conclusions:

- A one-notch downgrade multiplies stressed PD by between 3.6 and 5.5 times, and a two-notch downgrade by between 15 and 39 times, depending on the sector and natural asset (pessimistic scenario). For example, PD for BBB-rated construction companies would rise from 1.41%–1.89% to around 24%–28% after two notches.
- This amplifying effect shows **that initial credit quality** is as important a determinant of resilience to nature degradation as sectoral exposure: the sector sets the intensity of the shock, and the rating sets the sensitivity of PD to that shock.

Comparison with the CAC 40

The comparison with France's CAC 40 reveals significant structural differences:

- Structural and Biotic Integrity (EII) is the natural asset generating **the greatest financial risk in the IBEX 35,** whereas **Water Stress (WS)** ranks **first in the CAC 40.**
- **Construction and Infrastructure** is the most **vulnerable sector in the IBEX 35**, whereas **Automotive** is the most vulnerable sector in the **CAC 40,** reflecting the different sectoral composition of the two indices.
- The **CAC 40** starts from a lower **average PD than the IBEX 35,** at 0.22% compared with 1.22% for EII. This explains why amplification following a two-notch downgrade is more pronounced in relative terms for the CAC 40, at 24.3 times compared with 11.9 times for the IBEX 35, even though the absolute increase is greater in the IBEX 35.
- Given its sectoral composition, the **CAC 40** can be expected **to have more globalised supply chains,** potentially amplifying indirect transmission risk. This aspect is not specifically quantified in the study.
- Both indices identify **Telecommunications and Technology among the most resilient sectors.** However, the IBEX 35 shows a sharper contrast between vulnerable and resilient sectors because of the variability in baseline credit quality.

Risk-management implications

The study highlights the **need to integrate nature-related risks into credit-risk management models,** particularly in Construction, Energy and Manufacturing. Monitoring Structural and Biotic Integrity (EII) and Water Stress (WS) should become central to assessments of the creditworthiness of Spanish companies, especially those with speculative-grade ratings of BB or below.

The comparison with the CAC 40 shows that there is no single approach to managing nature-related risks. The IBEX 35 should prioritise habitat protection and water stress, whereas the CAC 40 should focus on water management and the complexity of global supply chains.

Finally, the study shows that the optimistic scenario (SSP1-RCP2.6) significantly reduces risk at the 2050 horizon compared with the pessimistic scenario (SSP5-RCP8.5), approximately halving EII-related PD and reducing WS- and MSA-related PD by around 40%. This provides a strong economic argument for accelerating

the ecological transition and adopting business practices that preserve the natural resources on which economic activity depends.

1. Introduction and methodological considerations

This report aims to quantify the impact of the degradation of five essential natural assets (Atmosphere, Structural and Biotic Integrity, Species, Soils and Sediments, and Water) on the probability of default (PD) of the main productive sectors represented in the IBEX 35. The analysis is based on outputs from **EthiFinance's Nature Stress Test (NST),** which translates natural-capital degradation and dependence on ecosystem services into production losses and, consequently, increases in PD through a macro-financial transmission model based on credit rating transition matrices. The data cover three climate and economic scenarios: optimistic (SSP1-RCP2.6), **intermediate** (SSP2-RCP4.5) and **pessimistic (SSP5-RCP8.5),** and three time horizons: 2025, 2030 and 2050. This makes it possible to assess both changes over time and sensitivity to different global socioeconomic development pathways. Two additional rating-downgrade simulations, of one and two notches, are also included.

Table 1. Summary of natural assets and their potential sectoral impact.

Natural Asset	Indicator	Most Affected Sectors	Impact Intensity
Structural and Biotic Integrity	Ecoregion Intactness Index (EII) (includes structural and biotic integrity)	Construction, Energy, Transport	Very high
Water	Aqueduct Water Stress (WS)	All sectors (broadly uniform impact)	Medium
Species	Mean Species Abundance (MSA)	Pharmaceuticals: approx. 0.5%–0.7%	Medium
Atmosphere	PM2.5 Air Quality (AQ)	No sector in particular	Very low
Soils and Sediments	Soil Organic Carbon (SOC)	No sector in particular	Null

A key overarching conclusion, before turning to the sectoral breakdown, is that not all natural assets exert significant pressure on corporate creditworthiness (Table 1). Over the period considered, the data consistently show that Air Quality (AQ) and Soil Organic Carbon (SOC) do not generate significant increases in probability of default (PD) across sectors and scenarios, with changes rarely exceeding one-hundredth of a percentage point. By contrast, Structural and Biotic Integrity (EII) emerges as the principal physical risk factor for Spanish companies, followed by Water Stress (WS) and Mean Species Abundance loss (MSA), whose impacts are similar. This hierarchy remains stable across time horizons and is fundamental to interpreting the sectoral vulnerabilities discussed below.

2. Detailed sectoral analysis

2.1 Construction and Infrastructure: the sector most affected by Habitat Degradation

The construction sector, encompassing both real-estate companies and infrastructure concession operators, is clearly the sector most affected by nature degradation, particularly the loss of habitat integrity (EII). The sector depends heavily on ecosystem services related to soil regulation, mass stabilisation and the availability of raw materials, which explains why its probability-of-default (PD) levels show the most significant effects across the index.

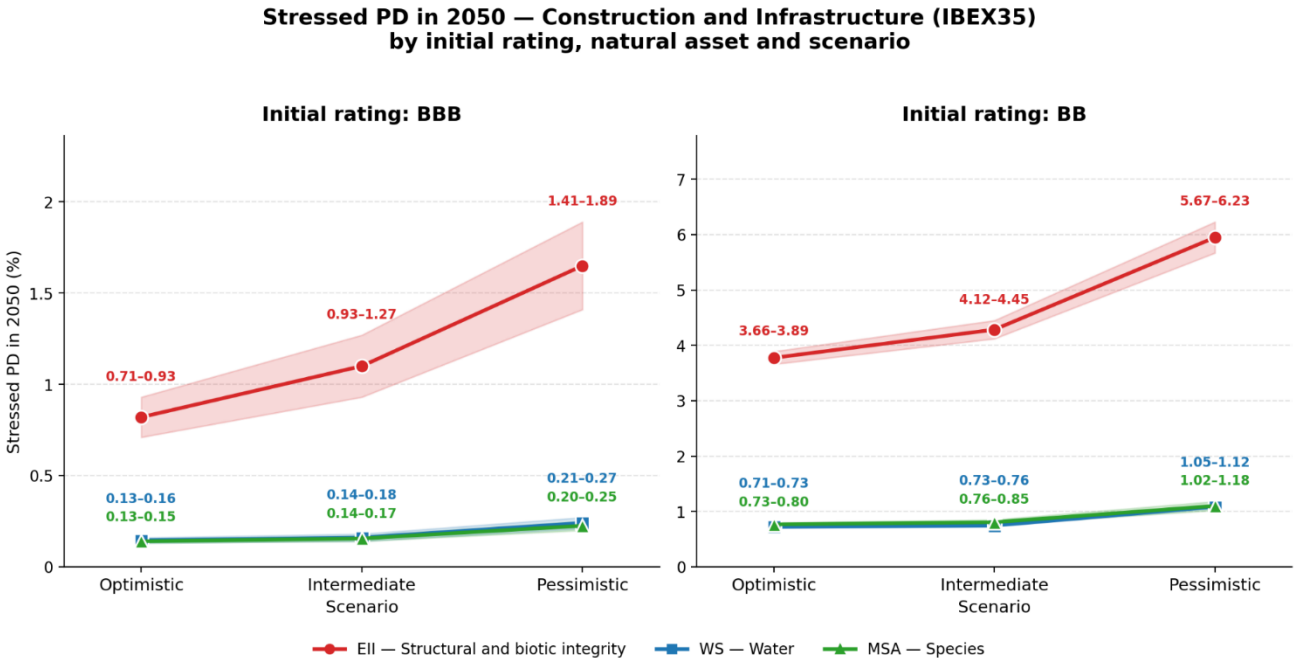


Figure 1. Minimum and maximum stressed PD among IBEX 35 construction-sector companies, by rating, natural asset and scenario (2050 horizon).

Under the intermediate scenario at the 2050 horizon, BBB-rated companies in the sector have EII-stressed PD ranging from 0.93% to 1.27%, compared with a reference through-the-cycle[3] (TTC) PD of 0.18% for this rating (Figure 1). Although this level may appear modest in absolute terms, it is in fact five to seven times the reference PD. The impact is considerably greater for the sector's more speculative segment, represented by BB ratings.

For BB-rated companies, the same habitat-degradation shock raises stressed PD to approximately 4.1%–4.5% by 2050, more than three percentage points above the 0.77% reference TTC PD for the BB rating. This behaviour illustrates a non-linear interaction between the initial credit rating and the environmental shock: companies with lower credit quality are considerably more sensitive to disruptions in productive capacity arising from nature degradation.

[3] Through-the-Cycle (TTC). In the context of credit risk, a Through-the-Cycle Probability of Default (TTC PD) estimates a company's likelihood of default over a full economic cycle, taking into account economic conditions across different phases of the cycle.

Water Stress (WS) and Mean Species Abundance loss (MSA), meanwhile, affect the sector much more moderately. At the same horizon and for companies with the same rating, stressed PD ranges from 0.14% to 0.18%, far below the dominant effect of Structural and Biotic Integrity (EII).

2.2 Energy: High sensitivity to Habitats and Water Stress

The energy sector, which includes major power companies as well as oil and gas and renewable-energy companies, presents a more diverse risk profile. Habitat degradation remains a relevant factor, whereas Water Stress (WS), despite the water dependence of certain activities such as cooling, hydropower generation and fossil-fuel extraction, has a clearly lower impact.

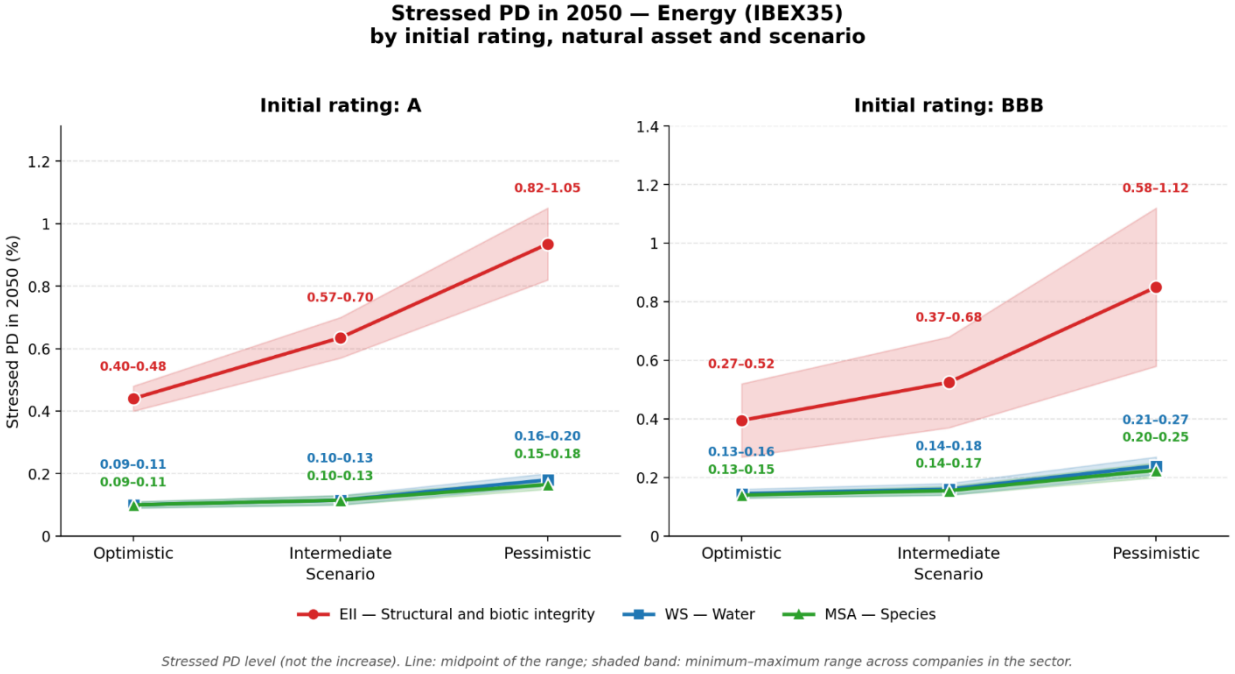


Figure 2. Minimum and maximum stressed PD among IBEX 35 energy-sector companies, by rating, natural asset and scenario (2050 horizon).

Under the intermediate scenario at the 2050 horizon, BBB-rated energy companies have EII-stressed PD ranging from 0.37% to 0.68%, depending on their specific exposure to ecosystem-linked supply chains (Figure 2). The effect of Water Stress (WS) is clearly lower, with stressed PD ranging from 0.14% to 0.18% and no material differences among companies in the sector.

A notable case is that of A-rated companies in the sector, whose EII-stressed PD, at 0.57%–0.70% under the intermediate scenario, is higher than that of BBB-rated companies despite their stronger financial position. This suggests that the composition of these companies' activities offsets the benefit of their higher rating. In other words, a company with a better credit rating may have a higher stressed PD because the rating establishes only the starting point, while the shock depends on the subsector. The result should therefore be assessed at issuer level.

More specifically, an A-rated energy issuer starts from a baseline PD of 0.094%, compared with 0.128% for a BBB-rated issuer, a difference of only 0.03 percentage points. Its subsector, however, is subject to a larger habitat shock: PD rises from 0.165% in 2025 to 0.57% in 2050, an increase of 0.41 percentage points under the intermediate scenario, exceeding the 0.37%–0.68% range for BBB-rated issuers in less exposed subsectors. Water is less material because its effect is calculated by multiplying the subsector's dependence on water-related services by the shock to the Water Stress index, and that shock is not significant in the output data. WS-stressed PD for BBB-rated issuers is 0.14%–0.18%, very close to their 0.128% baseline PD,

representing increases of only 0.01–0.05 percentage points, compared with 0.24–0.55 percentage points for habitats[4]. Mean Species Abundance loss (MSA) has a low but non-negligible effect on the energy sector, with values similar to those for WS, at 0.14%–0.17% for BBB-rated companies under the intermediate scenario.

