CONSTRUCTION AND BIODIVERSITY

Impacts and dependencies of the sector

Sectoral report

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Summary for policymakers | Construction

ANALYSING THE IMPACTS OF THE CONSTRUCTION SECTOR ON BIODIVERSITY

The relationship between biodiversity and business involves both **impacts** and **dependencies**. Organisations interact with biodiversity in two main ways: through their **reliance on ecosystem services**, and through the **impacts their activities** have on biodiversity. These interactions can create **risks** that affect operations, turnover, and profitability by influencing costs, sales, and even access to capital. When impacts and dependencies are high, they can amplify these risks for organisations, making them more vulnerable to disruptions and financial losses. Physical, transition, and systemic risks linked to biodiversity loss can also be transmitted to the financial sphere and, through contagion, spread throughout the wider financial system.

This analysis is designed to provide a **clearer understanding** of how the **sector interacts with biodiversity**. It highlights the main **impacts** and **dependencies**, as well as the potential **risks** and **opportunities** that may arise. It can therefore be useful not only for companies and financial institutions, but also for public authorities and anyone interested in gaining broader knowledge about biodiversity challenges. The findings are grounded in an extensive review of existing literature, combined with a quantitative assessment using the **Global Biodiversity Score**, a tool that measures biodiversity footprints. All detailed results and further findings are provided in a sectoral report.

This sector covered in this sheet is **general construction and specialised construction** activities for buildings and **civil engineering** works. This includes **new constructions**, **repair**, **extensions** and **alterations**, the **erection of prefabricated buildings or structures on site**, and **temporary construction** activities. This analysis does not include real estate activities but remains a relevant resource for this sector as construction represents the large majority of its upstream impacts.

3rd

Most impactful sector on terrestrial biodiversity

behind agriculture and raw material extraction

Direct and upstream terrestrial impacts equivalent to the destruction of a land area about

x6

the size of France

More than 95%

of the impact in the upstream value chain

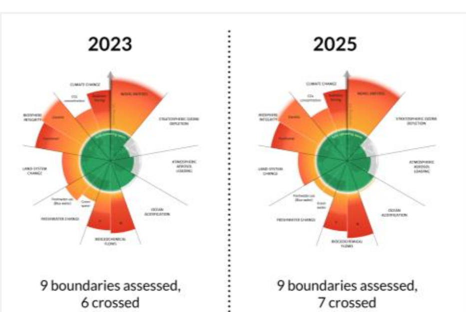
Mainly due to the extraction of raw materials and manufacture of construction materials

Land use, climate change and water pollutions

are the main pressures of the sector on biodiversity

IS THE SECTOR COMPATIBLE WITH PLANETARY BOUNDARIES?

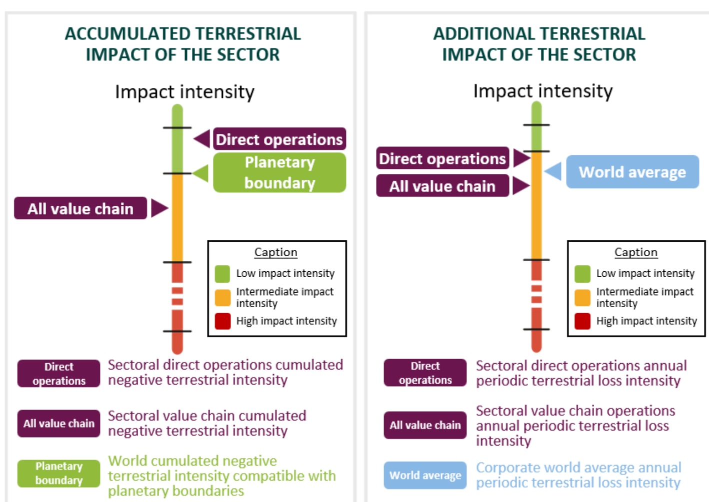
The Planetary Boundaries concept aims to **define the environmental limits within which humanity can safely operate**. This approach has significantly shaped the development of global sustainability policies and governance strategies. **6 out of the 9 boundaries are now exceeded** (2023) including biosphere integrity. Understanding and addressing biodiversity loss requires a holistic approach that considers its interplay with other planetary boundaries.



Source: Azote for Stockholm Resilience Centre, Stockholm University

Based on these boundaries, a global threshold that should not be exceeded has been estimated (traffic lights figure).

Accumulated terrestrial impacts and additional losses of **direct operations** are respectively below the planetary boundary and the corporate world average[1]. In contrast, impacts related to the **sector's value chain** exceed planetary boundaries and corporate world average. **The sector therefore remains deeply dependent on upstream activities that contribute substantially to their transgression.**



[1]Direct impacts are likely underestimated due to the difficulty of accounting for the land use of construction sites

Summary for policymakers | Construction

DEEP DIVE INTO THE SECTOR

KEY RESULTS ON DEPENDENCIES, IMPACTS, RISKS AND OPPORTUNITIES

IMPACTS

CONSTRUCTION MATERIALS ARE KEY

The **greatest impacts of the sector** on biodiversity are within its **Scope 3 upstream** (suppliers) terrestrial and aquatic impacts representing more than 95% of its total impacts across its value chain (see impact graph).

Land use, climate change, and terrestrial and water pollutions are the primary impact drivers, mainly due to **extraction and processing of building materials**

The building materials with the greatest impact on biodiversity are steel, cement, and glass.

Aluminium | Copper | Steel | Glass

Cement | Hardwood | Softwood | Sand

DEPENDENCIES

PROTECTION AGAINST DISTURBANCES

The sector is particularly dependent on ecosystem services that protect against **climatic and hydrological disturbances**.
Construction operations and timelines are highly sensitive to weather variability and extreme events such as storms or floods, making ecosystems like forests, wetlands, and vegetated soils essential for site stability and erosion prevention.

The sector also relies on **water-related ecosystem services** to secure the availability, and quality of water resources. From material processing to equipment cleaning, a steady supply of clean water is vital, and ecosystems that regulate flow and purify water help ensure un-interrupted construction activities.

KEY DEPENDENCIES

Very high	Rainfall pattern regulation
High	Soil and sediment retention
Medium	Storm mitigation Flood control
Medium	Water purification
Medium	Water flow maintenance

RISKS

HIGH EXPOSURE TO NATURE-RELATED RISKS

PHYSICAL RISKS

The sector is exposed to physical risks through its reliance on natural resources and ecosystem services. These risks can translate into higher input costs and supply disruptions (e.g. aggregates, timber, water), as well as direct damage to assets from extreme weather events such as floods or ground instability. Longer-term environmental degradation may also reduce the availability and quality of key materials and constrain project feasibility in certain areas.

TRANSITION RISKS

Stricter environmental requirements can increase compliance costs and delay projects, while shifts in client and investor preferences may reduce demand for high-impact practices. Companies may also need to invest in new materials and construction methods to adapt to evolving standards, creating additional technological and adjustment costs.

OPPORTUNITES

ECO-DESIGN AND LAND OPTIMISATION

01 ECO-DESIGN AND CIRCULAR CONSTRUCTION

Integrating biodiversity considerations at the design stage enables significant impact reduction. Prioritising reusable, recyclable, and dismantlable materials, as well as favouring renovation over new construction, helps reduce land-use change and lower demand for virgin resources.

02 BROWNFIELD REUSE AND LAND OPTIMISATION

Focusing development on brownfield sites rather than natural or semi-natural areas limits pressure on biodiversity. This approach supports more efficient land use while avoiding the conversion of high-value ecosystems.

03 NATURE-POSITIVE CONSTRUCTION PRACTICES

Adopting biodiversity-friendly site management can reduce operational impacts on ecosystems. Measures such as limiting invasive species, implementing greening initiatives, and using ecological compensation or restoration strategies help strengthen biodiversity outcomes in urban environments.

Summary for policymakers | Construction

ENGAGING THE SECTOR: WHAT'S NEXT?

REDUCING BIODIVERSITY IMPACTS IN THE CONSTRUCTION SECTOR REQUIRES ACTING PRIMARILY UPSTREAM IN THE VALUE CHAIN

Actions are presented based on their position in the value chain. Direct operations provide the most immediate leverage, followed by upstream supply chain interventions and downstream disclosure.

01 DIRECT OPERATIONS

Direct Operations — *Highest immediate control & accountability*

- Apply the **mitigation hierarchy** (avoid, reduce, restore & offset) to all construction-related impacts
- Limit **noise, pollution, and encroachment** during the construction phase for both wildlife and nearby residents
- Implement **permeable surfaces** or **soil decompaction** techniques to cancel soil sealing and prevent net land artificialisation
- Encourage **renovation** of old or unoccupied buildings to limit new land take
- Favour architectural designs that **minimise land use**
- Design sites to **create and maintain ecological corridors**, ensuring **ecological continuity**
- Integrate **green spaces** and infrastructures using native species and pollinator-friendly habitats

02 ENERGY USE DIRECT OPS

Energy Use for Direct Operations

- Use **renewable energy sources** with demonstrated low impact on biodiversity during the construction phase
- Optimise construction processes and machinery to **reduce energy consumption and noise**
- **Electrify construction equipment** where possible and monitor the carbon footprint of purchased electricity

03 UPSTREAM PHASES

Upstream Phases – *Greatest leverage on biodiversity — upstream phases drive 95% of impacts*

- Source materials from suppliers **with full environmental certifications** and **supply chain traceability**
- Integrate **biodiversity criteria in site selection**, based on early environmental impact assessments, avoided areas rich in biodiversity, habitats of endangered species, and protected areas
- Use **alternative materials** to replace conventional concrete where possible (*e.g.*, geopolymers, recycled aggregates, bio-based materials)

04 DOWNSTREAM PHASES

Downstream Phases

- Optimise building design to facilitate **dismantling, reuse and recycling** (design for disassembly, modular construction)
- Improve the recyclability of construction waste and develop **partnerships with local recycling facilities**
- Optimise the building **energy performance** through passive design (orientation, natural ventilation, insulation), use of natural light, and **biodiversity-friendly renewable technologies** (e.g., bird-safe solar panels)
- Use construction materials that **support biodiversity** (*e.g.*, porous surfaces as habitats for insects, mosses, lichens

MAIN REGULATIONS APPLICABLE TO THE SECTOR

A range of regulations and frameworks has been introduced aiming to regulate the sector's practices and mitigate its environmental impacts.

