Navigating the complexity of the other “E” risks: a practical approach to Nature-Related Risks

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Economic implications of Nature-Related Risks - NRRs

Why it matters for Finance

EUROPEAN CENTRAL BANK

"We are putting at risk more than half of global GDP. Around €40 trillion of global income relies on nature."

Frank Elderson, European Central Bank, June 2023

Degradation of nature can undermine production processes and consequently weaken the creditworthiness of many companies

Central banks and supervisors need to understand how **vulnerable** the **economy** and the financial system are to this degradation

72 %

of companies (corresponding to around three million individual companies) are highly dependent on at least one ecosystem service.

75%

of all bank lending in the euro area goes to companies that are highly dependent on at least one ecosystem service

Source: https://www.ecb.europa.eu/press/blog/date/2023/html/ecb.blog230608~5cffb7c349.en.html

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Introduction to Nature-Related Risks

Framework and Definition

- The **TNFD** (Taskforce on Nature-related Financial Disclosures) was launched in October 2021 to respond to the growing **awareness that biodiversity loss and ecosystem degradation** pose material financial risks.
- The final version of the TNFD framework was officially released in **September 2023** after two years of public consultation and pilot testing.
- Nature Related Risks were defined as:

…the risks of **negative effects on economies**, individual financial institutions and financial systems that **result from**:

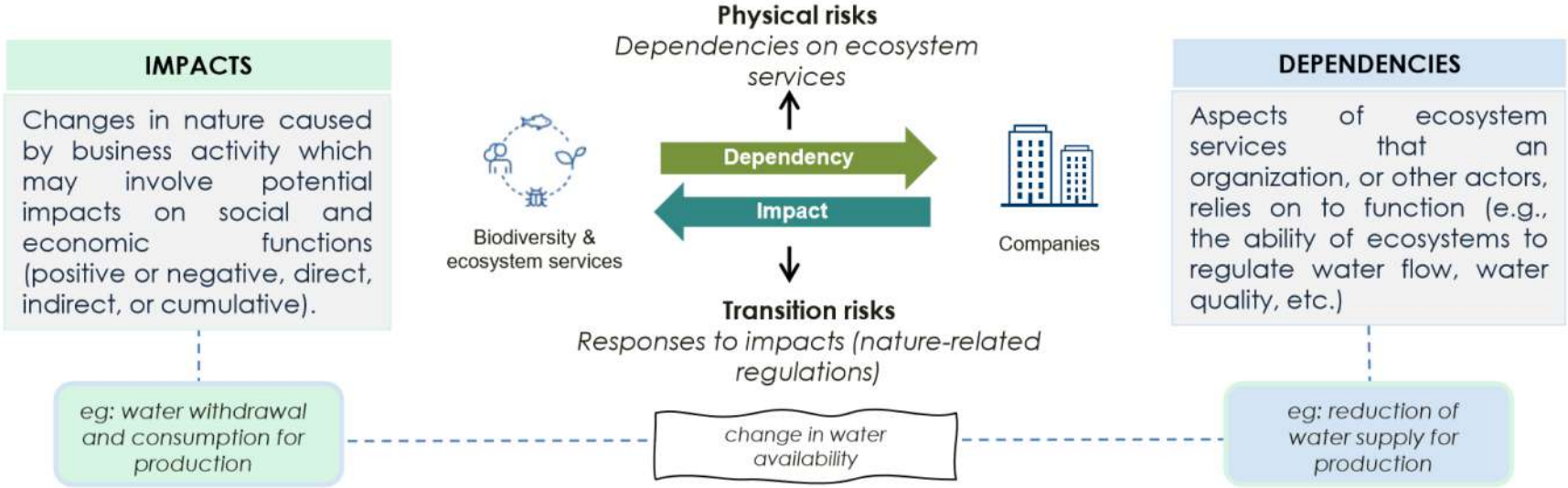
1. the **degradation of nature**, including its biodiversity, and the loss of ecosystem services that flow from it (**Physical Risk**)

2. the **misalignment of economic actors with actions aimed at** protecting, restoring, and/or **reducing negative impacts on nature (Transition Risk**)

Like climate risks, the framework is based on **Transition and Physical Risks**

Impacts & Dependencies

Risk Drivers for Transition and Physical Risks within Nature-Related Risks logic



ECOSYSTEM SERVICES provide benefits (goods/services enjoyed by people/companies) to enterprises (supply, adjustment/maintenance, cultural).