Finally, the pessimistic scenario (SSP5-RCP8.5) amplifies the effects of EII, WS and MSA by approximately 45%–60% compared with the intermediate scenario, underscoring the importance of mitigation and adaptation policies for the sector's stability.

2.3 Financial Services: An indirect but significant effect

Although financial institutions have no direct operational dependence on ecosystems, they are affected by nature degradation through their own sectoral dependencies and the propagation of production losses through their supply chains under the Leontief model. The model does not simulate institutions' loan portfolios, so the impact on the PD of banks and insurers does not reflect deterioration in their borrowers' creditworthiness. The effect is moderate, with this aspect incorporated only indirectly through the institutions' baseline credit ratings.

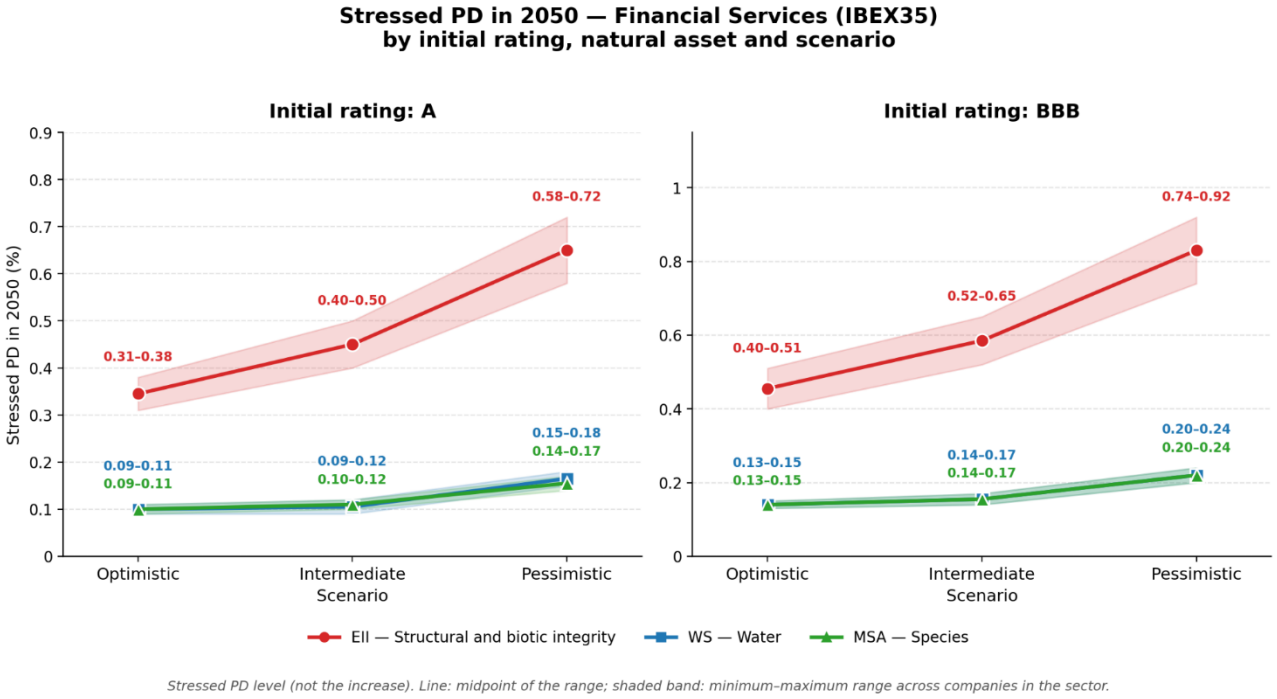


Figure 3. Minimum and maximum stressed PD among IBEX 35 financial-services companies, by rating, natural asset and scenario (2050 horizon).

At the 2050 horizon under the intermediate scenario, A-rated financial institutions have EII-stressed PD of approximately 0.40%–0.50%, while BBB-rated financial institutions are projected to exceed 0.52% and reach as high as 0.65% (Figure 3). Although these values are lower than those observed in construction and comparable to those in energy, they are relevant because they affect the index's largest banks, which are traditionally regarded as defensive stocks.

Water Stress (WS) and Mean Species Abundance loss (MSA) affect the financial sector much less strongly, remaining below 0.2% under the optimistic and intermediate scenarios and ranging from 0.20% to 0.24%

[4] The Aqueduct database, which assesses water stress across countries, indicates that Spain already experiences high levels of water stress. Consequently, any future increase in water stress would be relatively less significant compared with other regions.

under the pessimistic scenario for BBB-rated institutions. This suggests that, for banks, the principal transmission channel is habitat degradation (EII) through the supply chain.

It is particularly noteworthy that the difference in impact between A-rated and BBB-rated institutions is moderate, at approximately 1.3 times. This suggests that prior creditworthiness acts as an effective buffer against systemic shocks and reinforces the conclusion that initial credit quality is a key determinant of resilience to nature degradation.

2.4 Manufacturing and Steel: Raw materials as critical factors

The manufacturing sector, which includes major steel producers and machinery manufacturers, has a distinctive risk profile. Water Stress (WS) is a relevant factor, although its impact remains lower than that of habitat degradation (EII). Its relevance reflects the water-intensive nature of industrial processes, particularly steelmaking and the manufacture of metal components, where water scarcity can halt production or sharply increase operating costs.

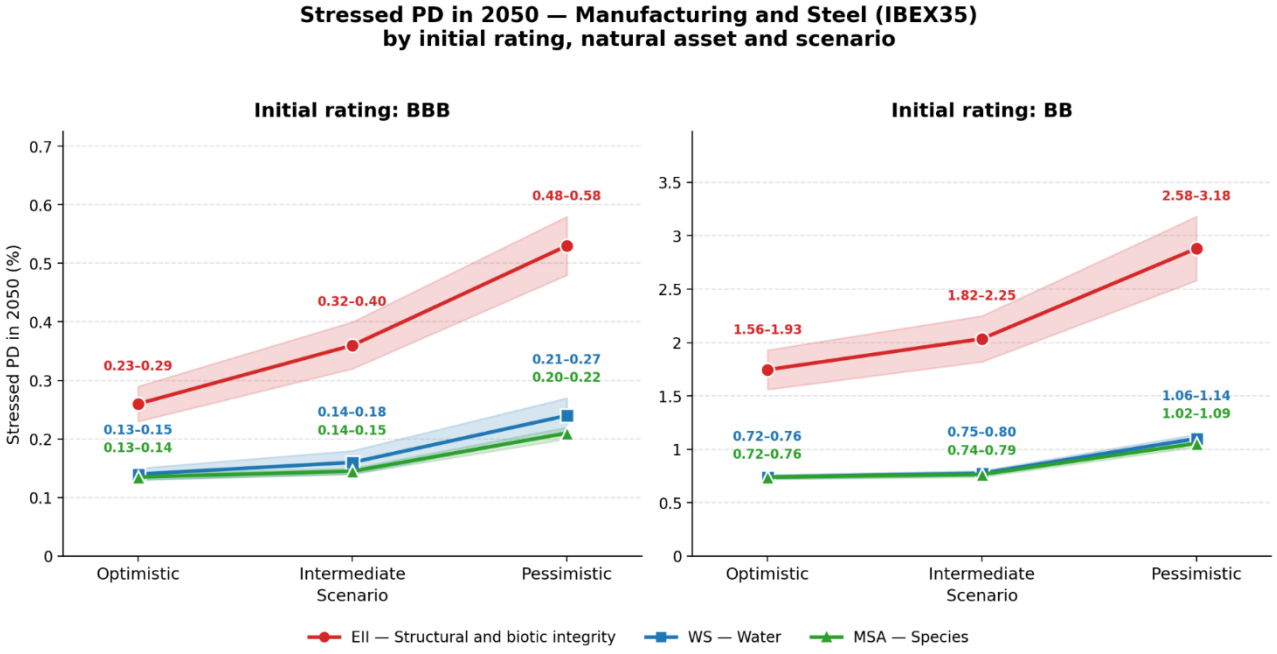


Figure 4. Minimum and maximum stressed PD among IBEX 35 manufacturing-sector companies, by rating, natural asset and scenario (2050 horizon).

Under the intermediate scenario at the 2050 horizon, BBB-rated companies in the sector have WS-stressed PD ranging from 0.14% to 0.18% (Figure 4). For BB-rated companies, however, this level is four to six times higher, reaching 0.75%–0.80%. Habitat degradation (EII) also affects manufacturing, less intensely than construction but clearly more strongly than WS, with stressed PD ranging from 0.32% to 0.40% for BBB-rated companies under the intermediate scenario.

BB-rated companies, meanwhile, have EII-stressed PD ranging from 1.82% to 2.25% under the intermediate scenario and from 2.58% to 3.18% under the pessimistic scenario (Figure 4). Mean Species Abundance loss (MSA) affects the sector at levels similar to WS, at 0.14%–0.15% for BBB-rated companies and 0.74%–0.79% for BB-rated companies under the intermediate scenario. This confirms that the principal risk channel for industry is the integrity of habitats associated with raw-material supply chains.

2.5 Transport, Tourism and Logistics: Moderate but growing risk

Air transport, logistics and tourism services show a level of vulnerability that, although lower than in construction, should not be underestimated. Air transport and airport infrastructure are particularly sensitive to habitat degradation (EII) because of their dependencies on ecosystem services and the propagation of impacts through their supply chains.

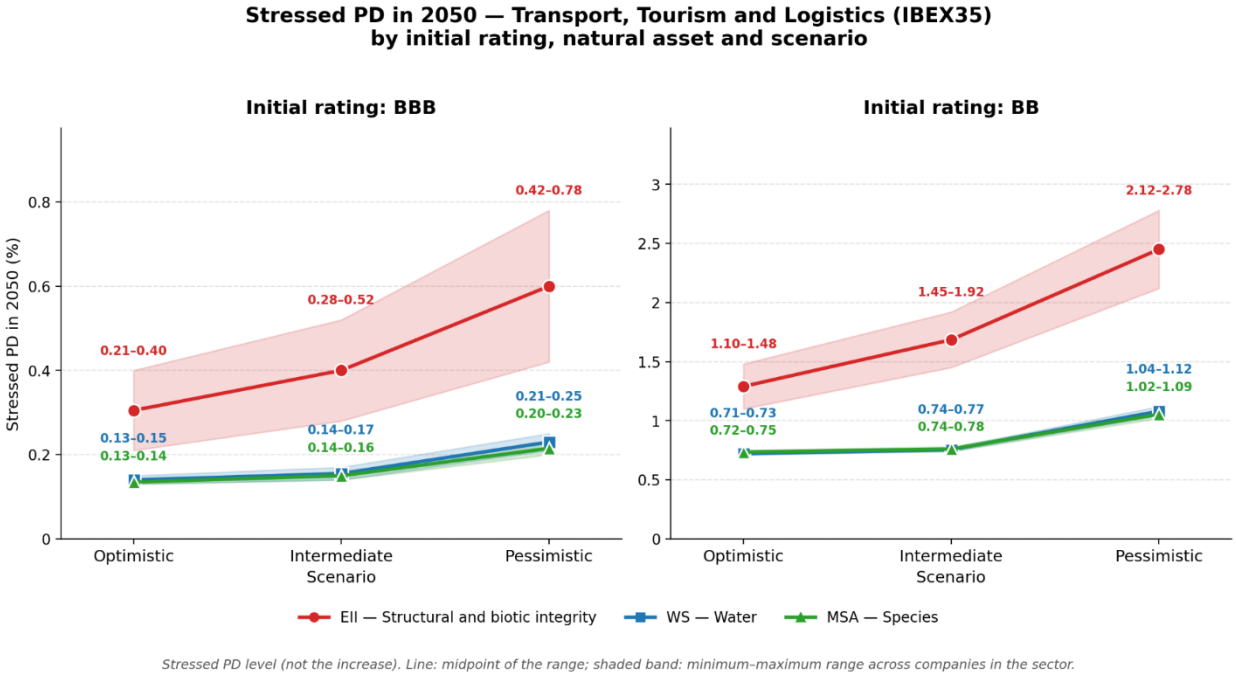


Figure 5. Minimum and maximum stressed PD among IBEX 35 transport, tourism and logistics companies, by rating, natural asset and scenario (2050 horizon).

At the 2050 horizon under the intermediate scenario, BBB-rated companies in the sector are projected to have EII-stressed PD ranging from 0.28% to 0.52% (Figure 5). There is, however, considerable variation among companies: those rated BB or lower have PD ranging from 1.45% to 1.92% over the same period, reflecting the greater sensitivity of more speculative companies with tighter margins.

Water Stress (WS) has a more limited effect on the sector, with stressed PD not exceeding 0.17% for BBB-rated companies under the intermediate scenario. Logistics occupies an intermediate position, with EII-stressed PD approaching 0.40% by 2050 for investment-grade companies and reaching more than 1.7% for BB-rated companies, approximately four to five times higher.

Overall, Transport, Tourism and Logistics presents a medium-risk profile, with material dependence on habitat conditions and water availability, but a lower absolute impact than the Energy sector.

2.6 Telecommunications, Technology and Other Services: The most limited impact

As expected, telecommunications, technology and other high-value-added technology services companies are the least exposed to natural-resource degradation. Their activities, centered primarily on knowledge, software and network infrastructure, have little direct dependence on ecosystems. The effect on PD is transmitted mainly through electronic-equipment supply chains, which in turn depend on manufacturing.