French regulations

- Measure 16 of France's Third National Biodiversity Strategy (2021–2030), Environmental Regulation 2020 – RE2020
- *"Plan bâtiment durable"*
- French Energy Transition for Green Growth Act – LTECV

European regulations

- Biodiversity strategy for 2030 integrated into the European Green Deal
- EU taxonomy

International regulations

- the 2030 Agenda and its Sustainable Development Goals
- Global Buildings Climate Tracker
- UN Environment Programme

TABLE OF CONTENTS

TABLE OF ILLUSTRATIONS

A. Introduction: global context of the construction sector

The construction and building sector is among the leading industrial sectors worldwide accounting for 13% of the global GDP and is expected to increase to 14.7% by 2030 (Infrastructure and Cities for Economic Development (ICED) 2018). Due to its size, the construction sector has an important environmental footprint, contributing to all of the five key drivers of biodiversity loss identified by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES): land and sea use change, direct exploitation of resources, climate change, pollution, and invasive alien species (IPBES 2019).

In terms of climate impact, the construction and building sectors generate approximately 34% of global CO_2 emissions and consume 32% of the world's produced energy (UNEP 2025). In addition, land use—an intrinsic aspect of construction activities—represents another major driver of environmental impact. Upstream in the value chain, the extraction and processing of raw materials—along with that of fuels and food—accounts for nearly 90% of global biodiversity loss and water stress, making it a particularly destructive stage (UNEP 2019). The sector heavily depends on materials such as cement and steel, which together account for 18% of global GHG emissions and generate significant waste volumes (WorlDynamics 2018). Furthermore, it is estimated that 10 to 15% of resources are wasted due to inefficient operations (WorlDynamics 2018). Downstream, the management of construction site waste is also a source of impacts on the environment. For instance, untreated construction and demolition waste accounts for 25 to 30% of total waste generated in the European Union (WorlDynamics 2018). The sector contributes heavily to ecosystem fragmentation, habitat destruction, and the disruption of ecological connectivity because of its important land use. In this context, infrastructure and the built environment have direct impacts on approximately 29% of threatened or near threatened species (wbcsd 2020).

In response to these issues, a range of regulations and frameworks has been introduced at different levels (national, European and world). While these frameworks do not directly enforce action, they aim to strengthen environmental transparency, improve traceability of impacts, and support informed decision-making by stakeholders. Altogether, they contribute to the broader transformation of the construction sector toward more sustainable, resource-efficient, and resilient practices. Their objectives include improving access to environmental data, reducing CO_2 emissions, and limiting land use. However, it is important to highlight that biodiversity remains only marginally addressed in most of these frameworks.

In this report, we will evaluate the impacts of the construction sector on biodiversity. Here, the construction sector refers to section F of NACE Rev. 2, including general construction and specialised construction activities for buildings and civil engineering works. This includes new constructions, repair, extensions and alterations, the erection of prefabricated buildings or structures on site, and temporary construction activities. This analysis does not include real estate activities but remains a relevant resource for this sector as construction represents most of its upstream impacts.

This report specifically presents the results of the impacts on biodiversity – obtained with the Global Biodiversity Score (GBS) tool - for the construction sector. It provides an analysis of these results, offers targeted insights (focuses) into specific aspects of the sector and places it within the regulatory and voluntary frameworks.

B. Methodology

B.1 What does the construction sector include? Perimeter of the report on the sector's impacts and dependencies

B.1.1. Overview of the sector

The Construction sector includes general construction and specialised construction activities for buildings and civil engineering works. This includes new constructions, repairs, extensions and alterations, the erection of prefabricated buildings or structures on site, and temporary construction activities. This analysis does not include real estate activities but remains a relevant resource for this sector as construction represents most of its upstream impacts.

B.1.2. EXIOBASE industries and NACE correspondence

In terms of **impact calculation**, the report covers the construction sector consisting of a single EXIOBASE industry: 'Construction (45)'. In the NACE rev 2 classification, this EXIOBASE industry corresponds to **section F** including divisions 41 'Construction of buildings', 42 'Civil engineering' and 43 'Specialised construction activities' (Eurostat 2008). Furthermore, this report only includes the construction work phase. All activities which take place after completion of construction are attributed to another section of NACE such as the real estate activity which is classified in section L and linked to the EXIOBASE industry 'Real estate activities (70)' and thus are not addressed in this study. **Figure 1** below shows the correspondence between EXIOBASE and NACE divisions:

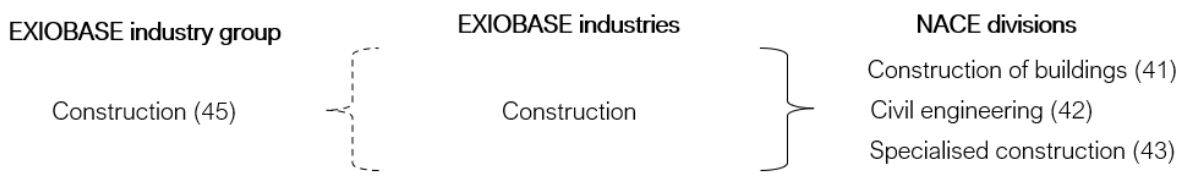


Figure 1: Correspondence between EXIOBASE and NACE rev 2 for the Construction sector

The available NACE rev.2 classification provides a more detailed overview of the activities falling under the scope of the Construction sector. For further details, please refer to the detailed NACE classification in **Appendix I.3** of this report.

B.1.3. EXIOBASE industries, ISIC and GICS correspondence

To understand the dependencies of the Construction sector, establishing a correspondence between EXIOBASE and the International Standard Industrial Classification (ISIC) used by ENCORE is necessary

(ENCORE 2025) (ENCORE 2024). The dependencies to ecosystem services are expressed in scores between 0 and 1 by the GBS using ENCORE data. Figure 2 illustrates the correspondence between the EXIOBASE industry group, the NACE description and the ISIC description.

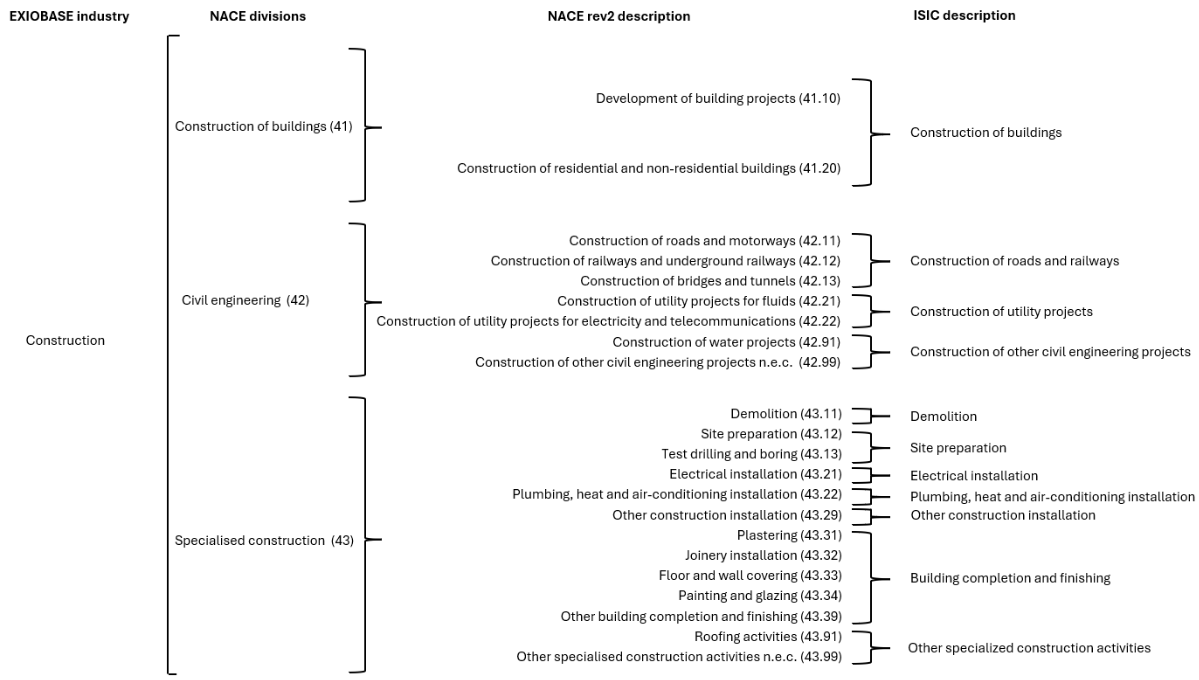


Figure 2: Correspondence between EXIOBASE, NACE and ISIC classifications for the Construction sector

Figure 3 illustrates the correspondence between the EXIOBASE industry group and the Global Industry Classification Standard (GICS) (MSCI 2025) subindustries for the Construction sector **to help companies or financial institutions using different classification systems to situate themselves**. The GICS database sorts industries thanks to five levels of detail: sector, industry group, industry, sub-industry and process.

In the case of the Construction sector, the EXIOBASE industry is divided under three GICS processes: Construction, Infrastructure builds and Infrastructure maintenance contracts.