BIODIVERSITY means variability among living organisms from all sources, including but not limited to ecosystems and the ecological complexes of which they are a part of.

Reference standards and recommended Approach

LEAP approach: ISP application

TNFD proposes an **assessment process** for **managing nature-related risks and opportunities**: the **LEAP** approach, a 4 step process aimed at supporting the **internal assessments**

Locate
your interface with nature

Headquarters and **local production units** are identified, setting the stage for analyzing the **interactions** between **industries and** their surrounding **nature (direct operations)** through access to different **maps** related to ecosystem services and pressures on biodiversity.

Evaluate
your dependencies and impacts

Industry-specific **impact and dependency** are identified and applied using geographic & sector-level estimates together with the application that considers **location-specific natural resources status** and taking into account potential **value chain considerations (top down – bottom up approach)**.

Assess
your risks and opportunities

Exposure to environmental risks is quantified by **combining normalized sectoral and territorial risk scores** and considering exposure to NFCs taking into account **possible future states in the short-medium-long term** (current status, 2030, 2050) of the natural capital in two **different scenarios***:

- SSP1 RCP2.6 (optimistic);
- SSP5 RCP8.5 (pessimistic).

Prepare
to respond to nature-related risks

Results at counterparty level are considered in order to **define the materiality of Nature-related risks** for the portfolio in scope of analysis.

*Given the lack of standardized and complete scenarios related to nature-related risks the forward looking analysis is conducted taking into consideration the state of the art future projections related to both terrestrial and aquatic biomes. NGFS is currently working on the development of dedicated scenarios taking into account the biodiversity – climate nexus

Locate: Industry-Nature Interactions

Business activities and state of nature

In the Locate phase, **headquarters** and **local production units** are identified, thus setting the stage for analyzing the interactions between industries and their surrounding nature (direct operations).

Access to external databases for mapping ecosystems provides the basis for analyzing **ecosystem services** and **pressures** on biodiversity.

Locate Business activity

The levels of risk associated with a business' impacts on nature will be closely related to:

1

Sectoral materiality

Top-down

The **materiality** of the impact or dependency is assessed through the analysis of external databases, taking into account the sector's specificity.

2

Territorial relevance

Bottom-up integration

The **relevance of geographic location,** is assessed to provide an estimate of the condition and capacity of the ecosystems in which business operations take place.

Source: SBTN: Technical Guidance: Assess

Nature-Related Risks: ISP assessment analysis

Evaluate step – Risk drivers

Sectors (macro)*	Impacts: Land use	Impacts: Resource exploitation	Impacts: Climate change	Impacts: Pollution	Impacts: Invasive species	Dependencies: Direct physical input	Dependencies: Enabling production	Dependencies: Mitigating direct impacts	Dependencies: Protecting from disruption
Agriculture, forestry & fisheries	Very high	Very high	High	High	High	Very high	Very high	No materiality	Very high
Energy	Very high	Very high	High	High	High	High	High	No materiality	High
Mining	Very high	Very high	High	High	High	High	High	No materiality	High
Transportation	High	High	High	High	High	High	No materiality	No materiality	Very high
Food and beverages	No materiality	High	High	High	No materiality	Very high	No materiality	No materiality	No materiality
Apparel	High	Very high	High	High	No materiality	Very high	No materiality	No materiality	No materiality
Utilities	High	High	High	No materiality	No materiality	Very high	Very high	No materiality	Very high
Chemicals	High	Very high	High	High	No materiality	High	No materiality	No materiality	No materiality
Manufacturing	No materiality	High	High	High	No materiality	Very high	No materiality	No materiality	No materiality
Construction	Very high	High	High	High	No materiality	Very high	No materiality	No materiality	High