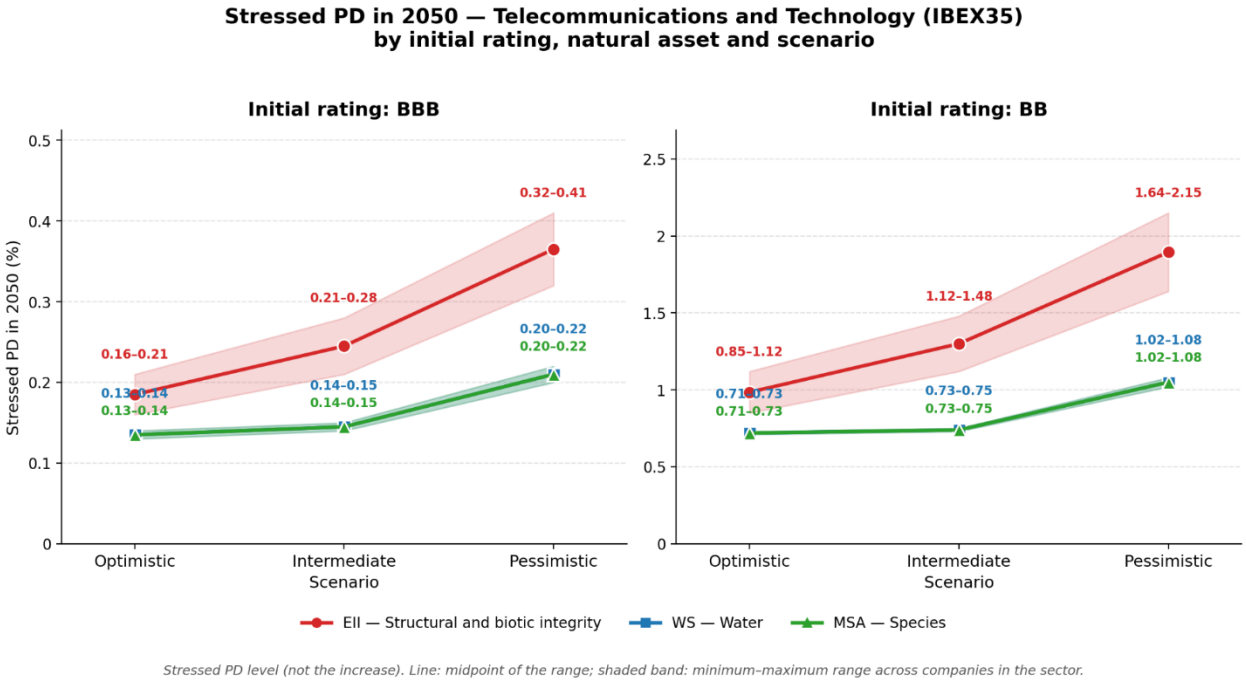


Figure 6. Minimum and maximum stressed PD among IBEX 35 telecommunications, technology and other technology services companies, by rating, natural asset and scenario (2050 horizon).

At the 2050 horizon under the intermediate scenario, BBB-rated companies in the sector have EII-stressed PD of approximately 0.21%–0.28%, while stressed PD associated with Water Stress (WS) and Mean Species Abundance loss (MSA) does not exceed 0.15% (Figure 6). These values make technology and telecommunications companies the most resilient group within an index exposed to physical risks arising from nature degradation.

Nevertheless, even within this lower-risk group, the amplification caused by credit rating deterioration is substantial. If companies in the sector, all rated BBB, were downgraded by one notch to BB, their EII-stressed PD would increase by a factor of 4.5 to 5, suggesting that prior creditworthiness is a more significant risk modifier than sectoral exposure itself.

3. Analysis of one- and two-Notch Credit-Rating downgrade

3.1 Methodological clarification on scenario selection

From a conservative financial stress-testing perspective, this section prioritises the pessimistic scenario (SSP5-RCP8.5), which maximises the impact of natural-asset degradation and provides an upper bound for resilience-risk analysis. This choice is intended to capture the most adverse pathways, in line with prudential stress-testing practices. Results for the intermediate scenario (SSP2-RCP4.5) are included for comparison where they help illustrate the magnitude of the amplification effect.

3.2 Non-linear amplification of PD following Credit-Rating downgrade

The analysis of the IBEX 35 under the pessimistic scenario (SSP5-RCP8.5) at the 2050 horizon shows that a one- or two-notch credit rating downgrade amplifies the impact of nature degradation on probability of default (PD) in a non-linear manner. The magnitude of this amplification depends on the natural asset, the initial rating and the issuer's position on the credit-risk scale. The patterns observed for the three most material assets are summarised below: EII (habitats), MSA (species) and WS (water).

EII (Habitat Integrity)

The effect of a rating downgrade on EII-stressed PD is not uniform across the investment-grade range. Three segments can be distinguished:

- From A to BBB: the impact is limited. In Financial Services, PD increases from 0.58%–0.72% to 0.74%–0.92%, or approximately 1.3 times. The proximity of the two ratings limits the increase, while the acceleration in PD becomes much more pronounced at lower rating levels.
- From BBB to BB and B: this is the segment in which PD accelerates significantly. In Construction and Infrastructure, PD for BBB-rated issuers ranges from 1.41% to 1.89%, while PD for BB-rated issuers reaches 5.67%–6.23%, approximately 3.6 times higher (Figure 7). After a two-notch downgrade to B, PD would be around 24%–28% (Figure 10).
- From BB to B and CCC: PD continues to rise sharply in absolute terms, although the relative amplification factor tends to moderate at higher PD levels. In Construction and Infrastructure, BB-rated issuers would move from 5.67%–6.23% to around 23%–25% at B and to 48%–52% at CCC, with successive multipliers declining from approximately 4.0 to 2.1 (Figure 13).

MSA (Species Loss) and WS (Water Stress)

For Construction and Infrastructure issuers, MSA and WS show particularly high sensitivity to rating deterioration. Comparing BBB- and BB-rated issuers, PD is approximately 4.5 to 5 times higher, illustrating a strong non-linear acceleration in risk:

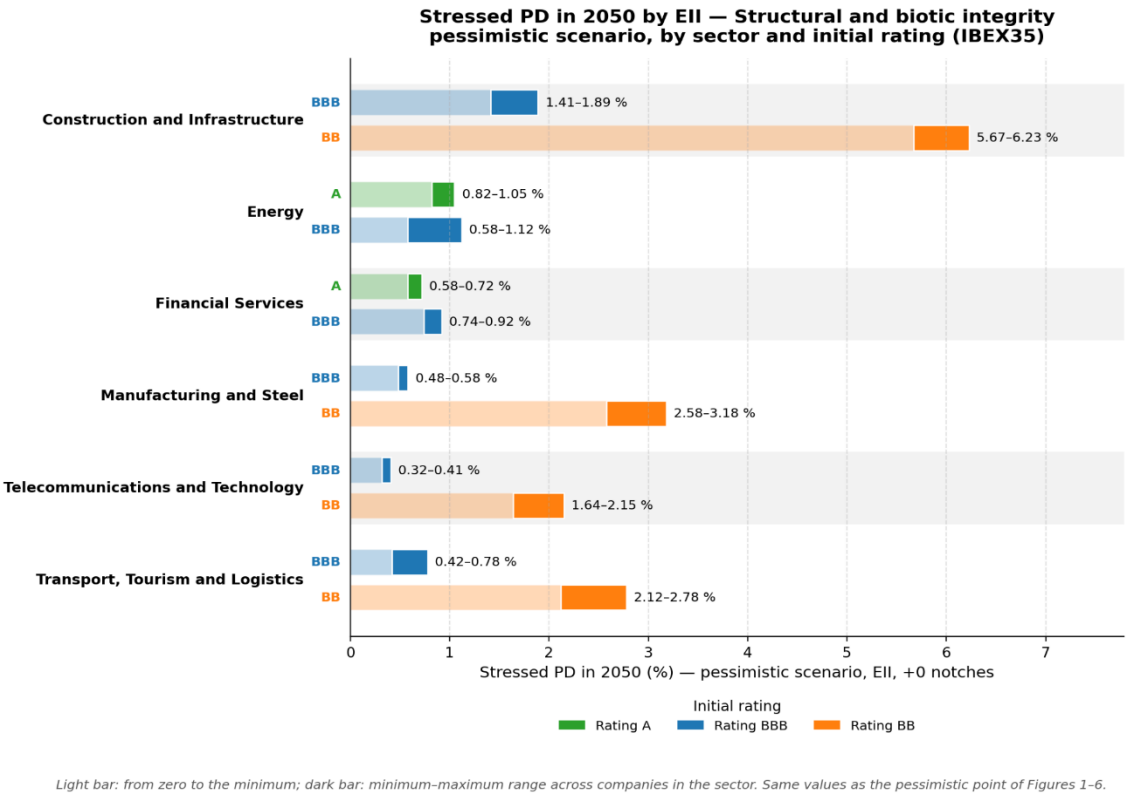
- **Construction and Infrastructure**: PD accelerates markedly as credit quality deteriorates. For MSA, PD for BBB-rated issuers ranges from 0.20% to 0.25%, compared with 1.02%–1.18% for BB-rated issuers, approximately 4.9 times higher (Figure 9). WS follows a similar path, with PD rising from 0.21%–0.27% at BBB to 1.05%–1.12% at BB, approximately 4.5 times higher (Figure 8). This confirms that the sensitivity of PD to rating deterioration is high even from very low initial PD levels.
- **Comparison across sectors**: the other sectors with BB-rated issuers show very similar factors. Between BBB and BB, PD is multiplied by 4.9–5.0 for MSA and by 4.6–4.7 for WS in Manufacturing and Steel and in Transport, Tourism and Logistics (Figures 8 and 9). The observed pattern therefore appears to be

driven primarily by credit-quality deterioration, while sectoral differences have a relatively limited effect on the magnitude of the change.

3.3 Sectoral analysis under the pessimistic scenario

EII (Habitat Integrity)

Figure 7 presents the increase in PD, under a pessimistic scenario, at the 2050 horizon, associated with EII, by sector and initial rating, with the credit rating held constant (+0 notches).



Light bar: from zero to the minimum; dark bar: minimum–maximum range across companies in the sector. Same values as the pessimistic point of Figures 1–6.

Figure 7. stressed PD associated with EII in 2050 under the pessimistic scenario, by sector and initial rating (+0 notches) – IBEX 35.

For the Construction and Infrastructure sector with a BBB credit rating, the EII shock raises the probability of default (PD) from the 0.18% through-the-cycle (TTC) level to a range of 1.41%–1.89%. For the same sector, but with a BB rating, PD reaches between 5.67% and 6.23% (Figure 7).

The results highlight the amplifying effect of credit quality on default risk. Specifically, in the sector analysed, the PD of BB-rated issuers under the EII shock (5.67%–6.23%) is between 3.0 and 4.4 times that of BBB-rated issuers (1.41%–1.89%). This result, based on IBEX 35 data, illustrates how lower credit quality can significantly amplify the default risk associated with the same nature degradation scenario.

WS (Water Stress)

Figure 8 presents PD under the pessimistic scenario, at the 2050 horizon, associated with WS, by sector and initial rating, with the credit rating held constant (+0 notches).

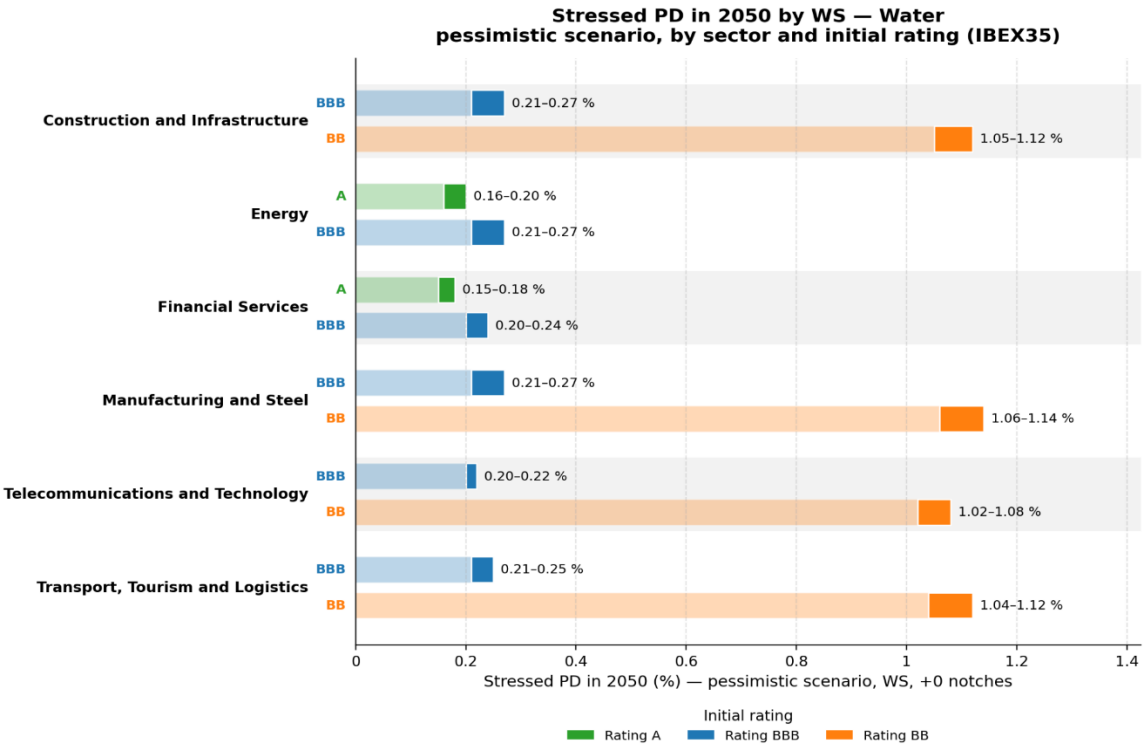


Figure 8. stressed PD associated with WS in 2050 under the pessimistic scenario, by sector and initial rating (+0 notches) – IBEX 35.