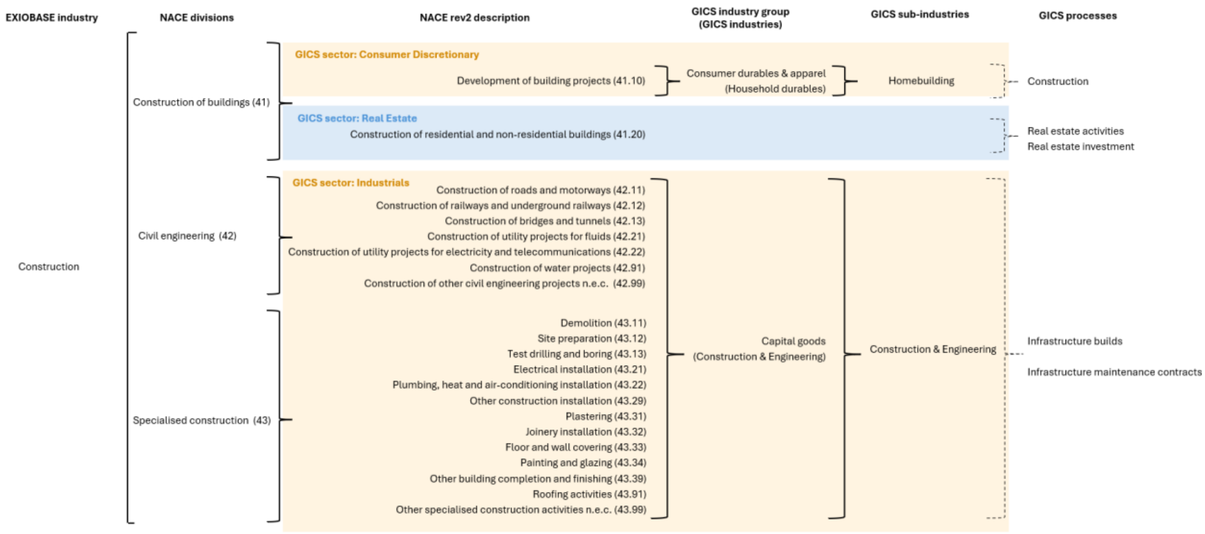


Figure 3: Correspondence between EXIOBASE, NACE and GICS classifications for the Construction sector

Regarding the classification, it is important to note an ambiguity between the construction sector and the real estate one, particularly in terms of (real estate) activity processes and (real estate) investments. Indeed, the NACE 'Construction of residential and non-residential buildings' description is included in the construction sector in EXIOBASE and in the real estate sector in GICS. This distinction may limit the visibility of certain key issues related to the construction sector if a company is categorised under one classification and not the other.

B.1.4. Scopes of the construction sector

Figure 4 below presents the value chain of the Construction sector with its inputs and outputs.

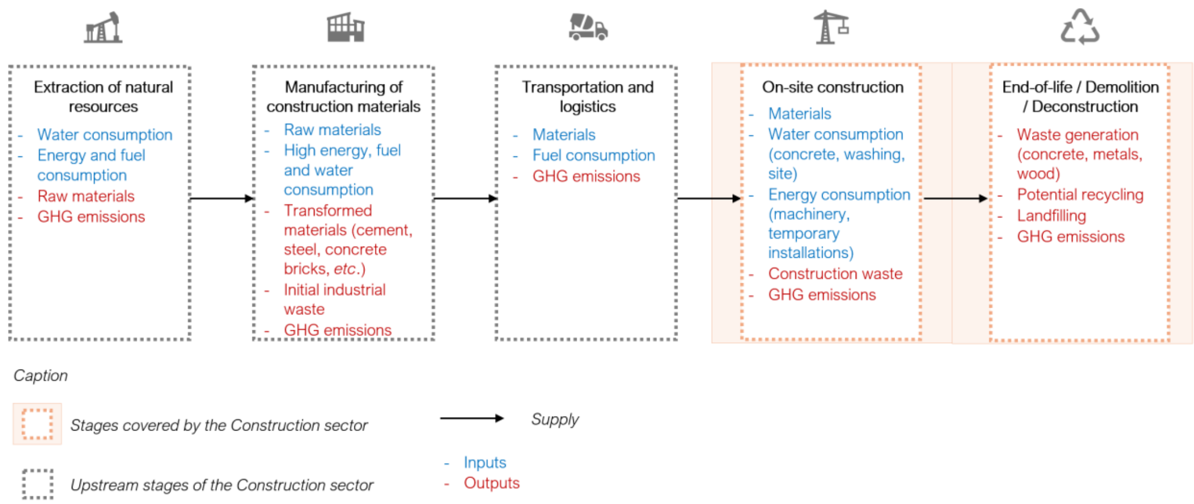


Figure 4: Value chain of the Construction sector (Barbhuiya and Bibhuti Bhusan 2023)

The construction sector's value chain relies heavily on the use of upstream materials derived from extraction processes. These materials are then transported to the construction site and may be processed in factories beforehand. These processes require the use of resources such as water, energy, and fuel. Once a building or infrastructure is completed, it becomes part of the real estate sector. Finally, the construction sector's value chain also takes into account repair and maintenance operations, as well as the demolition and landfilling of the building at the end of its life. According to our perimeter, recycling is not included in our analyses. However, we think it is important to mention it in the value chain.

To clearly present the Scopes of this sector, an analysis of the Scopes from EXIOBASE for Construction is presented with Figure 5 below.

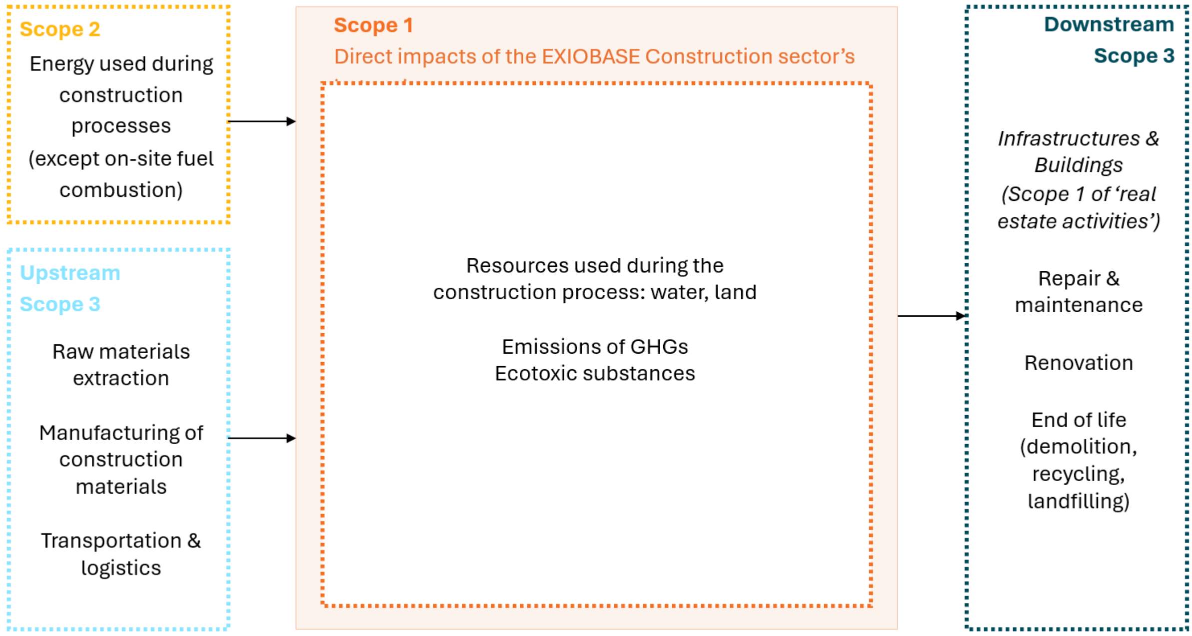


Figure 5: Scopes of the Construction sector or Construction sectoral perimeter

Please note that Scope 1 of the Construction sector refers only to the on-site construction phase and does not include the final built environment. This particularity distinguishes it from other sectors of economic activity and affects the methodology of accumulated impact accounting.

Once the work in the sector is completed, the impact related to the change in Land use is "reallocated" to another sector of activity because once the construction works completed, **the built infrastructure or building is operated and/or owned/financed by another sector than the Construction sector** such as Real estate or other economic activities clients of the Construction sector.

Scope 2 'emissions' in the Construction sector only includes energy used during the building process and does not include measures among "energetic building renovation".

In downstream Scope 3 of the sector, renovation is mentioned but is not included in our analysis.

Most results in the report are expressed in MSA.m²/kEUR of turnover of the EXIOBASE industry. The impacts in MSA.m² are indeed divided by the turnover of the EXIOBASE industry group. Please note that version 1.4.10 of the GBS uses **2011 turnover data from EXIOBASE 3.8.** The geographical area covered by the report is the **whole world**.

Table 1 below describes the share of the EXIOBASE industry group in the benchmark sector's turnover **in 2011**. According to EXIOBASE data, the overall turnover of the Construction sector is €7,500 billion and accounts for **7.4% of the global GDP**. By comparison, the French market turnover in this sector is €320 billion, while the Chinese market holds the largest share of the sector (20%) with a turnover of €1,500 billion.

Table 1: Turnover of the EXIOBASE industry group included in the Construction sector (data obtained from GBS 1.4.10 and therefore from EXIOBASE, 2011)

EXIOBASE industry group	*Turnover (MEUR)*	*Share in the benchmark sector's total turnover*	*France share of turnover*	*China share of turnover*
Construction	7 500 000	100%	4%	20%

B.2 The Global Biodiversity Score (GBS) in short

This section aims to remind the GBS main features to readers already familiar with it. For a more comprehensive introduction, readers are invited to refer to the GBS reports .