Impacts	Dependencies	
Very high	Very high	No materiality
High	High	

Main **biodiversity impacts sources** have been taken into account, taking into consideration specific risk drivers, and the main sources of direct physical input (e.g. crop provisioning) have been considered

Impacts

5 indicators

- Air pollution
- Soil Pollution
- Water Pollution
- Water Use
- Ecosystem Integrity and Land Use

Dependencies

3 indicators

- Crop Provisioning
- Water Provisioning
- Timber Provisioning

*UNEPFI : https://www.unepfi.org/wordpress/wp-content/uploads/2022/04/Prioritising-nature-related-disclosures.pdf

Evaluate: Company-Level Nature Risks

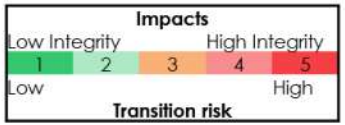
Territorial and Sector Risk Assessment

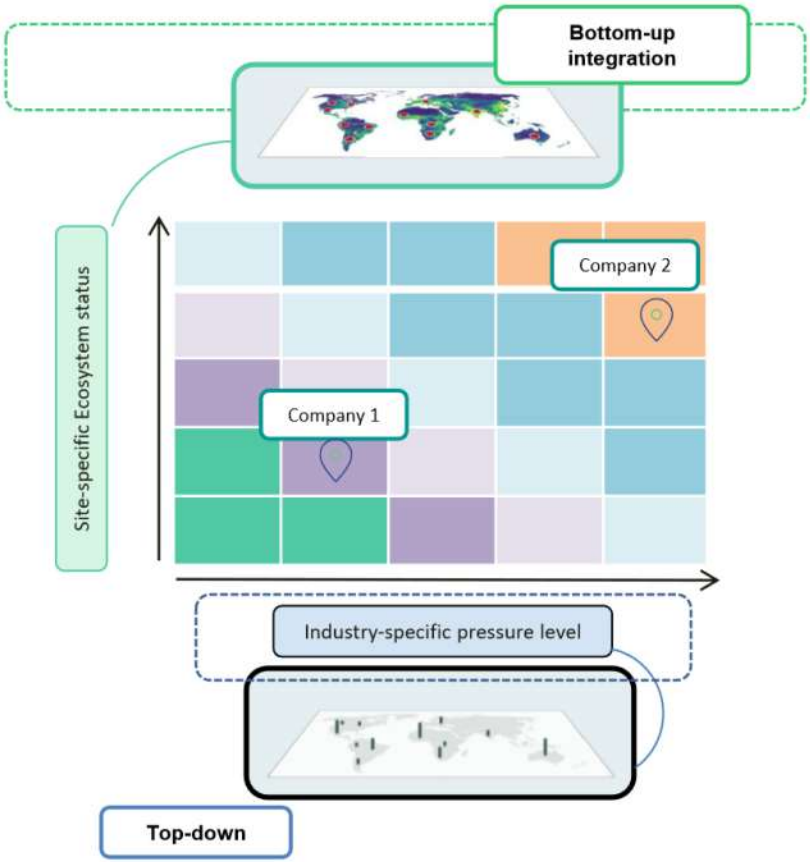
For industry-specific pressure level, an impact/dependency score is applied using sector-level materiality (**top-down approach**)

Companies	Sectors	Exposure	Impact: Resource exploitation	Depedency: Direct physical input
Company 1	Agriculture, forestry, and fisheries	100 mln	Very High	Very High
Company 2	Energy (including oil, gas and renewables)	50 mln	Very High	High

For the **most relevant impact and dependencies** (for **direct-operations**), applying a **bottom-up approach**, potential impacts and dependencies are identified considering the **relevance** of the location-specific natural resource status and the **materiality** of the industry-specific dependency or impact.
Relevance and materiality are assessed with **sectoral adjustments** through input-output matrices for **value chain** risk assessment.