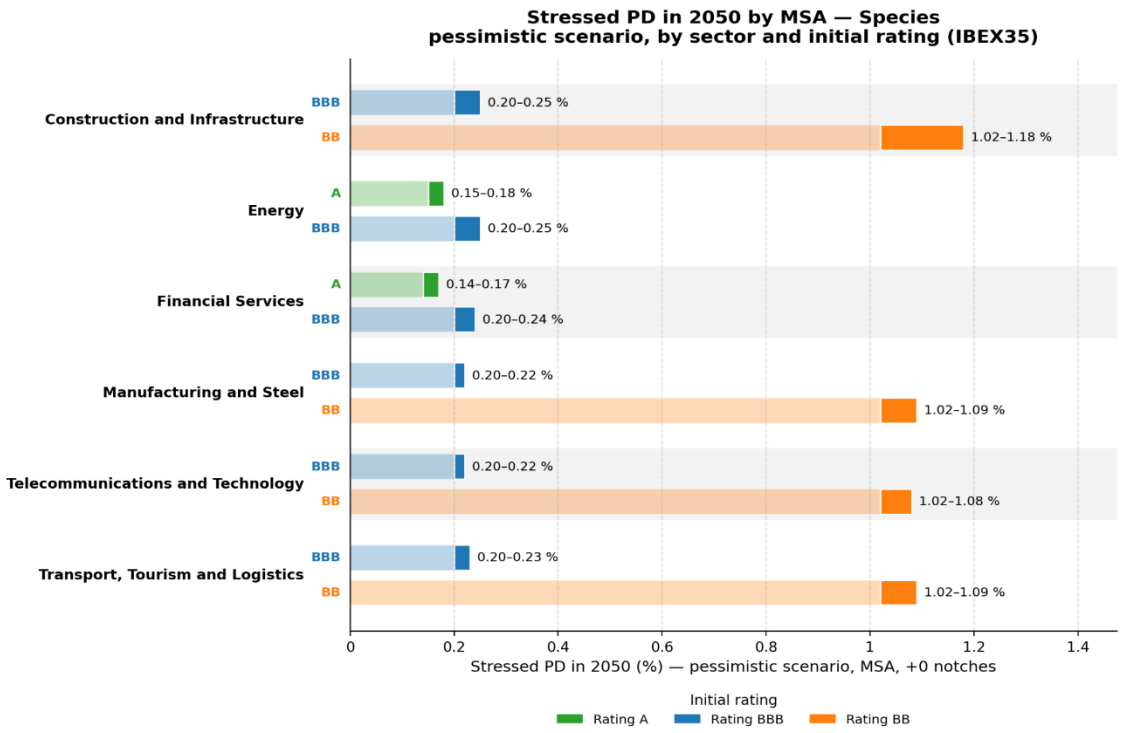
At the aggregate IBEX 35 level, Water Stress (WS) has a markedly smaller impact on PD than EII. In Construction and Infrastructure with a BBB rating, for example, WS-related PD ranges from 0.21% to 0.27%, approximately one seventh of the 1.41%–1.89% observed for EII (Figure 8). However, this relationship varies significantly across sectors. In Manufacturing and Steel, WS-related PD (0.21%–0.27%) represents nearly half of that associated with EII (0.48%–0.58%), reflecting the smaller impact of EII in this sector, since the level of WS-related PD is practically homogeneous across sectors.

The initial rating again plays an important role as an amplification factor. The move from BBB to BB multiplies water-stress-related PD by approximately 4.5–5 times, an order of magnitude similar to the ratio between the baseline PDs of the two ratings, confirming that the water shock is small and that the difference in PD is driven mainly by the starting rating.

Finally, sectoral differentiation among investment-grade issuers remains relatively limited, with a spread of approximately 1.8 times. This result may be explained, at least in part, by the geographical component of water stress and the high concentration of the analysed portfolio in Spain, which reduces location-driven dispersion in the shock across companies.

MSA (Species Loss)

Figure 9 presents PD under the pessimistic scenario, at the 2050 horizon, associated with MSA, by sector and initial rating, with the credit rating held constant (+0 notches).



Light bar: from zero to the minimum; dark bar: minimum–maximum range across companies in the sector. Same values as the pessimistic point of Figures 1–6.

Figure 9. stressed PD associated with MSA in 2050 under the pessimistic scenario, by sector and initial rating (+0 notches) – IBEX 35.

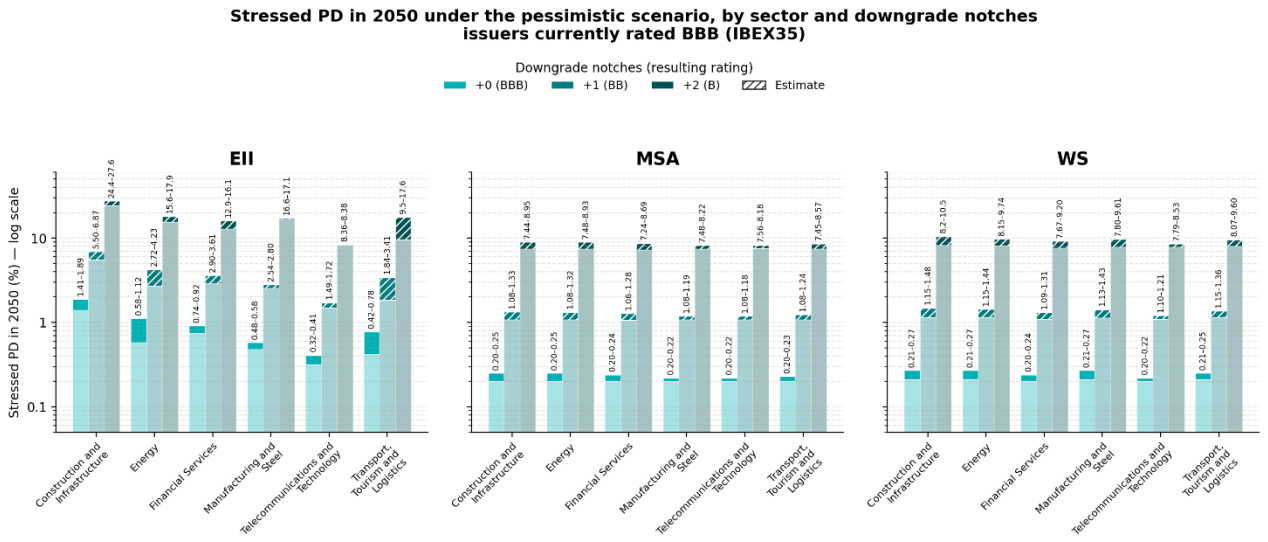
The distribution of MSA impacts follows a hierarchy consistent with that observed for EII. The effect is moderate for A- and BBB-rated issuers, with values ranging from 0.14% to 0.25%, but increases considerably for BB-rated issuers, reaching between 1.02% and 1.18%. The comparison between the two rating categories indicates amplification of approximately 5 times when moving from BBB to BB (Figure 9).

From a sectoral perspective, differences among BBB-rated issuers are very small (from 0.20% to 0.25%); the highest impacts occur in the sectors containing BB-rated issuers (Construction and Infrastructure, Manufacturing and Steel, and Transport, Tourism and Logistics), indicating that the dispersion is driven primarily by the distribution of ratings rather than by sectoral dependence.

However, the factor of approximately five times associated with a one-notch downgrade requires qualification: this order of magnitude is approximately valid for the move from BBB to BB but does not remain uniform across the rating scale. In particular, amplification is approximately 1.4 times between A and BBB and rises to around seven times from BB to B (Figure 10). This variability shows that the relationship between credit rating and estimated impact is non-linear, producing a non-proportional response across the rating scale.

3.4 Impact of Credit-Rating downgrades on PD in the IBEX 35

The analysis compares the amplification of probability of default (PD) associated with shocks to EII, MSA and WS according to credit rating and sector of activity (Figure 10). Drawing on IBEX 35 data, the aim is to identify the rating segments with the greatest sensitivity, as well as differences across indicators and sectors.



Light bar: from the axis floor to the minimum; dark bar: minimum–maximum range across companies in the sector. A single value is shown when only one company is available. Simulated downgrade keeping natural asset degradation constant.
+0 level: Figures 1–9. +1 and +2 levels (hatched): illustrative estimate applying the model's per-issuer downgrade factors to the +0 level.

Figure 10. Stressed PD under the pessimistic scenario at the 2050 horizon, by sector, for BBB-rated issuers and downgrade levels (+0 BBB → +1 BB → +2 B), in percent (logarithmic scale[5]). Levels +1 and +2 estimated.

Analysis of the results

1. **Amplification intensifies as the rating declines.** The transition from BBB to BB multiplies PD by approximately 3.6 to 5.3 times for EII and 5.3 to 5.5 times for MSA and WS. The move from BB to B produces even larger factors: 4.0 to 6.7 times for EII and around 7 times for MSA and WS. Overall, a two-notch downgrade multiplies PD by between 15 and 36 times for EII and between 36 and 39 times for MSA and WS.
2. **MSA and WS show greater relative amplification than EII.** In the BBB → BB segment, the factors observed for MSA and WS, at approximately 5.3 to 5.5 times, exceed those for EII, at 3.6 to 5.3 times, which are also more heterogeneous across sectors: the lowest correspond to Construction and Infrastructure (3.6–3.9 times) and the highest to Manufacturing and Steel (4.8–5.3 times). As explained below, this difference reflects the different size of the shock generated by each natural asset, not greater sensitivity of PD to water or biodiversity.
3. **Sectoral heterogeneity depends on the indicator analysed**. For EII, Construction and Infrastructure has the highest PD at +0, at 1.41%–1.89%, followed by Energy (0.58%–1.12%) and Financial Services (0.74%–0.92%), while Telecommunications and Technology records the lowest, at 0.32%–0.41%. After a two-notch downgrade, PD for Construction and Infrastructure would be around 24%–28%, compared with approximately 8% for Telecommunications and Technology. By contrast, for MSA and WS, differences among sectors are limited at all levels: 0.20%–0.27% at +0, around 1.1%–1.5% after one notch and 7%–10% after two.

The model calculates a sector's production loss as the relative change in the natural-capital integrity indicator in the issuer's country, multiplied by the sector's dependence on the services provided by that capital (Pineau et al., 2024). This loss shifts the systemic factor and, through the probit[6] curve, the PD associated with each

[5] The levels after the downgrade (+1 and +2) are estimated by applying the amplification factors derived from the model for each issuer to the pre-downgrade levels shown in Figures 7 to 9. They should therefore be interpreted as illustrative orders of magnitude.

[6] It is the S-shaped relationship used by the model to convert a shock into a probability of default (PD). It is called a *probit* model because it is based on the normal distribution. Each credit rating is associated with a default threshold. A company defaults if its "financial health", modelled as a normally distributed random variable, falls below that threshold.

rating. Dependencies are similar for the three most material forms of natural capital: habitats, species and water. What differs is the change in the relevant indicator. In the methodological paper, habitat degradation reaches −70% or more in several countries, whereas projected species loss ranges from −7% to −13% globally. In the WS output data, the water indicator changes very little. Habitat-related natural capital therefore generates a larger shock than species- and water-related natural capital.

The size of the shock determines the amplification factor between rating notches because the probit curve flattens as PD increases. With an almost negligible shock, as for water and species, the PD associated with each rating remains close to its baseline level, so the factor between consecutive ratings largely reproduces the ratio between their baseline PDs, approximately 5.5 times from BBB to BB. With a larger shock, as for habitats, PD increases substantially and moves closer to its upper bound, reducing the factor to approximately 3.6–5.3 times. Amplification therefore varies by natural asset because each asset generates a different shock, not because PD is inherently more sensitive to one type of natural capital than another.

3.5 Comparison of the impact of Credit-Rating downgrades on PD: CAC 40 vs IBEX 35

The CAC 40 shows **systematically higher notch-by-notch multipliers than the IBEX 35** across all five natural assets and both downgrade steps (+1 and +2). In the first step (+0 to +1), the CAC 40 amplifies PD by between 5.05 and 5.49 times, compared with 3.49 to 4.55 times for the IBEX 35. In the second step (+1 to +2), the CAC 40 amplifies PD by between 4.65 and 4.92 times, compared with 3.40 to 4.20 times for the IBEX 35. The gap is widest for habitats (EII), where the CAC 40 multiplier is 5.05 times compared with 3.49 times for the IBEX 35 in the first step, and narrowest for water (WS) and species (MSA), where the difference is approximately 0.8 in the first step and 0.5 in the second (Figure 11).

This difference is counterintuitive because the IBEX 35 starts from PD levels between 1.4 and 5.5 times higher than those of the CAC 40. There is no single explanation, and the drivers vary by asset. For EII, the IBEX 35 includes a significant proportion of A-rated issuers moving to BBB, with relatively low amplification factors of around 1.3 times, which dilutes the aggregate multiplier; the CAC 40 has no A-rated issuers for this asset. For WS, MSA, Air Quality (AQ) and Soils and Sediments (SOC), the difference is explained to a greater extent by the concentration of a small number of issuers with high PD, whose relative weight compresses the aggregate IBEX 35 multiplier. Overall, the difference in amplification does not reflect a structural property of the model, but rather a combination of sector composition and initial-rating distributions specific to each index and natural asset.

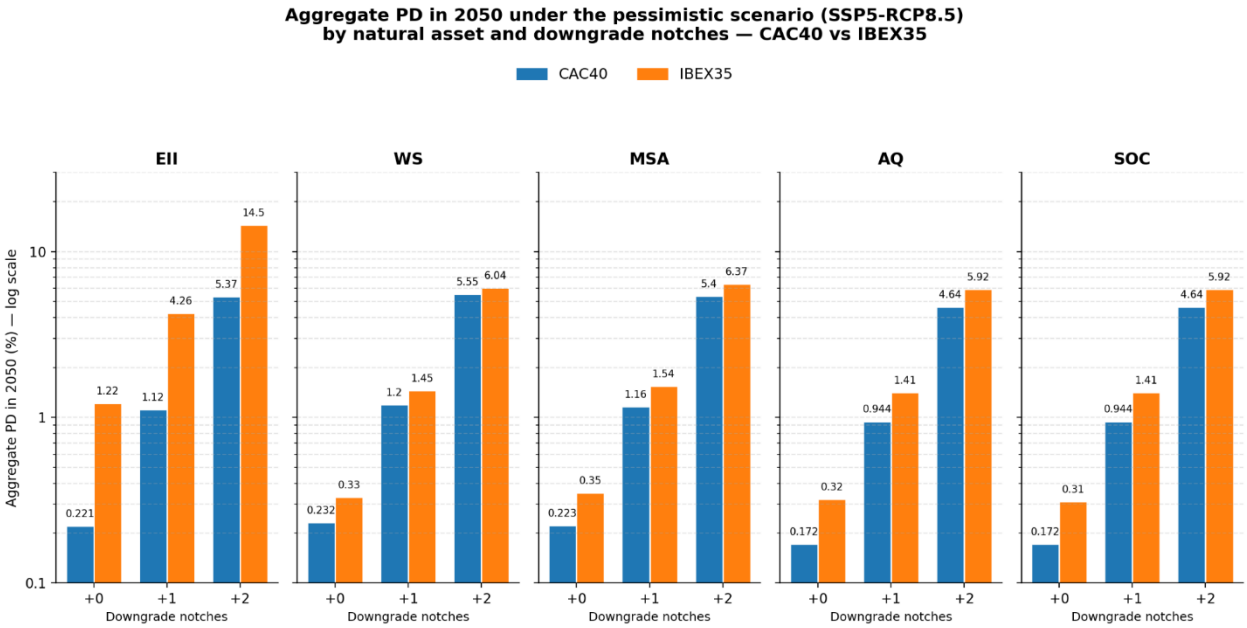


Figure 11. Aggregate PD at the 2050 horizon, by natural asset and two credit rating downgrade levels, under the pessimistic scenario.