SOME DEFINITIONS AND CLARIFICATIONS

The GBS is a corporate **biodiversity footprint assessment tool**: it can be used to evaluate the **impact** or **footprint** of companies and investments on biodiversity. The results of assessments conducted with the GBS are expressed in the MSA.km² **unit** where MSA is the Mean Species Abundance, a **metric** expressed in percentage characterising the intactness of ecosystems. MSA values range from 0% to 100%, where 100% represents an undisturbed pristine ecosystem.

To break down impacts across the value chain and provide ways to avoid double-counting, the GBS uses the concept of **Scope**, or value chain boundary. **Scope 1** covers direct operations. Impacts occurring upstream are broken down into non-fuel energy generation which falls within **Scope 2**, and other purchases which fall within **upstream Scope 3**. Finally, downstream impacts belong to **downstream Scope 3**. Our previous reports (CDC Biodiversité 2025c) provide more details on this concept.

To account for impacts lasting beyond the period assessed, GBS results are further split into **periodic gains/losses** – occurring within the period assessed, and **cumulated negative** – persistent – impacts.

METHODOLOGY

To assess corporate biodiversity footprint, the main approach of the GBS is to link data on **economic activity** to **pressures on biodiversity** and to translate these pressures into **biodiversity impacts**. A **hybrid approach** is used to take advantage of data available at each step of the assessment**.** **Biodiversity Footprint Assessments** (BFA) use company specific data on purchases or related to pressures (such as land use changes or greenhouse gas emissions). In the absence of precise data, a default calculation **assesses impacts based on financial turnover data**.

To link activity, pressures and impacts, the GBS uses peer-reviewed tools such as EXIOBASE, an environmentally extended multi-regional input-output model, and GLOBIO, a model assessing the impact of various pressures on biodiversity intactness. Its underlying assumptions are transparent.

In the long run, the aim of the GBS is to cover all biodiversity impacts across the value chain (including both upstream and downstream impacts). It currently covers direct operations and upstream impacts (cradle to gate) on terrestrial and aquatic (freshwater) biodiversity. The pressures covered are part of 4 out of the 5 pressures described by IPBES:

Land/sea change (IPBES):

- ➔ **Land use (LU)**: Impacts on natural habitat quality and quantity caused by a high level of pressure which prevents ecosystems from reverting towards more natural states
- ➔ **Wetland conversion (WC)**: Loss of aquatic ecosystems caused by the conversion and draining of wetlands for human purposes
- ➔ **Fragmentation of natural ecosystems (F)**: Reduction and subdivision of natural habitats and disappearance of ecological corridors
- ➔ **Human encroachment (E)**: Anthropogenic activities in otherwise natural areas (direct and indirect disturbance)

Climate change (IPBES):

- ➔ **Climate change (CC)**: The global mean temperature increase (GMTI) and the induced climate change modify the repartition areas of different biomes
- ➔ **Hydrological disturbance due to climate change (HD_{CC})**: Climate change can be the cause of the deviation of current river flows from the natural ones (changes in rainfall or evaporation)

Direct exploitation (IPBES):

- ➔ **Hydrological disturbance due to direct water use (HD_{water})**: Anthropic water abstraction can be the cause of the deviation of current river flows from the natural ones - this pressure is called "hydrological disturbance" in GLOBIO

Pollution (IPBES):

- ➔ **Atmospheric nitrogen deposition (N)**: Agricultural and industrial activities cause nitrogen emissions into the atmosphere, then nitrogen deposits on terrestrial ecosystems. When the critical load of the ecosystem is exceeded, the imbalance caused by additional nitrogen deposition harms ecological integrity
- ➔ **Land use in catchment of rivers (LUR) and wetlands (LUW)**: Watershed's upstream land use changes have an indirect negative impact on downstream water bodies. Land use type is indeed a good proxy for the nutrient emissions leaching from human activities to ecosystems
- ➔ **Freshwater eutrophication (FE)**: Human activities can lead to excess of nutrients leaching into water bodies and overstimulating algal and aquatic plant growth
- ➔ **Ecotoxicity (X)**: Ecotoxicity is the pressure caused by chemical substances on terrestrial or aquatic ecosystems (pesticides for example)

C. Impacts and dependencies of the sector

KEY MESSAGES

The construction sector ranks as the third most impactful industry on biodiversity in absolute terms, behind agriculture and raw material extraction. While the relatively low impact intensity of its direct activities appears to keep it within planetary boundaries, this conclusion is tempered by two factors. First, direct activities are likely underestimated due to the difficulty in accounting for the land use of construction sites. Second, upstream value chain impacts far exceed planetary boundary limits. Therefore, the sector deeply depends on activities that contribute substantially to their transgression. Across all impact categories, upstream value chain activities constitute the dominant source of biodiversity pressures. Terrestrial static impacts are driven by a combination of spatial pressures — including land use, fragmentation and encroachment — and climate change, while terrestrial dynamic impacts are predominantly attributable to climate change. Aquatic impacts are primarily driven by land use in catchment of wetlands, compounded by hydrological disturbances and wetland conversion. These pressures are the result of various activities supporting the construction industry such as raw materials extraction, manufacture of construction materials, transportation and extensive land requirements. Regarding the sector's Scope 1 impacts, climate change emerges as the leading pressure on terrestrial ecosystems, while aquatic impacts are mainly linked to land use in catchment of wetlands and ecotoxic pollution from construction sites.

C.1 Overall sector’s impacts

C.1.1. Absolute impacts of the sector

Key findings

In terms of absolute impacts, the construction sector ranks as the third most impactful industry, behind agriculture and raw material extraction. Most of the sector's impacts on biodiversity stem from its upstream value chain, which relies heavily on raw material extraction to supply construction materials. The sector also exerts direct pressure on biodiversity through its own activities, primarily driven by land use.

The following calculations were performed using GBS 1.4.10 in May 2025. The previous results of the report and factsheet from 2022 are based on older versions of the GBS, which can explain some differences. Please note that the **terrestrial static** results **include the results associated with the Climate change pressure**, which is not the case for all the sectoral studies, as the static Climate change pressure was added from version 1.4.2 of the GBS. Further details (and calculations) are available in section 4.2 of MEB's Report n°49 (CDC Biodiversité 2023).

Tables below display the absolute impacts in MSA.km² of the sector, within its Scope 1 (Table 2), tier 1 upstream Scope 3 (Table 3) and vertically integrated (*i.e.* all scopes combined) (Table 4). Scope 1 terrestrial static impacts of the sector reach **55 000 MSA.km²** and **3 100 000 MSA.km²** for its vertically integrated terrestrial static impacts. This represents biodiversity losses equivalent to the destruction of a land area about **6 times the size of France**, under the assumption that these regions were initially covered by intact natural ecosystems. These impacts are lower compared to other sectors. For instance, Scope 1 impacts of raw materials extraction are about 4 700 000 MSA.km². This difference can partly be explained by the fact that the Land use pressure is underestimated in the analysis of the construction sector's Scope 1 impacts.

However, the results remain consistent with the sector's downstream position in the economic value chain, especially when compared to extraction activities such as logging, which are known to generate very high terrestrial impacts. While Scope 1 impacts of the construction sector may increase significantly with improved accounting of Land use pressures (potentially increasing tenfold), they would remain well below those of the raw materials sector. Nonetheless, this should not lead to an underestimation of the construction sector's role: **despite being downstream, it remains one of the sectors with the highest terrestrial impacts after agriculture and raw material extraction**.

As a mainly downstream sector of the economy, the construction sector is highly dependent on upstream industries resulting in high terrestrial and aquatic impacts in its Scope 3 (see Table 3). Therefore, it is essential to account for both upstream Scope 3 impact intensities and vertically integrated intensities. Given the relatively lower direct (Scope 1) impacts, **addressing upstream pressures represents a major lever for reducing the sector's overall environmental footprint**.

Realm	Accounting category	Scope 1 impacts in MSA.km²
		Construction
Terrestrial	Static	55 000
	Dynamic	1 100
Aquatic	Static	80

Table 2: Absolute Scope 1 biodiversity impacts of the Construction sector (Source: GBS 1.4.10, May 2025, Chloé Nguyen Van)

Realm	Accounting category	Tier 1 upstream Scope 3 impacts in MSA.km²
		Construction
Terrestrial	Static	940 000
	Dynamic	13 100
Aquatic	Static	21 400

Table 3: Absolute Tier 1 upstream Scope 3 biodiversity impacts of the Construction sector (Source: GBS 1.4.10, May 2025, Chloé Nguyen Van)

Realm	Accounting category	Vertically integrated impacts in MSA.km²
		Construction
Terrestrial	Static	3 100 000
	Dynamic	33 000
Aquatic	Static	120 000

Table 4: Absolute vertically integrated biodiversity impacts of the Construction sector (Source: GBS 1.4.10, May 2025, Chloé Nguyen Van)

C1.2. Impact intensities of the sector

Key findings

Although the relatively low impact intensity of the sector's direct activities appears to keep it within planetary boundaries, two factors temper this conclusion and suggest that the sector contributes substantially to their transgression. First, the direct activities of the sector are likely underestimated in this study, owing to the difficulty of accounting for land use in construction activities. Second, and more critically, the upstream value chain impacts of the sector far exceed the limits compatible with planetary boundaries. In other words, even if the sector's direct activities do not constitute a major driver of planetary boundary exceedance, the sector remains deeply dependent on activities that do.

Table 5, Table 6, and Table 7 below show the impact intensities of the sector, within their Scope 1, Tier 1 upstream Scope 3 and vertically integrated. All pressures included in the GBS are presented. The impact intensities, expressed in MSA.m²/kEUR were obtained by dividing the absolute impacts of the sector in MSA.m² by its total turnover. This approach enables comparisons between different sectors, industries or industry groups for the same amount of turnover. The results are then converted into MSAppb per bEUR, allowing a comparison between terrestrial and aquatic impacts, providing a first overview of the biodiversity performance of the sector and its EXIOBASE industry group. Further methodological details are available in section 2.2 and 2.3 of the general appendix (CDC Biodiversité 2022).