A **normalized Score** is calculated for every single risk driver as below:





ISP Nature Related Risk Analysis

Assess step – Forward Looking score

- To evaluate potential evolutions of the geographical status of the ecosystem and biodiversity pressures for different scenarios two synthetic indicators for terrestrial (EII) and aquatic (Water stress index) biomes have been used in order to recalibrate the current status territorial scores (increasing or decreasing the risk score depending on the results stemming from the scenarios taken into consideration).

Biome	NRR driver	NRR Stressor	Scenarios
Terrestrial biome	Soil pollution Air pollution Crop provisioning Timber provisioning Land use & EI	**Ecosystem integrity index** MSA* (Mean Species Abundance) projected data in the location of interest and recalibration of EII.	Lack of standardized and complete scenarios related to nature-related risks the forward looking analysis is conducted taking into consideration the state of the art future projections related to both biomes: • **SSP1 RCP2.6 (optimistic):** limits the rise in average global surface temperatures by 2100 to 1.3°C to 2.4°C (vs 1850-1900) and characterized by sustainable socioeconomic growth • **SSP5 RCP8.5 (pessimistic)**: temperatures increase up to 3.3°C to 5.7°C by 2100 with fossil-fueled development, rapid economic growth lack of global environmental concern
Aquatic biome	Water use Water provisioning Water pollution	**Water stress index** Projected data on ratio of total water withdrawals to available renewable surface and groundwater supplies	

*MSA (Mean Species Abundance): it is defined as the mean abundance of original species relative to their abundance in undisturbed ecosystem.

ISP Nature Related Risk Analysis

Assess step - Final NRR score

For each **company** and **single risk-driver**, different associated risk scores are calculated:

- an **overall direct NRR risk score** (DSn) given by an average of impact (dependency) score for direct operations (DOSn) of the company and related territorial risk score (TSn), where the effects of TSn increases as DOSn increases;
- an **overall NRR risk score** (OSn) given by an average of impact (dependency) score for direct (DSn) and upstream value-chain operations (ISn) of the company and related territorial risk score.

Territorial and overall nature-related risk scores are available for different scenarios and time horizons.

All scores described range from values of 1 (very low risk) to 5 (very high risk).

Overall NRR risk score (OSn)

$$OS\text{n} = 1 + ((DS\text{n} + (5 - DS\text{n})/5 \times IS\text{n} - 1.8)/3.2)*(4)$$

Where:

n = company under analysis

OSn = overall impact or dependency score of company n

DSn = impact or dependency score for direct operations of company n

ISn = impact or dependency score for supply chain operations of company n

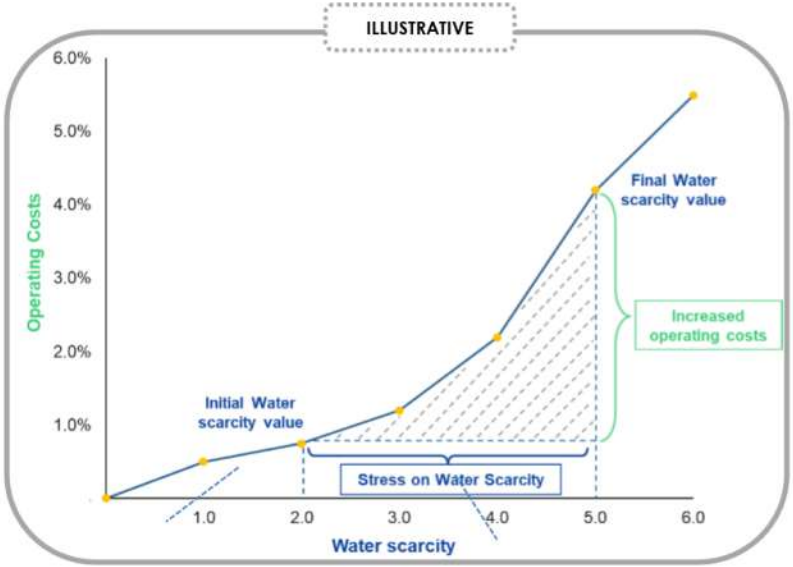
A **single NFC risk score** is then defined by taking into account taking into account the single scores related to each nature-related risk driver and taking into account medians of dependency and impact of the set of NRR risk drivers' "OSn" associated to counterparty "n"