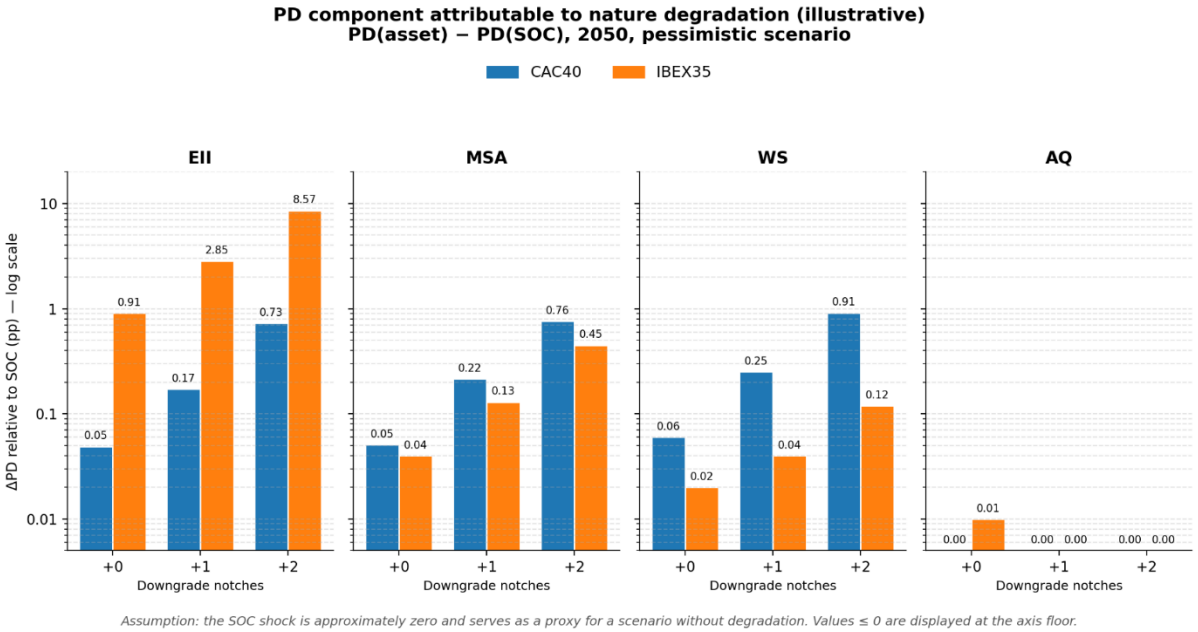


Figure 11b. Component of PD attributable to nature degradation (illustrative): PD (asset) − PD(SOC), 2050, pessimistic scenario.

For illustrative purposes, Figure 11b isolates the component of PD in both indices attributable to the degradation of each natural asset. It is calculated as the difference between the PD associated with each natural asset and the PD associated with SOC, whose shock is virtually nil and therefore approximates a no-degradation scenario.

In the **IBEX 35,** this component reaches 0.91% for EII at the current rating, rising to 2.85% at +1 and 8.57% at +2. By comparison, it ranges from only 0.02% to 0.12% for WS and from 0.04% to 0.45% for MSA.

In the **CAC 40,** the EII component is much lower, at 0.05%–0.73%, whereas the components for WS, at 0.06%–0.91%, and MSA, at 0.05%–0.76%, are higher than in the IBEX 35. This confirms that the difference between the indices is concentrated in EII and that, in the IBEX 35, most of the PD associated with WS and MSA reflects the initial level of credit risk rather than nature degradation.

The aggregate gap between the indices is concentrated in a single natural asset

The aggregate comparison suggests that the IBEX 35 is between 1.1 and 5.5 times riskier than the CAC 40. However, this range does not describe a generalised difference between the two indices, but rather the interaction of two distinct regimes. Excluding habitat-related natural capital (EII), the IBEX 35 is 1.4–1.9 times riskier than the CAC 40 at the baseline level and only 1.1–1.3 times riskier at +2 notches, with ratios of 1.42 times for WS, 1.57 times for MSA, 1.86 times for AQ and 1.80 times for SOC. EII, by contrast, moves from 5.52 times at +0 to 3.81 times at +1 and 2.70 times at +2. In absolute terms, the EII gap at +2, at 9.13 percentage points, exceeds the combined gaps for the other four natural assets, at 4.02 percentage points, and represents approximately two thirds of the total difference between the indices across the three rating levels. The relevant conclusion is not simply that the IBEX 35 is riskier than the CAC 40, but **that the IBEX 35 has much greater exposure to habitats** and that this exposure explains almost all of the aggregate difference.

For four of the five natural assets, the indices differ in the level of PD increase but not in their trend

For WS, MSA, AQ and SOC, the IBEX 35 multipliers, at 4.39–4.55 times in the first downgrade step and 4.14–4.20 times in the second, are consistently lower than those of the CAC 40, at 5.15–5.49 times and 4.65–4.92 times, respectively. The gap is highly uniform, at 0.8–1.1 multiplier points in the first step and 0.5–0.7 points in the second. This consistency suggests a common driver that is not specific to any natural asset and is compatible with differences in initial-rating distributions rather than asset-specific model calibration.

Habitat-related natural capital deviates from this pattern and explains the structural divergence

EII is the only natural asset for which the two indices do not converge. Its multiplier in the IBEX 35, at 3.49 and 3.40 times, is the lowest of the five natural assets in the index, whereas in the CAC 40, at 5.05 and 4.80 times, it is similar to the other assets. The combination of a lower multiplier and a baseline level five times higher means that the IBEX 35 retains a 2.70-times gap at +2, far above that observed for the other assets. There are two reasons: the IBEX 35 includes a high proportion of A-rated issuers moving to BBB with low amplification factors, which reduces the aggregate EII multiplier; and its sector composition concentrates exposure in activities with a high dependence on habitats. EII is therefore the natural asset that defines the comparison between the indices and introduces the heterogeneity concealed by the aggregate results.

4. Temporal evolution and scenario sensitivity

The temporal dimension of the analysis is perhaps as relevant as the sectoral dimension. The data show that the impact of habitat degradation (EII) increases over time, particularly in absolute terms after 2030, and that this acceleration is more pronounced under the more pessimistic scenarios.

Table 2. Evolution over time of the range of EII-stressed PD (Construction sector, BBB rating)

Horizon	Optimistic Scenario	Intermediate Scenario	Pessimistic Scenario
2025	0.08%–0.11%	0.10%–0.14%	0.15%–0.20%
2030	0.14%–0.18%	0.18%–0.24%	0.28%–0.36%
2050	0.71%–0.93%	0.93%–1.27%	1.41%–1.89%

Under the pessimistic scenario, the increase in PD between 2025 and 2030 is already significant: the range rises from 0.15%–0.20% to 0.28%–0.36%, almost doubling the initial values, equivalent to a relative increase of approximately 80%–90%.

Between 2030 and 2050, the increase is even more pronounced in absolute terms, with the range reaching 1.41%–1.89%, approximately five times the 2030 values. In absolute terms, PD increases by around 0.07 percentage points per year between 2030 and 2050, compared with around 0.03 percentage points per year between 2025 and 2030, although the relative annual growth rate moderates to approximately 8%–9%, from 12%–13%. This progression reflects the degradation pathways projected under the scenarios; the model does not incorporate threshold effects or ecological feedback loops (see the Limitations section).

Table 3. Scenario comparison at the 2050 horizon, based on the stressed-PD range for the Energy sector (BBB rating)

Natural Asset	Optimistic Scenario	Intermediate Scenario	Pessimistic Scenario	Pessimistic vs Optimistic
EII	0.27%–0.52%	0.37%–0.68%	0.58%–1.12%	+115%
WS	0.13%–0.16%	0.14%–0.18%	0.21%–0.27%	+66%
MSA	0.13%–0.15%	0.14%–0.17%	0.20%–0.25%	+61%

Under the pessimistic scenario (SSP5-RCP8.5), stressed PD is generally around 45%–65% higher than under the intermediate scenario. For EII specifically, pessimistic-scenario values are approximately twice those under the optimistic scenario, compared with factors of 1.6–1.7 for WS and MSA. The gap between the optimistic and pessimistic scenarios widens over time, indicating that sustainability and ecological-transition policies have increasing mitigating potential over the long term. At the 2050 horizon, for sectors such as Energy and Construction, EII-related PD under the optimistic scenario is approximately half the level observed under the pessimistic scenario. This provides quantitative evidence that a robust and early sustainability strategy can have tangible effects on financial stability.

5. Comparative sectoral summary

The sectoral comparison is the logical conclusion of the analysis: it establishes a clear hierarchy of vulnerabilities and identifies the structural drivers of nature-related risk within the IBEX 35. Two dimensions are particularly relevant: (i) the absolute level of stressed PD, which reflects sectoral exposure to natural capital; and (ii) the sensitivity of this increase to credit rating downgrades, which reveals the capacity to absorb nature-related impacts. Table 4 and Figure 12 summarise these two dimensions under the intermediate scenario at the 2050 horizon[7].

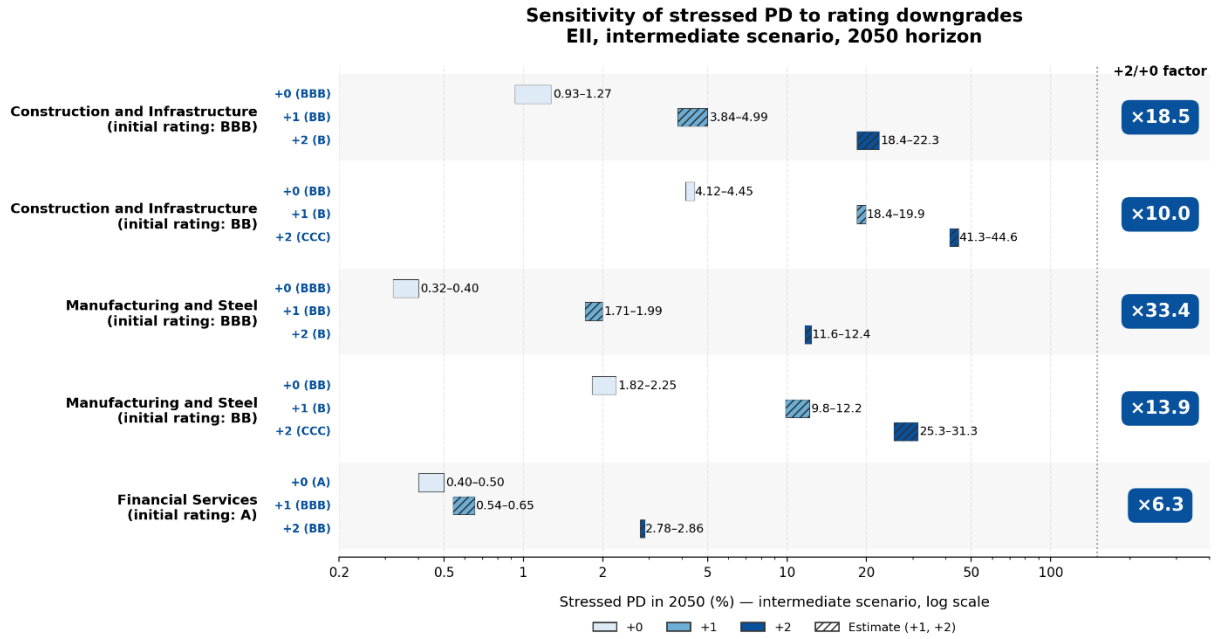
Table 4. Sectoral vulnerability ranking by EII-stressed PD in 2050 (intermediate scenario, each issuer's current rating)

Sector	Most Relevant Natural Capital	Issuers (Ratings)	Stressed-PD Range	Average Stressed PD (approx.)
Construction and Infrastructure	EII	(BBB, BB)	0.93%–4.45%	≈1.90%
Transport, Tourism and Logistics	EII	(BBB, BB)	0.28%–1.92%	≈1.04%
Manufacturing and Steel	EII	(BBB, BB)	0.32%–2.25%	≈0.92%
Energy	EII	(A, BBB)	0.37%–0.70%	≈0.54%
Financial Services	EII	(A, BBB)	0.40%–0.65%	≈0.49%
Telecommunications and Technology	EII	(BBB, BB)	0.21%–0.28%	≈0.25%

Table 4 reveals three main findings:

- **Construction and Infrastructure** clearly ranks **first,** with an average stressed PD of approximately 1.90% and a range of 0.93%–4.45%. This position reflects the sector's dependence on habitat integrity (EII) and the presence of a BB-rated issuer (4.12%–4.45%). Its average PD nearly doubles that of the next sector.
- **Transport, tourism and logistics** (≈1.04%) and **manufacturing and steel** (≈0.92%) rank second and third, at similar levels, owing to the presence in each of a BB-rated issuer (1.45%–1.92% and 1.82%–2.25%), while their investment-grade issuers remain at low levels (0.28%–0.52% and 0.32%–0.40%). **Energy** (≈0.54%) and **financial services** (≈0.49%) show comparable levels, with overlapping ranges (0.37%–0.70% and 0.40%–0.65%). The financial sector is illustrative: its direct exposure is low and most of its issuers are rated A, while its fifth-place ranking reflects the indirect effects transmitted through its supply chain.
- **Telecommunications and Technology ranks last**, with an average stressed PD of approximately 0.25% (0.21%–0.28%), roughly one eighth of that of the construction sector. Even so, the most resilient sectors are not immune to nature degradation, particularly through their supply chains.

[7] The post-downgrade levels shown in Figure 12 are estimated using the same methodology as in Figure 10 and should therefore be interpreted as illustrative orders of magnitude.



+0 level: Figures 1–6. +1 and +2 levels (hatched): illustrative estimate applying the model's per-issuer downgrade factors to the +0 level. Factor computed as the ratio of range midpoints (+2 / +0). Resulting rating in parentheses.

Figure 12. Summary of sensitivity to credit rating downgrades (intermediate scenario, 2050 horizon). Levels +1 and +2 estimated.