In the same way as for the absolute impacts, impact intensities of construction are lower than other sectors. For instance, the raw material extraction sector has a Scope 1 aggregated score of 14 000 MSAppb/bEUR for static impacts whereas the construction sector has one of **56 MSAppb/bEUR**. Regarding the vertically integrated static impacts, raw material extraction reaches 20 000 MSAppb/bEUR whereas construction accounts for **4 600 MSAppb/bEUR**. These results remain consistent as explained in section 0.

According to Figure 6, **terrestrial static and dynamic Scope 1 impacts** respectively reach 7 MSA.m²/kEUR and 0.14 MSA.m²/kEUR, which is **respectively below the planetary boundary and the corporate world average**. However, these results might be underestimated since they only account for direct activities, and that construction site areas are not included. In contrast, impacts related to the sector's value chain exceed planetary boundaries (above 320 MSA.m²/kEUR) (see section E - Glossary and units for the detail calculation of this threshold) and corporate world average. While the sector's direct activities remain well below the thresholds, they rely on a value chain that significantly contributes to the transgression of these boundaries.

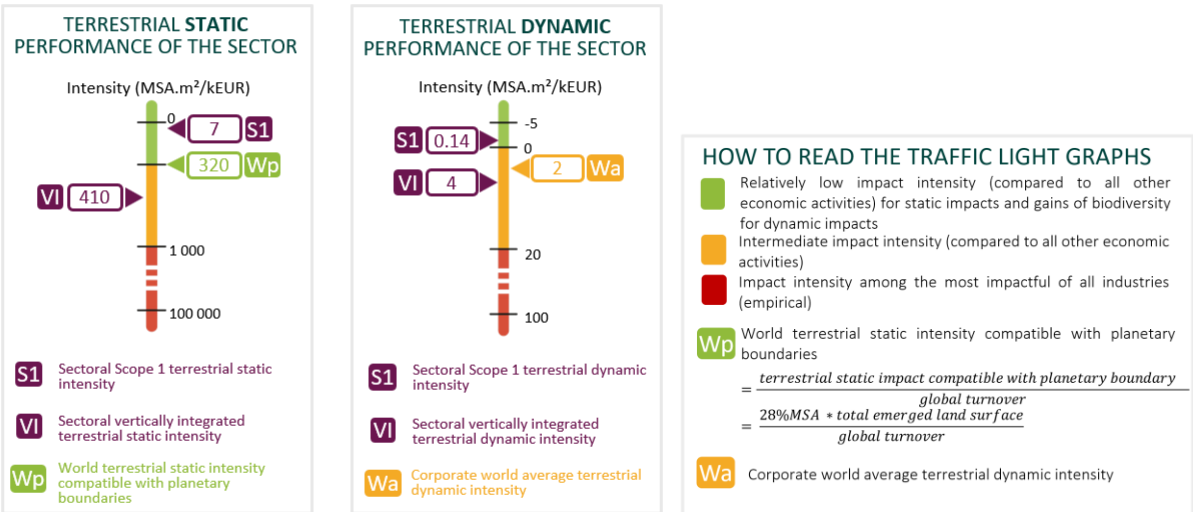


Figure 6: Traffic light graphs of terrestrial static and dynamic performance of the sector without Ecotoxicity pressure

According to Table 5 and Table 6, static aquatic impacts are much lower in Scope 1 (1 MSAppb/bEUR) than in tier 1 Scope 3 (270 MSAppb/bEUR). Indeed, the aquatic impact of the on-site construction phase is low: "the amount of direct water use in the construction process was found to be minimal compared to the indirect water used to produce raw materials" (Mannan and Al-Ghamdi 2020). This limited direct water use typically relates to localized needs (*e.g.*, concrete mixing, equipment cleaning, or temporary installations) compared to upstream operations such as material extraction or material processing. Moreover, these phases are more likely to cause sustained and large-scale discharges into aquatic environments.

Ecotoxicity has been reported separately due to its high uncertainty. It represents a significant environmental pressure in the construction sector, especially when the entire value chain is taken into account. While direct emissions (Scope 1) show a relatively low ecotoxic footprint, the impact becomes much more pronounced in upstream activities (Scope 3) and when adopting a vertically integrated perspective.

Terrestrial static Ecotoxicity emerges as a major impact driver (1 210 MSA.m²/kEUR) when all Scopes are considered. This predominance is largely due to **diffuse pollution from extractive and forestry practices** involved in the production of construction materials such as metals, cement, and timber. The aquatic static compartment also shows a noteworthy contribution.

These findings highlight the importance of expanding environmental impact reduction strategies beyond the construction site itself by integrating the indirect impacts associated with material inputs. Eco-design, responsible sourcing, reduction of toxic substances, and supplier engagement thus appear as key levers to mitigate ecotoxic effects in the construction sector.

Realm	Accounting category	Footprint in MSA.m²/kEUR of the sector (without Ecotoxicity)	Ecotoxicity only in MSA.m²/kEUR of the sector	Footprint in MSAppb/bEUR
Terrestrial	Static	7	0.5	54
	Dynamic	0.14	NA	1.0
Aquatic	Static	0.01	0.07	1.0

Table 5: Scope 1 impact intensities for Construction sector (Source: GBS 1.4.10, May 2025, Chloé Nguyen Van)

Realm	Accounting category	Footprint in MSA.m²/kEUR of the sector (without Ecotoxicity)	Ecotoxicity only in MSA.m²/kEUR of the sector	Footprint in MSAppb/bEUR
Terrestrial	Static	50	390	930
	Dynamic	2	NA	13
Aquatic	Static	3	5	270

Table 6: Tier 1 of upstream Scope 3 impact intensities for Construction sector (Source: GBS 1.4.10, May 2025, Chloé Nguyen Van)

Realm	Accounting category	Footprint in MSA.m²/kEUR of the sector (without Ecotoxicity)	Ecotoxicity only in MSA.m²/kEUR of the sector	Footprint in MSAppb/bEUR
Terrestrial	Static	410	1 210	3 100
	Dynamic	4	NA	33
Aquatic	Static	16	16	1 500

Table 7: Vertically integrated impact intensities for the Construction sector (Source: GBS 1.4.10, May 2025, Chloé Nguyen Van)

To fully understand these results and the following sections, please note these key methodological elements and assumptions:

- The static values are higher than the ones in the analysis performed in 2022 because the Climate change pressure was not evaluated and thus not integrated into these results. These new results shows that the Climate change pressure has an important effect on the impact intensities in this sector and thus it is important not to neglect this data. The following sections provide a more detailed analysis of each pressure.
- This GBS assessment relies exclusively on financial data.
- The results of downstream Scope 3 are not represented as they are difficult to estimate. due to the complexity of attributing environmental impacts across diverse and long value chains.
- The Construction sector shows low Scope 1 land use impact intensities because of the way GBS calculations are performed: they rely on financial data without accounting for infrastructures, which leads to an underestimation of results. In EXIOBASE, land use data is not used in the GBS since it does not distinguish between land occupation and land use change. As a result, land use impacts are only computed through commodities and the underlying

dedicated GBS module. This implies that industries not producing commodities, such as construction or real estate, display 0 Scope 1 land use impacts. In the case of the construction sector, land use is linked to the commodities purchased by the sector and thus appears in its Scope 3. To summarise, Scope 1 land use impacts of the construction sector are underestimated in the results of this report because of the technical limitations of the GBS financial module that accounts for land use only through purchased and produced commodities. Moreover, for static impacts, construction works carried out and finished in year N-1 are transferred downstream in year N (because they are sold to other industries). To effectively account for Scope 1 land use impacts of the construction sector, only areas under construction should be considered.

Only vertically integrated results are presented in the next sections.

C.1.2.a. Terrestrial static impacts

Key findings

Most of the sector's terrestrial static impacts are attributable to upstream value chain activities. These impacts are driven at 60% by spatial pressures (regrouping Land use, Fragmentation and Encroachment) and at 40% by climate change.

Figure 7 displays the terrestrial static impact intensities of the Construction sector respectively, broken down by Scope, pressure and commodity.

In the next graph, metallic Ecotoxicity impacts have been excluded from the results and analyses due to their high uncertainties. However, they are reported separately in section 0. and 0.

This figure illustrates that rest of upstream Scope 3 and **tier 1 of upstream Scope 3** are the primary contributors to the terrestrial static impacts. The sector exerts significant **spatial pressures** due to the extraction of raw materials, manufacture of construction materials (cement, steel) (according to EXIOBASE explorer), transportation/logistic infrastructures (roads, harbour, *etc.*), extensive land requirements (for wood logs, deforestation, crops, grazing, *etc.*). For more detail, please refer to Figure 21 in appendix.

According to the figure below, more than half of the vertically integrated terrestrial static impacts (250 MSA.m²/kEUR) can be attributed to **Land use, Fragmentation of natural habitats, Human encroachment**. The other 40% of vertically integrated impacts (around 150 MSA.m²/kEUR) can be attributed to **Climate change** mainly due to greenhouse gas emissions produced during the extraction of raw material, transportation of material, construction of machinery and temporary infrastructure.