*Formula adapted from: Boldrini, Simone and Ceglar, Andrej and Lelli, Chiara and Parisi, Laura and Heemskerk, Irene, Living in a World of Disappearing Nature: Physical Risk and the Implications for Financial Stability (November, 2023). ECB Occasional Paper No. 2023/333, Available at SSRN: https://ssrn.com/abstract=4630721 or http://dx.doi.org/10.2139/ssrn.4630721.

A framework for assessing nature-related risk

Linking risk-levels to balance sheet items

A **sensitivity analysis** on single counterparties and /or portfolios can be developed given specific **damage functions** connecting nature-related events to the financial impacts on **companies' balance sheets**.



The qualitative/quantitative identification of the level of **risk** must be **translated** into company's financial value. Specific damage functions for sector/impacts and dependencies are helpful for an initial **assessment** of **sensitivity to nature-related risks.**

Current research gaps

A recent **top-down** ECB study(1) combines sectoral dependency scores on ecosystem services and biodiversity shocks to calculate a proxy for variations in PD.

$$\Delta PD_j^s \approx DS_j^{bio} \cdot \sigma_j^s$$

The translation of the risk indicators obtained impacts the **directly affected balance sheet items** such as:

Physical risks

- **Increase** production **cost**;
- **Reduce** business **productivity**;

DEPENDENCY

Transitions risks

- Increase costs for imposing a **tax** on companies that cause environmental damage or do not respect environmental boundaries;
- Increase costs to implement **new technologies** with reduced environmental impact

IMPACT

(1) Boldrini et al. "Living in a World of Disappearing Nature: Physical Risk and the Implications for Financial Stability." *ECB* (2023).

So what?!

Challenges and limitations in measuring nature-related risks

Measuring NRR is a **complex challenge**:

- **Complexity**: Combination of climate change, biodiversity loss and pollution interact non-linearly, making it difficult to predict the impacts of nature-related risks.
- **Lack of data:** The data are often limited or incomplete, making it difficult to estimate the magnitude and intensity of these risks.

Different factors may represent **limitations**:

- **Probabilistic and not certain events**: Difficult to estimate the probability of occurrence and intensity of these risks.
- **Uncertainty of consequences:** Difficult to estimate the financial impact of these risks.

Thanks for your attention!

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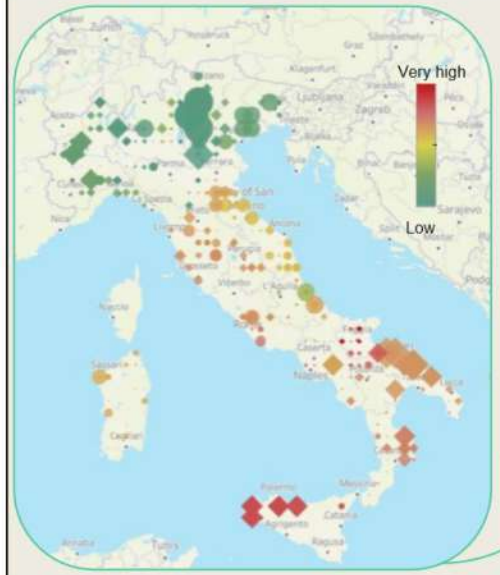
Annex

Geolocalization: Where economic activity takes place matters

Water dependency case: business activity

We selected **two NACE sectors**: 3511 (electricity production) and 0121 (viticulture). The selection was based on **the water withdrawal dependency level** of these two sectors (direct-operations).

Business activities



The bubbles on the map represent the location of the **local units** and **headquarters** of the NFCs in the ISP portfolio for these two sectors and their size represents their turnover volume.

Sectors
- Viticulture
- Electricity Production

In-detail examples