Figure 12 shows that sensitivity to credit rating downgrades varies considerably by sector and initial rating. Three key findings emerge:

- Within the same sector, **the PD amplification factor is greater when the initial rating is stronger.** In Manufacturing, a two-notch downgrade from +0 to +2 multiplies stressed PD by approximately 33 times for a BBB-rated issuer, compared with approximately 14 times for an issuer initially rated BB. This pattern reflects a base effect: the lower the starting PD, the larger the multiplier associated with the same degree of credit deterioration. In other words, stronger issuers have greater shock-absorption capacity, but once this buffer is exceeded, risk accelerates sharply. Issuers that are already vulnerable experience a larger absolute impact, but the relative effect is mechanically lower because their starting PD is already high.
- **Construction** has an atypical profile. For a BBB-rated issuer, its amplification factor is lower than in Manufacturing, at approximately 18 times compared with approximately 33 times, because its initial stressed PD is already high. This configuration limits the relative amplification from a further downgrade: BBB-rated construction companies are already in a zone of significant vulnerability at their current rating; a downgrade to BB places them in the 3.8%–5.0% range, while a downgrade to B places them in a high-risk range of 18.4%–22.3%. Companies already rated BB would reach a critical range of 41%–45% after two notches, at CCC.
- Although less directly exposed, **Financial Services** has the lowest amplification factor in the comparison, at approximately 6.3 times for an A-rated issuer. Even so, a two-notch downgrade raises stressed PD from 0.40%–0.50% to 2.8%–2.9%, a significant increase relative to the starting level. This illustrates how sectors with apparently low exposure may become vulnerable once their credit quality deteriorates.

6. Differences from the French CAC 40 Index

This analysis compares the resilience of two major European stock-market indices, Spain's IBEX 35 and **France's** CAC 40, to **the degradation** of natural assets. Both indices were assessed using the same EthiFinance Nature Stress Test (NST) methodological framework, enabling a rigorous comparison of their vulnerability profiles. Nevertheless, differences in sector composition, credit quality and geographical exposure produce markedly different results.

The IBEX 35, with substantial exposure to **Construction, Infrastructure, Energy and Financial Services, has a** very different risk profile from the CAC 40, **where sectors** such **as Automotive, Luxury Goods, Pharmaceuticals, Aerospace and Semiconductors** carry considerably more weight. These structural differences result in a different hierarchy of nature-related risks and in substantially different impacts on probability of default (PD) across the two indices.

6.1 Differences in the hierarchy of natural assets

Table 5. Comparison of the hierarchy of natural assets by impact on PD (pessimistic scenario, 2050 horizon)

IBEX 35	CAC 40
Structural and Biotic Integrity (EII)	Water (WS)
Water (WS)	Species (MSA)
Species (MSA)	Structural and Biotic Integrity (EII)
Atmosphere (AQ)	Atmosphere (AQ)
Soils and Sediments (SOC)	Soils and Sediments (SOC)

The most significant difference between the two indices concerns the natural asset generating the greatest financial impact (Table 5). Structural and Biotic Integrity (EII) is the dominant factor in the IBEX 35. In the Construction sector, EII-stressed PD ranges from 1.41% to 1.89% under the pessimistic scenario (Figure 1). In the CAC 40, by contrast, Water Stress (WS) ranks first, although its levels are very close to those of MSA and EII (Figure 11). This divergence reflects profound differences in the sector composition of the two indices.

In the IBEX 35, the weight of Construction and Infrastructure, whose operations depend critically on habitat stability and integrity, explains why EII is the most relevant factor. By contrast, the CAC 40 has a much greater presence of sectors such as Automotive, Pharmaceuticals, Food and Electronics, resulting in substantially greater dependence on water both in direct production processes and across global supply chains.

Table 6. Comparison of impact intensity by natural asset (intermediate scenario, 2050 horizon, BBB-rated issuers)

Natural Asset	IBEX 35 (Most Affected Sector)	CAC 40 (Most Affected Sector)
Structural and Biotic Integrity (EII)	Construction and Infrastructure: approx. 0.93% – 1.27%	Automotive: approx. 0.6% – 0.8%
Water (WS)	Construction and Infrastructure, Energy, and Manufacturing and Steel: approx. 0.14% – 0.18%	Food and Hospitality: approx. 0.8% – 1.2%
Species (MSA)	Construction and Infrastructure: approx. 0.14% – 0.17%	Pharmaceutical Laboratories: approx. 0.5% – 0.7%
Atmosphere (AQ)	Negligible impact	Negligible impact
Soils and Sediments (SOC)	No impact	No impact

Table 6 shows that vulnerability in the IBEX 35 is concentrated in Construction, whereas in the CAC 40 it is distributed across a more diverse group of sectors, with Automotive, Food and Pharmaceuticals among the most exposed. Irrespective of sector, both indices remain primarily sensitive to the same three forms of natural capital: Structural and **Biotic Integrity (EII), Water Stress (WS) and Mean Species Abundance loss (MSA). Both also** show very high resilience to degradation of Atmosphere (AQ) and Soils and Sediments (SOC).

6.2 Differences in sectoral vulnerability

Comparison of the most vulnerable sectors

The sector composition of the two indices differs radically, resulting in very different risk profiles.

Table 7. Comparison of the most vulnerable sectors in the IBEX 35 and CAC 40 (pessimistic scenario, 2050 horizon)

IBEX 35	CAC 40
Construction and Infrastructure	Automotive
Manufacturing and Steel	Hospitality
Transport, Tourism and Logistics	Real Estate
Energy	Pharmaceuticals
Financial Services	Spirits

The construction and infrastructure sector is the most affected in the IBEX 35, with an EII-stressed PD of between 5.67% and 6.23%, under a pessimistic scenario and for BB-rated companies (Figure 7). In the **CAC 40,** by contrast, **automotive emerges as the most vulnerable sector**, reflecting the complexity and globalisation of its supply chains, which depend critically on healthy ecosystems across multiple regions worldwide.

The **second most vulnerable sector in the IBEX 35 is manufacturing and steel,** whose EII-stressed PD reaches between 2.58% and 3.18% for BB-rated companies, under a pessimistic scenario (Figure 4), owing to the dependence of its raw-material supply chains on habitat integrity. In the **CAC 40**, this position is occupied by the **hospitality sector**, reflecting the weight of tourism in the French economy and its high dependence on water and healthy ecosystems.

Next, the **transport, tourism and logistics, energy and financial services sectors follow in the IBEX 35,** while in the **CAC 40** these positions are held by **real estate, pharmaceuticals and spirits**. Only activities linked to tourism and the real-estate sector appear among the most vulnerable in both indices, confirming that each index's vulnerability reflects its own sectoral structure.

Resilient Sectors: Similarities and differences

In the **IBEX 35, Telecommunications and Technology is the most resilient sector**, with EII-stressed PD of only 0.21%–0.28% under the intermediate scenario at the 2050 horizon.

In the **CAC 40**, on the other hand, the **financial services sector (banking and insurance)** ranks among the most resilient, reflecting the substantial weight of French financial institutions and their limited direct exposure to ecosystems. In the IBEX 35, by contrast, this sector ranks fifth among the most vulnerable, owing to the indirect effects transmitted through its supply chain.

6.3 The water paradox: Differences in dynamics under the optimistic scenario

One of the most important findings of the CAC 40 report is the water paradox under the optimistic scenario: Water Stress (WS) produces a greater increase in PD than under the pessimistic scenario. This phenomenon is not observed in the IBEX 35, where the impact of WS is consistently greater under the pessimistic scenario than under the optimistic scenario (Table 8).

Table 8. Comparison of the effect of the optimistic scenario on Water Stress (2050 horizon)

Index	WS Impact: OPT vs PES	Main Explanation
CAC 40	OPT > PES	The agricultural transition in France is more intensive in its use of water resources.
IBEX 35	PES > OPT (no paradox)	Lower weight of the agri-food sector in the index, despite the sector's importance to the Spanish real economy.

In the CAC 40, the transition towards more sustainable agricultural practices under the optimistic scenario **(SSP1-RCP2.6) entails increased water consumption** in temperate regions such as France, raising water stress despite more favourable environmental conditions. In the IBEX 35, the lower weight of the agri-food sector in the index and the different structure of Spanish agriculture, with a greater presence of rainfed crops and lower irrigation intensity in certain regions, may help explain the absence of this paradox.

6.4 Differences in the effect of Credit-Rating downgrade

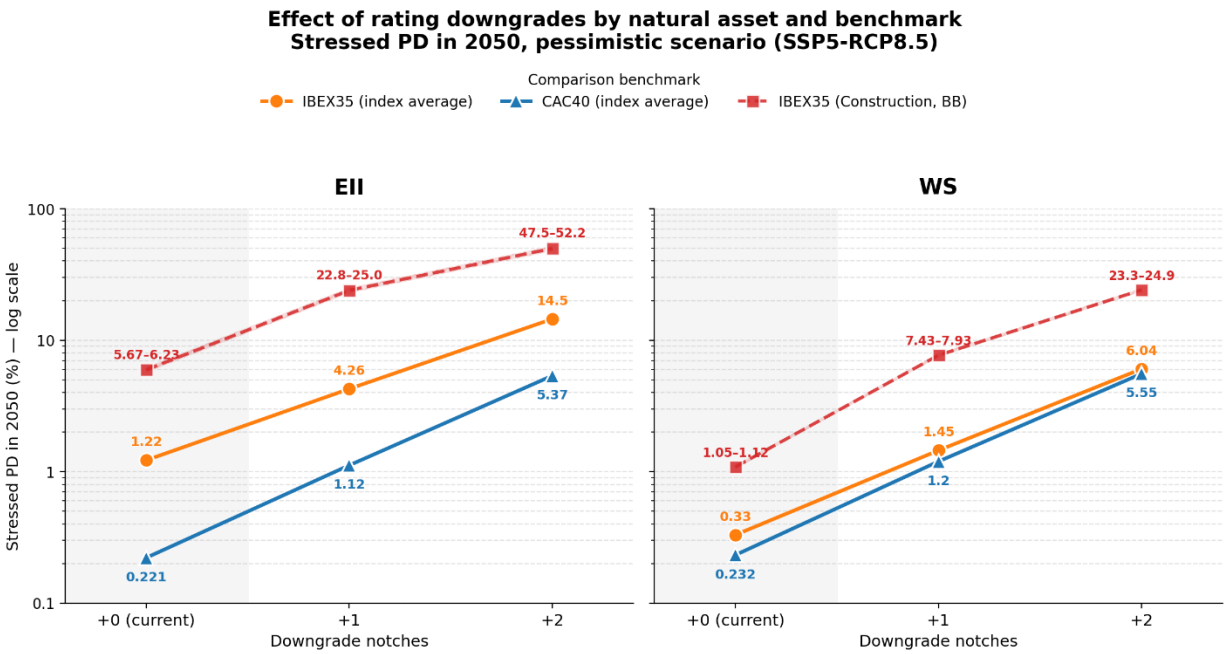
Both indices show that a credit rating downgrade significantly amplifies the impact of nature degradation on probability of default (PD). The relationship is non-linear: a one- or two-notch downgrade produces a more-than-proportional increase in risk, as illustrated by the amplification factors presented below. However, the starting point and magnitude of the effect differ between the two indices.

Table 9. Comparison of the effect of credit rating downgrades: IBEX 35 vs CAC 40 (EII, 2050, pessimistic scenario) – PD levels in percent

Scenario	IBEX 35 (index average)	CAC 40 (index average)
Current rating	1.22%	0.22%
+1 notch	4.26%	1.12%
+2 notches	14.49%	5.37%
Amplification factor (+2 vs current)	11.9×	24.3×

The CAC 40 starts from a more favourable position in terms of average PD under the pessimistic scenario, at 0.22% compared with 1.22% for the IBEX 35. Three complementary factors explain this difference in baseline level. First, geography: projections for natural capital are less severe in France than in Spain, such that a B-rated French issuer has a PD similar to that of a BB-rated Spanish issuer; in the model, the lower intensity of the country shock offsets one rating notch. Second, sector composition: the CAC 40 includes sectors with low dependence on habitats, such as Luxury Goods, Healthcare and Financial Services, whereas the IBEX 35 contains a higher proportion of issuers in Construction, Infrastructure and Real Estate, sectors with strong dependence on EII. Third, average credit quality: for EII, the CAC 40 includes three AA-rated issuers with baseline PD of approximately 0.062%, well below that of A-rated issuers in the IBEX 35, at around 0.09%, and BBB-rated issuers, at around 0.13%.

Despite starting from a lower baseline PD, downgrade amplification is more pronounced in the CAC 40, with a factor of 24.3 times between the current rating and a two-notch downgrade, compared with 11.9 times for the IBEX 35. This difference does not indicate greater sensitivity to deterioration in the CAC 40, but rather the arithmetic effect of starting from a lower base. The absolute increase in PD is greater in the IBEX 35, at 13.27 percentage points compared with 5.15 percentage points for the CAC 40. However, because the IBEX 35 baseline is 5.5 times higher, its relative factor is approximately half. In absolute terms, the IBEX 35 remains riskier than the CAC 40 at all three levels, although the gap narrows from 5.5 times at +0 notches to 2.7 times at +2 notches.



Index averages: model outputs (Figure 11). Construction BB: +0 level from Figures 7–8; +1 and +2 estimated with the model's downgrade factor (band: minimum–maximum range). Compare like-for-like series (average with average).

Figure 13. Effect of credit rating downgrades by natural asset and reference sector (2050, pessimistic scenario) – PD levels in percent. Construction BB: levels +1 and +2 estimated.

Figure 13 shows that amplification of probability of default (PD) by rating notch varies according to the natural asset and index analysed. In the IBEX 35, for a BB-rated Construction issuer, cumulative amplification reaches 8.4 times for EII and 22.2 times for WS. In the CAC 40, the aggregate factors are 24.3 times and 23.9 times, respectively. The latter correspond to the index average and should therefore be compared with the IBEX 35 averages of 11.9 times and 18.3 times, rather than with an individual issuer.

These differences reflect the interaction between initial-rating distributions, sector composition and the intensity of natural-asset shocks in each geography. In particular, a lower initial PD may produce a larger multiplier for comparable absolute increases. Amplification factors should therefore be interpreted together with starting PD levels and absolute changes, since a higher multiplier does not necessarily imply greater risk in absolute terms.

6.5 Differences in the temporal evolution of risk

The temporal evolution of PD follows different patterns in the two indices, reflecting their differing sector composition and exposure to natural assets.