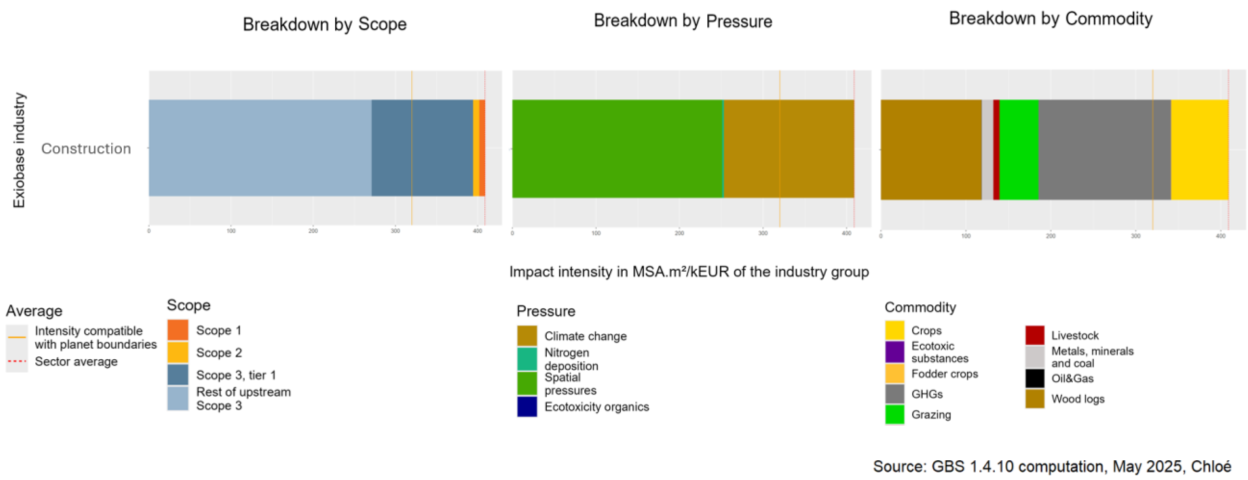


Figure 7: Terrestrial static impact intensities of the Construction sector, breakdown by Scope, pressure and commodity, vertically integrated

C.1.2.b. Terrestrial dynamic impacts

Key findings

Most of the sector's terrestrial dynamic impacts are attributable to upstream value chain activities. These impacts are driven at 72% by climate change and at 28% by spatial pressures (regrouping Land use, Fragmentation and Encroachment).

Figure 8 displays the terrestrial dynamic impact intensities of the Construction sector respectively, broken down by Scope, pressure and commodity. As a reminder, this computed dynamic impact reflects **the impacts of all the construction works in progress in 2024 and not all the existing buildings and artificialised areas**, which are the properties or operated by other sectors (notably the real estate sector).

This figure reveals that **Climate change pressures** are the dominant drivers of terrestrial dynamic impacts (around 3 MSA.m²/kEUR). It accounts for 72% of the total pressures of the sector due to GHG emissions (such as fossil fuel consumption, material production, industrial processes or land use changes) mainly from Scope 3 (and not Scope 2 which is energy used during the construction process) followed by **spatial pressures** (1.2 MSA.m²/kEUR).

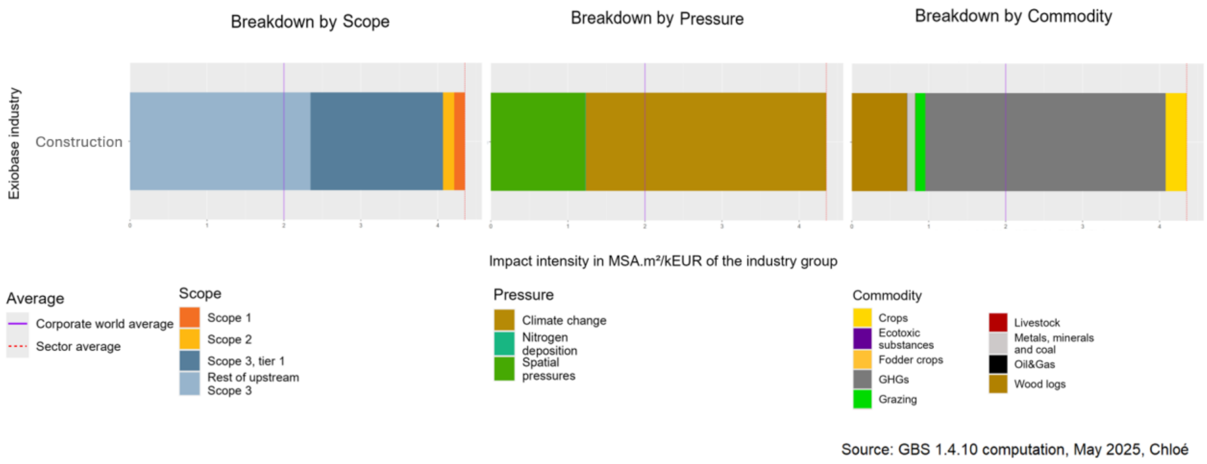


Figure 8: Terrestrial dynamic impact intensities of the Construction sector, breakdown by Scope, pressure and commodity, vertically integrated

C.1.2.c. Aquatic static impacts

Key findings

Most of the sector's aquatic static impacts are attributable to upstream value chain activities, with pollution from raw material extraction serving as the primary driver. Among the pressures identified, land use in wetland catchment areas stands out as the most significant, followed by hydrological disturbances caused by water consumption and wetland conversion, and finally freshwater eutrophication.

Figure 9 displays the aquatic static impact intensities of the Construction sector respectively, broken down by Scope, pressure and commodity. Please note that Scope 2 of aquatic static impacts is not represented as it has not been measured (difficulty to obtain data linked to energy consumption for this Scope). Moreover, metallic Ecotoxicity impacts have been excluded from the results and analyses due to their high uncertainties. However, they are reported separately in section 0. and specifically for Scope 1 in section 0.

This figure reveals that the sector exerts significant pressures on aquatic ecosystems, particularly wetlands and only on Scope 3, tier 1 and rest of upstream Scope 3. The majority of the aquatic static impacts is linked **to Land use in catchment of wetlands** (which is a pollution pressure). These impacts can result from land artificialisation due to mining extraction, which increase runoff and pollutant loads reaching wetlands. This, in turn, can diminish the capacity of wetlands to deliver key ecosystem services.

Another pressure on aquatic ecosystems, particularly wetlands, arises **from Wetland conversion**. As this analysis focuses exclusively on static impacts, it assesses the consequences of historical Wetland conversion while excluding the impacts of current construction practices on aquatic ecosystems.

Hydrological disturbance due to direct water use is another significant pressure on aquatic biodiversity, due to the intrinsic need for water to grow wood logs and to extract and produce other construction materials (more explanation of aquatic static impact of Scope 1 and tier 1 Scope 3 in sections 0. and 0). This pressure comes from water consumption and helps us to understand how this water consumption disturbs rivers or wetlands in relation to a reference state.

Finally, **Freshwater eutrophication** is also reported as a pressure in this sector due to construction products and equipment (Brachet 2020).

In Figure 9, commodities such as crops and grazing are represented. However, they result from an EXIOBASE background noise. As agricultural commodities ultimately support all human activities, their impacts are represented in the upstream impacts of every sector.

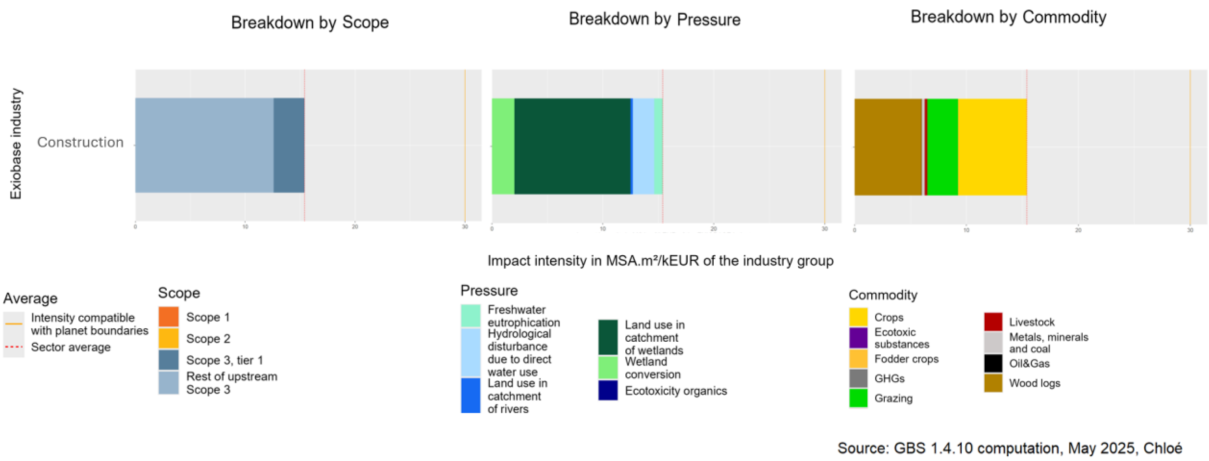


Figure 9: Aquatic static impact intensities of the Construction sector, breakdown by Scope, pressure and commodity, vertically integrated

C.1.2.d. Scope 1 impacts detailed analysis (breakdown by pressure and commodity)