The **IBEX 35** shows a **much more pronounced acceleration in risk** between 2030 and 2050 than the CAC 40. This difference is explained by the weight of Construction and Energy in the IBEX 35, whose supply chains are particularly sensitive to long-term habitat degradation.

In the **CAC 40,** risk evolves more gradually over time, although the **water paradox** creates a distinctive dynamic in which the optimistic scenario may present greater risk than the pessimistic scenario over the medium term.

6.6 Differences in geographical exposure

Geographical exposure is another differentiating factor between the two indices. Although the methodology uses the location of the registered office as a proxy, the global supply chains of CAC 40 companies are generally more extensive and complex than those of IBEX 35 companies.

This difference is particularly relevant because the Leontief model captures the transmission of shocks through supply chains. With a greater presence of sectors such as Automotive and Semiconductors, the CAC 40 has more globalised and complex supply chains, amplifying indirect transmission risk. The IBEX 35, by contrast, has greater exposure to the domestic market due to the higher weight of sectors such as Construction, Energy and Financial Services, resulting in risk transmission that is more concentrated within the Spanish economy.

6.7 Conclusions of the comparative analysis: IBEX 35 vs CAC 40

- **Apparent overall resilience:** the comparison between the IBEX 35 and CAC 40 shows that, although both stock-market indices appear resilient to nature degradation owing to their generally high average credit quality, their underlying risk profiles differ substantially. This overall resilience therefore conceals distinct structural vulnerabilities that may materialise differently depending on the evolution of climate- and nature-related risks.
- **Concentrated vulnerabilities in the IBEX 35:** the Spanish index is characterised by a greater concentration of vulnerabilities, particularly to habitat degradation (EII) and primarily in Construction, as well as by a faster temporal evolution of risk than in the CAC 40. This dynamic reflects the structural weight of Construction and Energy in the Spanish economy, sectors whose economic activity depends critically on ecosystem integrity and soil stability.
- **Diversified vulnerabilities in the CAC 40:** by contrast, the French index presents a more diversified vulnerability profile. Water Stress (WS) is the principal risk factor and significantly affects key sectors such as Automotive, Hospitality and Pharmaceuticals, which are among the most exposed to this risk.
- **Credit quality and amplification of financial risk:** the CAC 40 starts from a lower average PD than the IBEX 35. Owing to an arithmetic base effect, relative amplification following a one- or two-notch downgrade is therefore more pronounced for the French index, although the absolute increase in PD is greater in the IBEX 35 (Table 9). In addition, the complexity and globalisation of French companies' supply chains introduce an additional transmission risk, or domino effect, that has no direct equivalent in the IBEX 35, given the latter's greater exposure to the domestic market.
- **Sectoral resilience and contrasts:** both indices identify Telecommunications and Technology as among the most resilient sectors; Financial Services is also among them in the CAC 40, whereas in the IBEX 35 it shows moderate vulnerability arising from indirect effects through its supply chain. However, the IBEX 35 shows a sharper contrast between vulnerable and resilient sectors, indicating greater dispersion within the Spanish economy.
- **Nature of the risks:** overall, while both indices present moderate risk under the intermediate scenario, the nature of their vulnerability differs. The IBEX 35 is more exposed to the direct effects of habitat degradation in infrastructure-intensive sectors, whereas the CAC 40 is more sensitive to water stress and to risk transmission through global supply chains.

6.8 Implications for effective financial risk management

Table 10. Risk-management implications by index

Dimension	IBEX 35	CAC 40
Monitoring priority	Habitat Integrity (EII)	Water Stress (WS)
Critical sectors to monitor	Construction and Infrastructure	Automotive, Food and Tourism
Key amplification factor	Ratings of companies in the Construction and Infrastructure sector	Supply-chain complexity
Priority adaptation measures	Habitat and soil protection, and water management	Water efficiency and water management
Emerging risk	Acceleration of habitat degradation after 2030	Water paradox under transition scenarios

This comparative analysis highlights that **nature-related risk management cannot follow a one-size-fits-all approach, but must be adapted to each portfolio's sector composition, credit quality and geographical exposure** (Table 10).

For the **IBEX 35,** monitoring should prioritise **habitat integrity** and the exposure of **Construction and Infrastructure** companies. For the **CAC 40**, the principal pillars of the mitigation strategy should be the **management of water stress,** the exposure of companies in the **Automotive, Food and Tourism** sectors, and the complexity of global supply chains.

It should also be noted that the Spanish index has material exposure to water stress. This exposure is reflected, directly or indirectly, in issuers' initial credit ratings, underscoring the need to manage water resources over the short, medium and long term.

7. Conclusions

- The sectoral analysis of the IBEX 35 through the lens of EthiFinance's Nature Stress Test reveals a complex but clearly ordered picture. **Habitat integrity (EII)** is the natural asset that poses the most significant financial risk to most sectors in the index, with a particularly marked effect on Construction, Energy, and **Manufacturing and Steel.** It is followed at some distance by **Water Stress (WS) and Mean Species Abundance loss (MSA).** By contrast, Atmosphere (AQ) and Soils and Sediments (SOC) have a negligible impact in terms of increases in probability of default (PD), allowing monitoring and mitigation efforts to be concentrated on the most financially material ecological dimensions.
- **Construction** is clearly the **most exposed sector. At** the 2050 horizon under the intermediate scenario, stressed PD exceeds 4% for companies with lower credit quality. **Telecommunications shows low vulnerability, while Financial Services displays moderate vulnerability**, driven mainly by indirect effects transmitted through its supply chain (Table 11).

Table 11. Key findings by financial materiality and sector-level recommendations

Sector	Principal Risk	Vulnerability Level	Main Recommendation
Construction and Infrastructure	EII (habitats)	**Very high**	Monitor exposure to areas of high ecological sensitivity
Manufacturing and Steel	EII (habitats) and WS (water)	**High–medium**	Invest in water efficiency and the circular economy
Transport, Tourism and Logistics	EII (habitats)	**High–medium**	Assess risks associated with environmental regulation
Energy	EII (habitats) and WS (water)	**High–medium**	Diversify water sources and establish contingency plans
Financial Services	Indirect EII (habitats)	**Medium**	Integrate nature-related risk into credit models
Telecommunications and Technology	EII (habitats)	**Low**	Maintain continuous monitoring; no urgent action required

- The sensitivity analysis of initial credit ratings shows that a **one- or two-notch downgrade** amplifies **default risk in a non-linear manner, multiplying stressed PD by a factor of between 1.3 (from A to BBB) and 7 per notch, depending on the sector and initial rating** (Figures 10, 12 and 13). This finding reinforces the need to integrate nature-related risk into credit ratings and financial institutions' stress-testing models and underscores that companies' structural financial resilience cannot be separated from nature degradation.
- The comparison across scenarios shows that the more sustainable pathway, represented by the optimistic scenario (SSP1-RCP2.6), substantially mitigates risk. **At the 2050 horizon, it approximately halves EII-related PD** (and reduces MSA- and WS-related PD by around 40%) compared with the pessimistic scenario, providing a strong economic argument for accelerating the ecological transition.
- Finally, **Construction and Infrastructure** is the sector most financially affected by natural-capital degradation across all scenarios analysed at the 2050 horizon. **Habitat integrity (EII)** is the **most material form of natural capital** and shows the most pronounced deterioration over time, amplifying the financial effect (Table 12).

Table 12. Effect of the different scenarios at the 2050 horizon for Construction and Infrastructure (BBB rating)

Natural Capital	Optimistic	Intermediate	Pessimistic	PES/OPT Factor
EII	0.71%–0.93%	0.93%–1.27%	1.41%–1.89%	**2.0×**
WS	0.13%–0.16%	0.14%–0.18%	0.21%–0.27%	**1.7×**
MSA	0.13%–0.15%	0.14%–0.17%	0.20%–0.25%	**1.6×**

Based exclusively on outputs from EthiFinance's Nature Stress Test model, this report shows that nature **degradation and dependence on ecosystem services are already relevant and quantifiable factors for Spain's benchmark stock market index.** Their appropriate measurement and management should therefore be a priority for asset managers and financial-institution risk teams.

Limitations

The interpretation of the results should take several structural limitations into account.

First, the analysis focuses exclusively on dependencies on natural capital, namely the impact of ecosystem degradation on the continuity of production. It does not incorporate transition risks, such as regulation, consumer preferences or market pressures, which would require specific modelling frameworks. In addition, geographical exposure is approximated using the location of the company's headquarters, which only imperfectly reflects the multi-regional nature of operations and supplier networks. Natural capital is also assumed to evolve independently, without interactions, feedback loops or threshold effects, potentially leading to an underestimation of systemic impacts.

Second, the sample analysed, the IBEX 35, is primarily specific to Spain, limiting the statistical representativeness of some conclusions. The results are based solely on changes in probability of default (PD), without incorporating loss given default (LGD) or tail-risk measures such as value at risk (VaR) at the 99.9th percentile and are not aggregated into a single overall nature-risk indicator. In addition, PD levels after a one- or two-notch downgrade (Figures 10, 12 and 13) are estimated by applying the model's amplification factors to the PD level without a downgrade and therefore represent an illustrative order of magnitude.

Third, the Merton-Vasicek model used to translate production losses into changes in PD assumes a linear relationship between production losses and the systemic credit-quality factor, although the resulting PD responds non-linearly. While this assumption is accepted in stress-testing exercises, it may not fully reflect the non-linearities observed during periods of stress. The results are also sensitive to the transmission parameters, elasticities and correlations used.

Finally, nomenclature discrepancies between the EXIOBASE and FIGARO reference systems may affect the mapping between portfolio sectors and dependency sectors. As a result, the imputations applied to unmatched rows, including the use of an unrated average and recourse to the NACE Rev. 2 letter-level classification, may dilute or bias PD levels.

In conclusion, the results presented are indicative and do not constitute forecasts. They are intended to provide a forward-looking analytical framework for risk management, and any use in investment decision-making or prudential calibration should be supplemented with additional analysis.

Disclaimer

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References

- European Central Bank. (2022). *ECB report on good practices for climate stress testing*. European Central Bank.
- Bednar-Friedl, B., Biesbroek, R., Schmidt, D. N., Alexander, P., Børsheim, K. Y., Carnicer, J., Georgopoulou, E., Haasnoot, M., Le Cozannet, G., Lionello, P., Lipka, O., Möllmann, C., Muccione, V., Mustonen, T., Piepenburg, D., & Whitmarsh, L. (2022). Europe. In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate change 2022: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1817–1927). Cambridge University Press. https://doi.org/10.1017/9781009325844.015
- Belkin, B., Suchower, S., & Forest, L. R., Jr. (1998). A one-parameter representation of credit risk and transition matrices. *CreditMetrics Monitor*, *1*(3), 46–56.
- Beyer, H. L., Venter, O., Grantham, H. S., & Watson, J. E. M. (2020). Substantial losses in ecoregion intactness highlight urgency of globally coordinated action. *Conservation Letters*, *13*(2), e12692. https://doi.org/10.1111/conl.12692
- Boldrini, S., Ceglar, A., Lelli, C., Parisi, L., & Heemskerk, I. (2023). *Living in a world of disappearing nature: Physical risk and the implications for financial stability* (Occasional Paper Series No. 333). European Central Bank.
- Ceglar, A., Jwaideh, M., O'Donnell, E., Danieli, F., Pasqua, C., Hutchinson, J., et al. (2025). *Nature at risk: implications for the economy and financial stability of the euro area* [ECB Occasional Paper No. 380, forthcoming].
- European Environment Agency. (2021). *Water resources across Europe — confronting water stress: An updated assessment* (EEA Report No. 12/2021). Publications Office of the European Union.
- Eurostat. (2008). *NACE Rev. 2 – Statistical classification of economic activities in the European Community*. Office for Official Publications of the European Communities.
- Eyring, V., Bony, S., Meehl, G. A., Senior, C. A., Stevens, B., Stouffer, R. J., & Taylor, K. E. (2016). Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization. *Geoscientific Model Development, 9* (5), 1937–1958. https://doi.org/10.5194/gmd-9-1937-2016
- IPBES. (2019). *Global assessment report on biodiversity and ecosystem services* (S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, E. H. M. Butchart, et al., Eds.). https://ipbes.net/global-assessment
- Kuzma, S., Bierkens, M. F. P., Lakshman, S., Luo, T., Saccoccia, L., Sutanudjaja, E. H., & Van Beek, R. (2023). *Aqueduct 4.0: Updated decision-relevant global water risk indicators* (Technical Note). World Resources Institute. https://doi.org/10.46830/writn.23.00061
- Leontief, W. (1936). Quantitative input and output relations in the economic systems of the United States. *The Review of Economics and Statistics*, 18(3), 105–125.
- Merton, R. C. (1974). On the pricing of corporate debt: The risk structure of interest rates. *The Journal of Finance, 29* (2), 449–470. https://doi.org/10.1111/j.1540-6261.1974.tb03058.x
- Natural Capital Finance Alliance. (2020). ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure. https://www.encorenature.org/en/
- NGFS-INSPIRE Study Group on Biodiversity and Financial Stability. (2022). *Central banking and supervision in the biosphere: An agenda for action on biodiversity loss, financial risk and system stability* (Final report). Network for Greening the Financial System.