Key findings

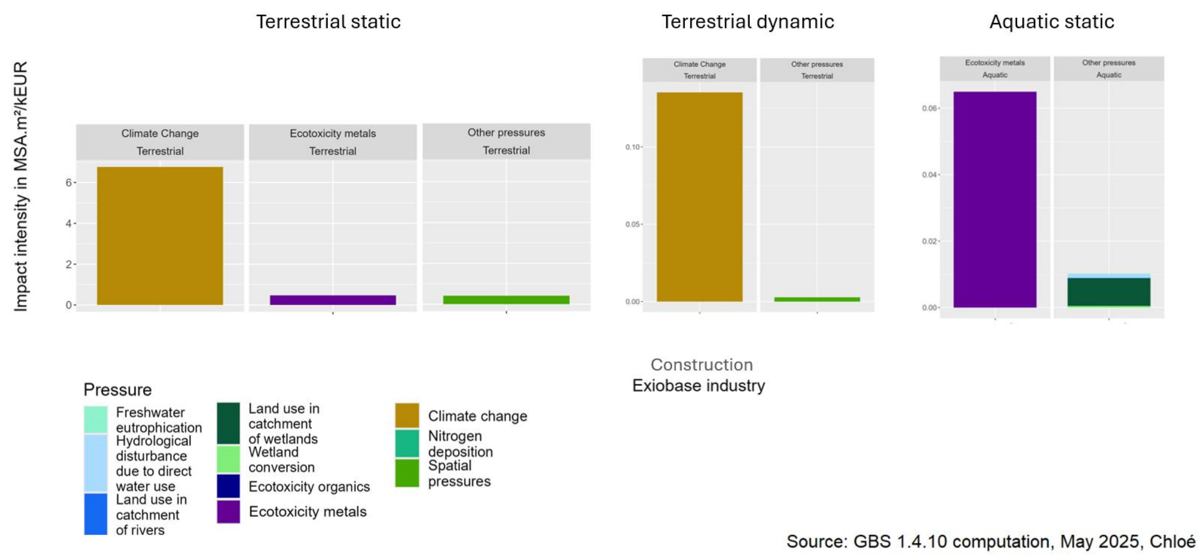
The sector's Scope 1 terrestrial impacts are predominantly driven by climate change pressures, reflecting significant greenhouse gas emissions from construction activities. Spatial pressures appear negligible in the results. As only financial data was used for the calculation of impacts, the GBS was unable to capture the physical footprint of infrastructures — leading to an underestimation of total Scope 1 impacts. Aquatic Scope 1 impacts are primarily attributable to land use in catchment of wetlands, while ecotoxic pressures on aquatic environments also emerge as a notable contributor, consistent with the literature on diffuse pollution from construction sites.

Figure 10 and Figure 11 below displays Scope 1 impact intensities respectively broken down by pressure and by commodity, with the GBS computation using financial data.

Scope 1 terrestrial impacts are mainly driven by the **Climate change pressure**. As explained above in 0 and 0 sections and according to Figure 11 they are linked to important GHG emissions. Spatial pressures are very low as the default GBS calculation, only based on financial data, does not include the impact of infrastructures. In the same way, aquatic static impacts are mainly due to the pollution pressure **Land use in the catchment of wetlands** and does not include spatial pressures. This is why the total Scope 1 impacts are underestimated. A correction of this default calculation has been estimated in a section below.

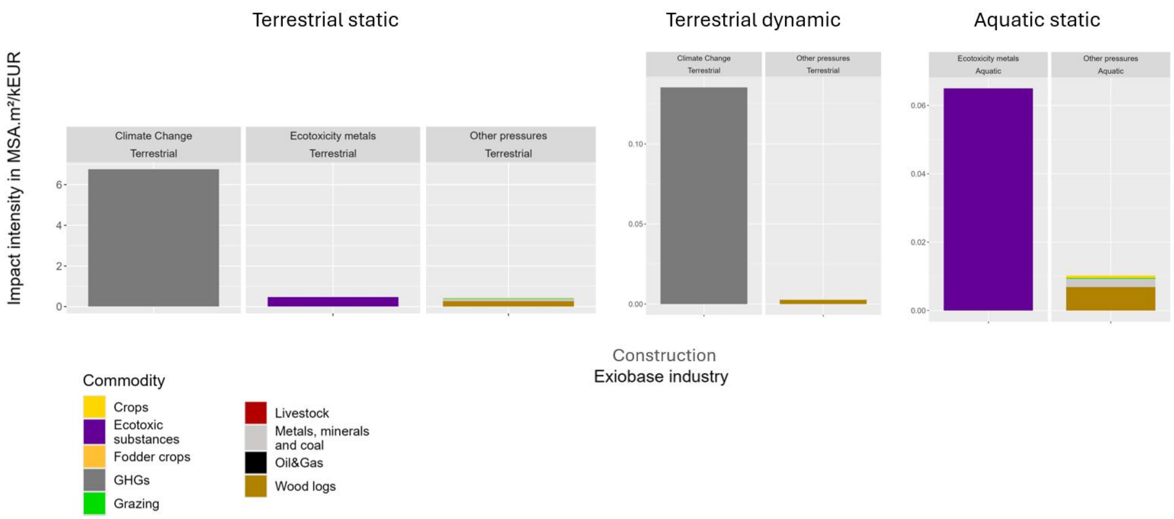
Figure 10 and Figure 11 also show the significant impact of **ecotoxic** substances on aquatic environments during construction phases. These results are also found in the literature. Indeed, construction sites can lead to non-negligible forms of water pollution — especially during rainfall events, where poorly managed waste, fuel, and other pollutants may be washed off into nearby water bodies resulting in ecotoxic pollutions (Jain et al. 2016).Such diffuse and episodic pollution can have localized but significant impacts (Jain et al. 2016). Thus, it is important to have appropriate mitigation strategies — particularly ensuring that pollutants and hazardous substances generated are properly handled before they can reach aquatic environments (Joshi et al. 2021).

In Figure 11, commodities such as crops, wood logs and grazing are represented. However, they result from an EXIOBASE background noise. As agricultural commodities ultimately support all human activities, their impacts are represented in the upstream impacts of every sector.



Source: GBS 1.4.10 computation, May 2025, Chloé

Figure 10: Construction impact intensities breakdown by pressure, Scope 1



Source: GBS 1.4.10 computation, May 2025, Chloé

Figure 11: Construction impact intensities breakdown by commodity, Scope 1

C.1.2.e. Tier 1 upstream Scope 3 detailed analysis

Figure 12 is taken from EXIOBASE explorer — a supplementary GBS tool that allows users to explore the links (monetary purchases, commodity purchases) between industries in EXIOBASE — and gives an example of the tier 1 upstream Scope 3 of a construction company in China (the country with the largest share of the global construction sector). This figure roughly shows what is included in tier 1 upstream Scope 3 of the sector for the terrestrial static impact as it is the most important impact in tier 1 upstream Scope 3. According to this plot, extraction of raw materials (quarrying), cultivation of crops (see section 0) and manufacturing of construction material (such as iron, steel, copper, glass, cement, lime, stone) are well included in the upstream Scope 3 of the sector and play an important role in this sector. Moreover, this figure shows the high presence of **ecotoxic** substances (*i.e.* Cr, Zn, Mn, Ba, Cd) in this part of the sector due to raw material extraction.

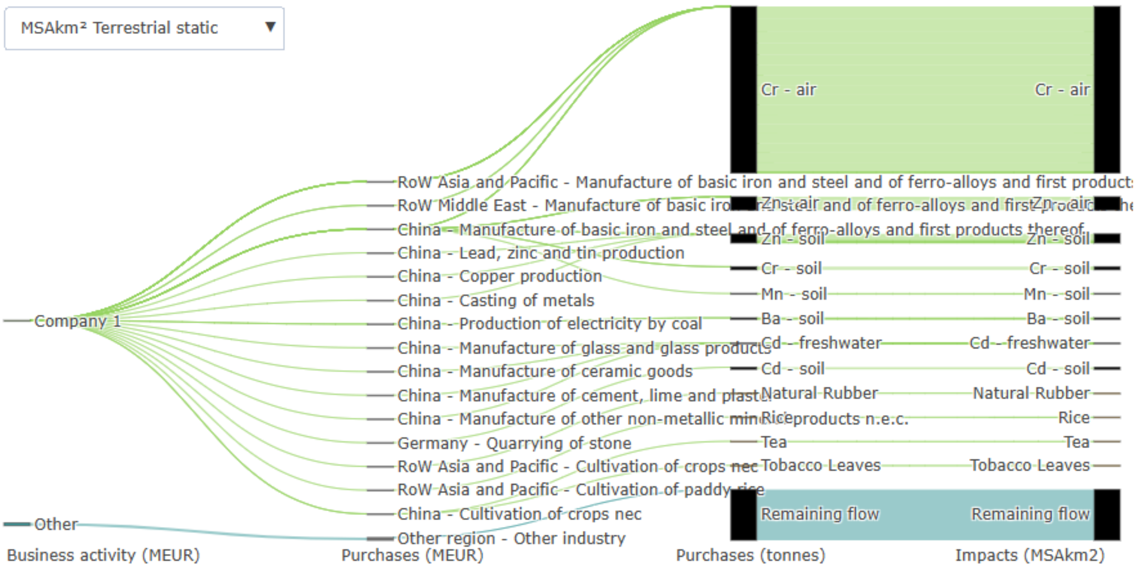


Figure 12: Overview of purchases and terrestrial static impacts of the tier 1 upstream Scope 3 of a factice construction company in China according to EXIOBASE explorer

C.2 The Impacts of the construction materials

Key findings

This section analyses the biodiversity impacts of eight construction materials, focusing on the impacts of raw material extraction and processing. Impacts are assessed both per kilogram and proportionally to their usage in new buildings, accounting for disparities in quantity. The analysis distinguishes between pressures (e.g., climate change, ecotoxicity) and effects on terrestrial or freshwater ecosystems. Here are the key findings per material:

- **Aluminium:** Very high impacts per kilogram on both terrestrial and freshwater ecosystems, driven by GHG and ecotoxic emissions. Proportionally, its impact is low due to limited use in buildings.
- **Copper:** Very high terrestrial impacts per kilogram (climate change, ecotoxicity) and high freshwater impacts (ecotoxicity, freshwater eutrophication). Proportionally, its impact is low due to limited use in buildings.
- **Reinforced steel:** High terrestrial and freshwater impacts, both per kilogram and proportionally, due to its large share in buildings. Main drivers: climate change, ecotoxicity, and freshwater eutrophication.
- **Glass:** Moderate terrestrial impacts (ecotoxicity, climate change), but high freshwater impacts due to ecotoxicity and its significant use in buildings.
- **Cement:** Low impacts per kilogram, but high proportional impacts due to widespread use. Major contributor to climate change and ecotoxic emissions.
- **Softwood:** Low impacts per kilogram, but high proportional impacts, especially on terrestrial ecosystems, due to land use. Freshwater ecosystems are also affected by softwood production through pollutions induced by plantations.
- **Hardwood:** Low impacts and limited use, making it one of the least impactful materials.
- **Sand:** Low impacts per kilogram, but moderate terrestrial and high freshwater impacts proportionally, driven by climate change, ecotoxicity, and land use.