- PBL Netherlands Environmental Assessment Agency. (2020). GLOBIO model: a global biodiversity model for policy support. https://www.globio.info/
- Pineau, E., Riano Sanchez, J., Bres, J., & Schrapffer, A. (2024). *Nature stress testing and value at risk* (SSRN Working Paper No. 4923237). EthiFinance Analytics.
- Pineau, E., & Zuñiga, E. (2024). Sectoral credit sensitivity to carbon price with value chain effects. *Review of World Economics*.
- Remond-Tiedrez, I., & Rueda-Cantuche, J. M. (Eds.). (2019). *EU inter-country supply, use and input-output tables — Full international and global accounts for research in input-output analysis (FIGARO)*. Publications Office of the European Union.
- Riahi, K., van Vuuren, D. P., Kriegler, E., Edmonds, J., O'Neill, B. C., Fujimori, S., … Tavoni, M. (2017). The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. *Global Environmental Change*, *42*, 153–168. https://doi.org/10.1016/j.gloenvcha.2016.05.009
- S&P Global Ratings. (2024). Credit ratings and research [Various rating reports].
- Schipper, A. M., Hilbers, J. P., Meijer, J. R., Antão, L. H., Benítez-López, A., de Jonge, M. M. J., … Huijbregts, M. A. J. (2020). Projecting terrestrial biodiversity intactness with GLOBIO 4. *Global Change Biology*, *26*(2), 760–771. https://doi.org/10.1111/gcb.14848
- Stadler, K., Wood, R., Bulavskaya, T., Södersten, C.-J., Simas, M., Schmidt, S., … Tukker, A. (2018). EXIOBASE 3: Developing a time series of detailed environmentally extended multi-regional input-output tables. *Journal of Industrial Ecology*, *22*(3), 502–515. https://doi.org/10.1111/jiec.12715
- Taskforce on Nature-related Financial Disclosures. (2023). *Recommendations of the Taskforce on Nature-related Financial Disclosures*. TNFD.
- van Vuuren, D. P., Edmonds, J., Kainuma, M., Riahi, K., Thomson, A., Hibbard, K., … Rose, S. K. (2011). The representative concentration pathways: An overview. *Climatic Change*, *109*, 5–31. https://doi.org/10.1007/s10584-011-0148-z
- Vasicek, O. (2002). The distribution of loan portfolio value. *Risk*, *15*(12), 160–162.
- World Resources Institute. (2020). *Aqueduct Water Risk Atlas*. https://www.wri.org/aqueduct

Annexes

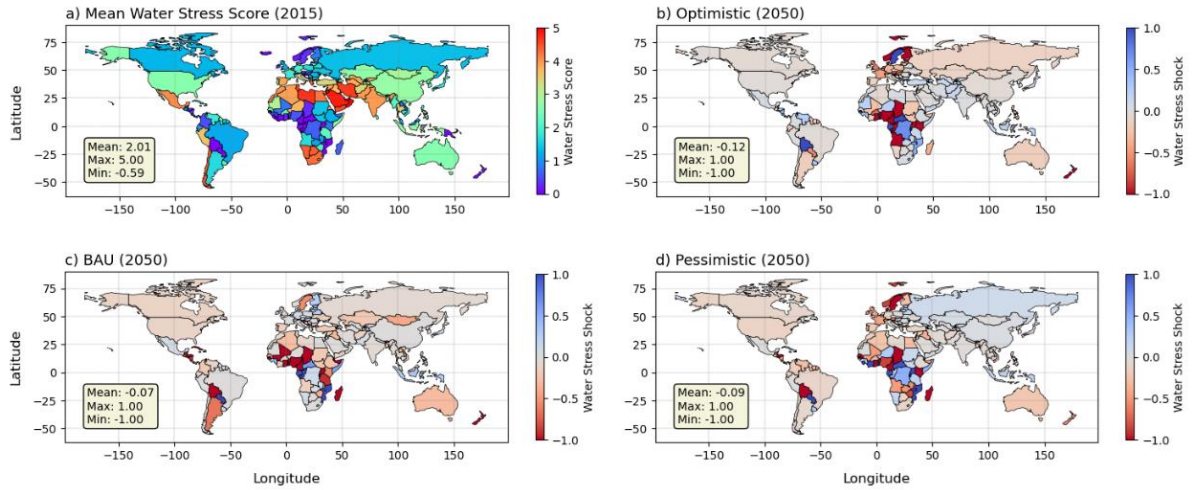

Figure 14. Water-related natural capital: 2015 reference year and rate of change under the pessimistic (PES), optimistic (OPT) and business-as-usual (BAU) scenarios.

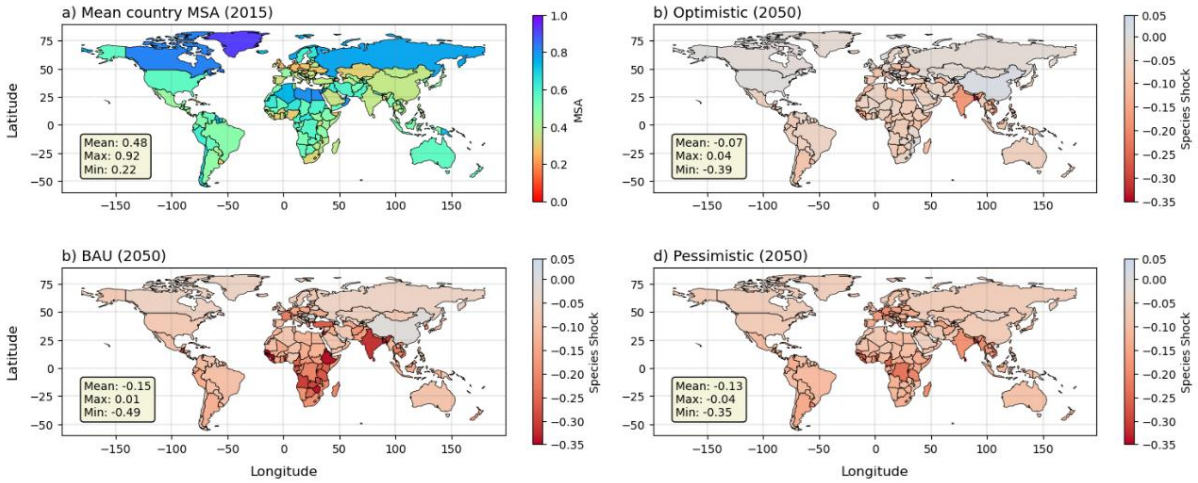

Figure 15. Species-related natural capital: 2015 reference year and rate of change under the pessimistic (PES), optimistic (OPT) and business-as-usual (BAU) scenarios.

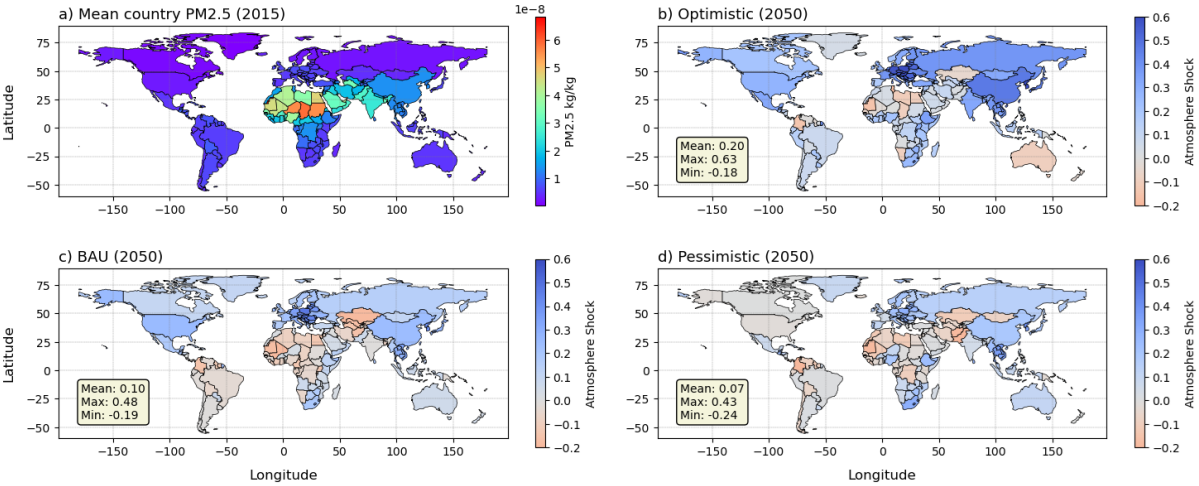

Figure 16. Atmosphere-related natural capital: 2015 reference year and rate of change under the pessimistic (PES), optimistic (OPT) and business-as-usual (BAU) scenarios.

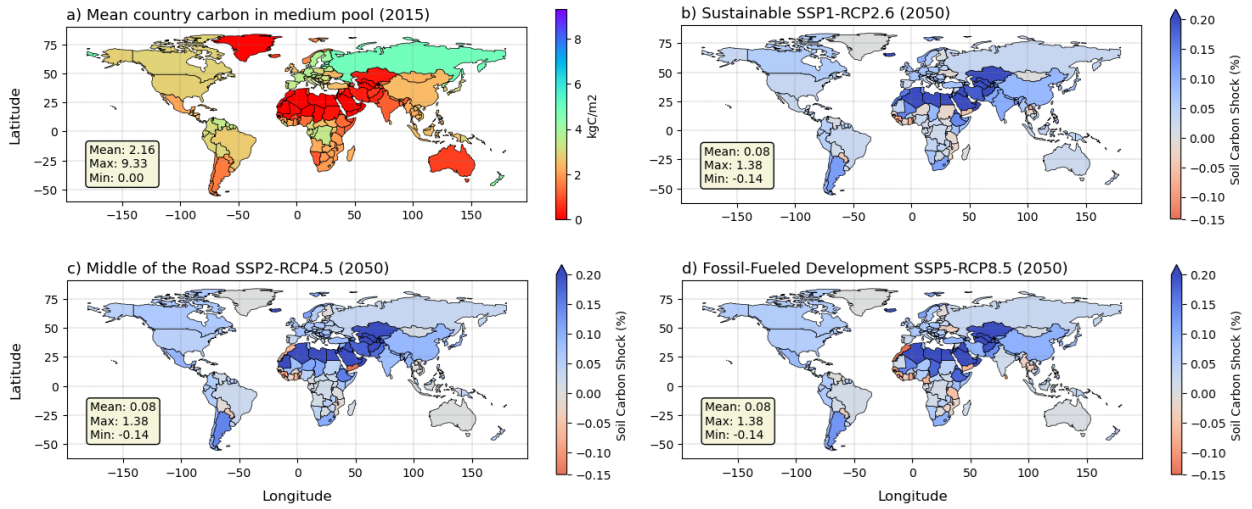

Figure 17. Soil-related natural capital: 2015 reference year and rate of change under the pessimistic (PES), optimistic (OPT) and business-as-usual (BAU) scenarios.

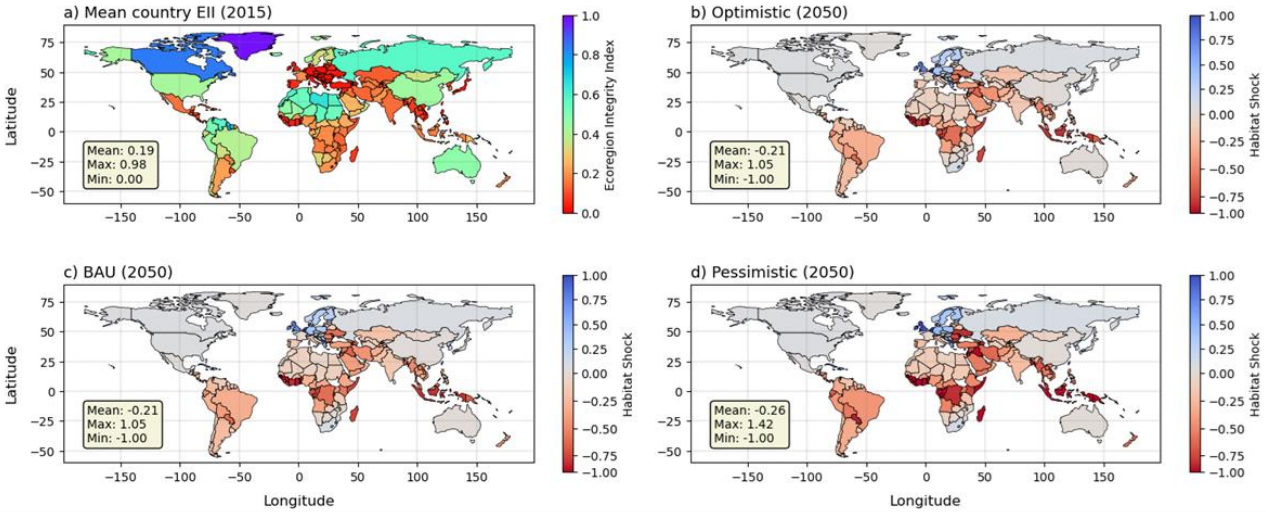

Figure 18. Natural capital related to structural and biotic integrity: 2015 reference year and rate of change under the pessimistic (PES), optimistic (OPT) and business-as-usual (BAU) scenarios.

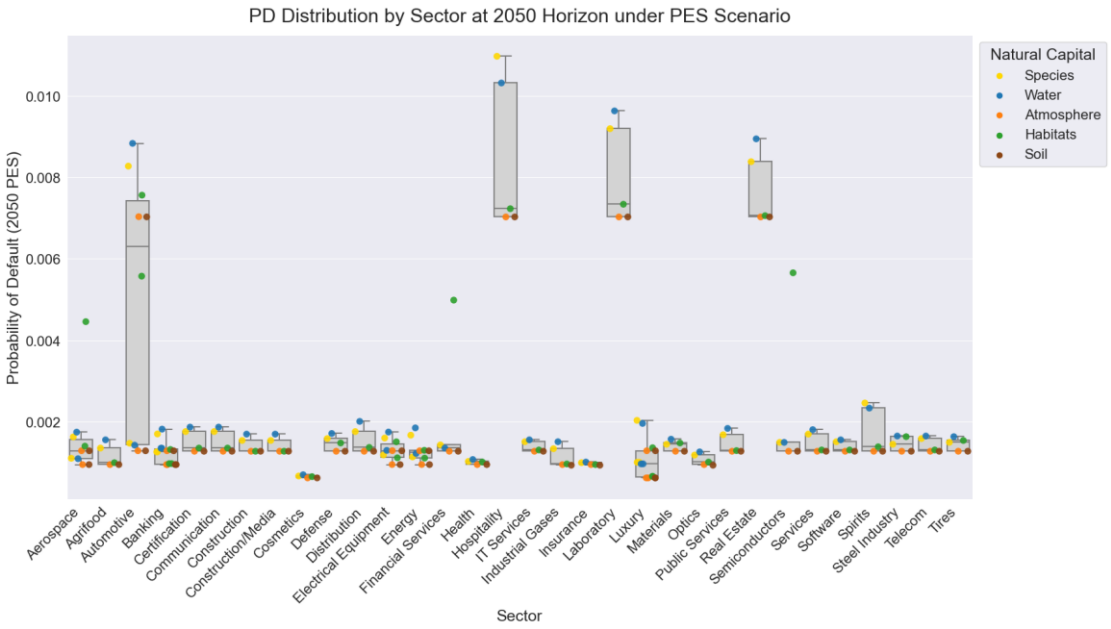

Figure 19. Distribution of stressed PD for the CAC 40 under a pessimistic scenario in 2050



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