As shown in part C.1., most of the biodiversity impacts of the construction sector are caused by upstream activities. A significant share of these upstream impacts is likely caused by the production of construction materials. In this section, the impacts of the most used construction materials are analysed using life cycle assessment data (LCA) in combination with the GBS.

For most of the analysed materials, we used the GBS ProductTool, which is based on life cycle assessment (LCA) data. For wood specifically, we used the CommoTool — a tool developed by CDC Biodiversité to assess the impacts of raw materials, which is based on data derived from modelling, as detailed in the GBS review *Woodlogs* (CDC Biodiversité 2020a). The results are expressed in MSA.km² and allow for comparisons between materials both per kilogram produced and based on their average proportion in buildings in France in 2015, according to an ADEME study (ADEME 2022).

This study identified the main materials used in construction, both in residential areas (including residential care facility) and in the tertiary sector (large shopping centres, hotels, schools, offices, etc.).(see Table 8). In 2015, in France, the three most commonly used materials (by weight) for new building construction were aggregates (44%), sand (31%) and cement (10%). These materials are the main components of concrete. Thus, 85% of the materials used for new construction in 2015 were intended for concrete construction.

Materials in bold represents the one analysed in this section.

Materials	Residential areas (including residential care facility)	Tertiary sector (large shopping centers, hotels, schools, offices, etc.)	**TOTAL**: residential areas and tertiary sector
Aggregates	18 045	3 626	21 671
Sand	13 931	2 746	16 677
Cement	4 402	921	5 323
Terracotta	2 825	94	2 919
Plaster	1 341	155	1 496
Wood	920	119	1 039
Steel	679	323	1 002
Other materials	238	53	291
Other plastics	230	21	251
Glass	95	40	135
Mineral wool	97	32	129
Alveolar plastics	88	22	110
Slate	68		68
Aluminium	18	25	43
Copper	21	4	25
Wood insulation	17	5	22
Other metals	5	4	9
Other bio-sourced insulation	8	0	8
Zinc	1	0	1
TOTAL	**43 030**	**8 190**	**51 220**

Table 8: Consumption of materials for new buildings in 2015 (thousands of tonnes) (source: ADEME)

Among those available in the Product Tool, we selected six materials: cement, steel, aluminium, copper, glass, and sand, along with two types of wood (only available in the CommoTool): softwood and hardwood. The complete list of selected materials is provided in Figure 13. We did not compare different variants within a same material category (*e.g.,* various types of aluminium or steel). Instead, we selected one representative type per material, and, when several options were available, we chose the one with the highest environmental impact.

Short name	Type	Description from the Product Tool	GBS Package
Sand (quartz, silica)	Sand	Quartz/Silica sand, single route, at plant, mining, cleaning, grinding, screening, sand 0/2 [EU-28+EFTA]	GBStoolbox
Glass	Glass	Flat glass, uncoated, at plant, production mix, per kg flat glass [EU-28+3]	GBStoolbox
Reinforcing steel	Steel	reinforcing steel production | reinforcing steel | Cutoff, U [Europe]	GBSecoinvent
Portland cement 2	Cement	cement production, Portland | cement, Portland | Cutoff, U [Europe without Switzerland]	GBSecoinvent
Aluminium ingot (magnesium main solute)	Aluminium	Aluminium ingot (magnesium main solute), single route, at plant, primary production, aluminium casting and alloying, 2.7 g/cm3 [EU-28+EFTA]	GBStoolbox
Copper (metal working)	Copper	metal working, average for copper product manufacturing | metal working, average for copper product manufacturing | APOS, U [Rest-of-World]	GBSecoinvent

Short name	Type	Description from the Commo Tool
Hardwood	Wood	Woodlogs - Hardwood
Softwood	Wood	Woodlogs - Softwood

Figure 13: Impact factors used to evaluate materials impacts in buildings

Please note that the impact results based on the ProductTool's impact factors do **not account for the share of recycled materials**. The tool assumes that all materials are newly extracted, which is not always the case in practice. This assumption may therefore lead to an overestimation of actual impacts. In reality, the average share of recycled materials used across the EU economy was around 11.8% in 2023 (European Environment Agency 2025). However, despite higher recycling rates for construction and demolition waste, actual reuse rates in new building projects remain very low—below 1% in France (Fédération Française du Bâtiment 2024b).

Moreover, the impact results based on the CommoTool only consider the harvested wood at the forest exit, without accounting for subsequent stages such as transport, processing, or implementation (CDC Biodiversité 2020a). As a result, some potential pressures are not covered by the GBS. Only Land use, Climate change and Land use in catchment of wetlands are considered. In addition, potential material losses occurring during processing are not considered, which may lead to an underestimation of the actual impacts.

Note on wood:

Although French forests are predominantly composed of hardwood species, 85% of the wood used in construction is softwood (Ducerf Groupe 2021). This means that, out of 920 billion tons of wood used in new buildings in France in 2015, approximately 782 billion tons are softwood.

C.2.1. Terrestrial static impacts of materials

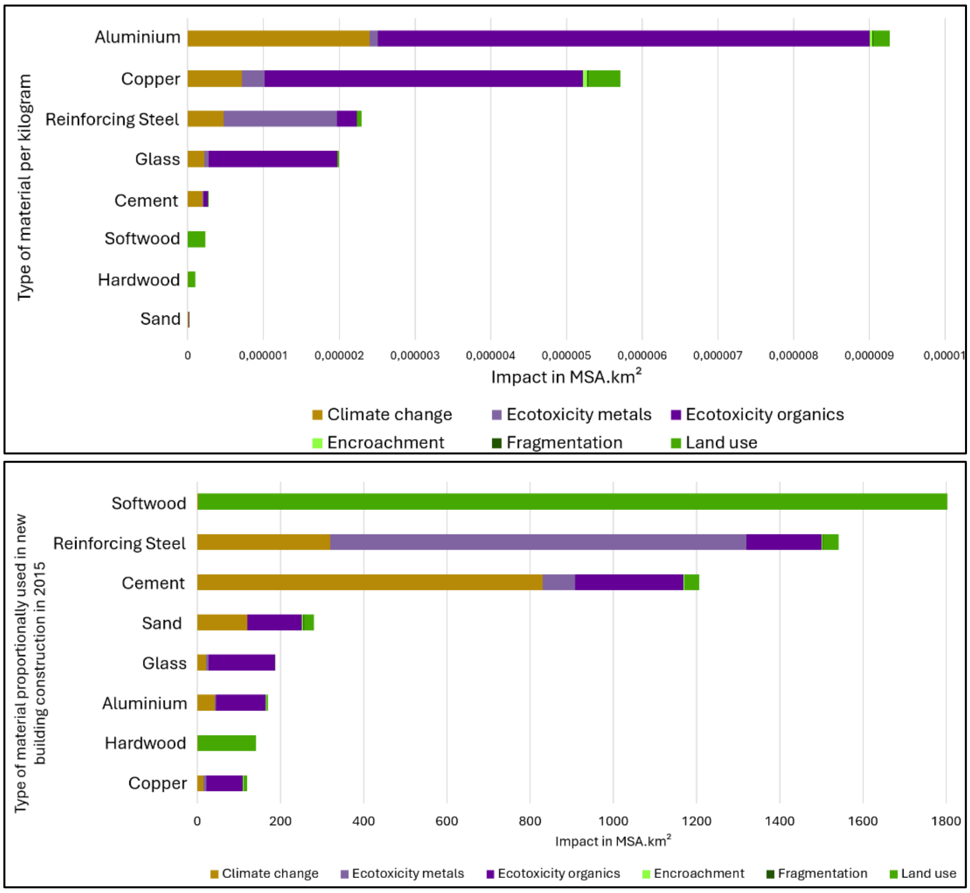


Figure 14: Terrestrial static impacts per kg of material (top) and proportionally used in new buildings in 2015 (bottom) in MSA.km²

The two graphs in Figure 14 show the terrestrial static impacts (all the accumulated negative past – already existing impacts on terrestrial ecosystems) of construction materials using two different approaches: per kilogram of material (top graph) and according to the actual share used in buildings (bottom graph). In both cases, **steel exhibits a high impact both per kilogram and in proportion to its presence in the building stock, making it a major contributor**. Aluminium and copper have the highest impacts per kilogram, but their overall contribution is moderated by relatively low usage. Conversely, cement and steel, which have a moderate impact per kg, emerges as ones of the most impactful materials overall due to the large quantities used. These impacts are mainly driven by pressures such as Ecotoxicitiy (both metal and organic), Land use and Climate change, all resulting from material extraction and processing.

Regarding wood, the results show that **softwood has a higher total impact than hardwood**, primarily because it is far more widely used in construction and softwood generally has lower yields on average, thus requiring larger surface areas for its production. However, on a per kg basis, hardwood could have a higher cumulative impact due to its slower regeneration rate. Unlike metals or minerals, the biodiversity impacts of wood are mainly linked to Land use, offering greater potential for mitigation through sustainable forest management practices. As a result, it is often more feasible to act on Land use-related pressures associated with wood than on Ecotoxicity-related pressures tied to metals or minerals.

Please note that these two approaches provide relative comparisons, as the orders of magnitude differ significantly between impacts per kilogram and impacts based on actual proportions used in buildings. Therefore, the graphs aim to highlight relative contributions rather than provide directly comparable absolute values.

C.2.2. Terrestrial dynamic impacts of materials

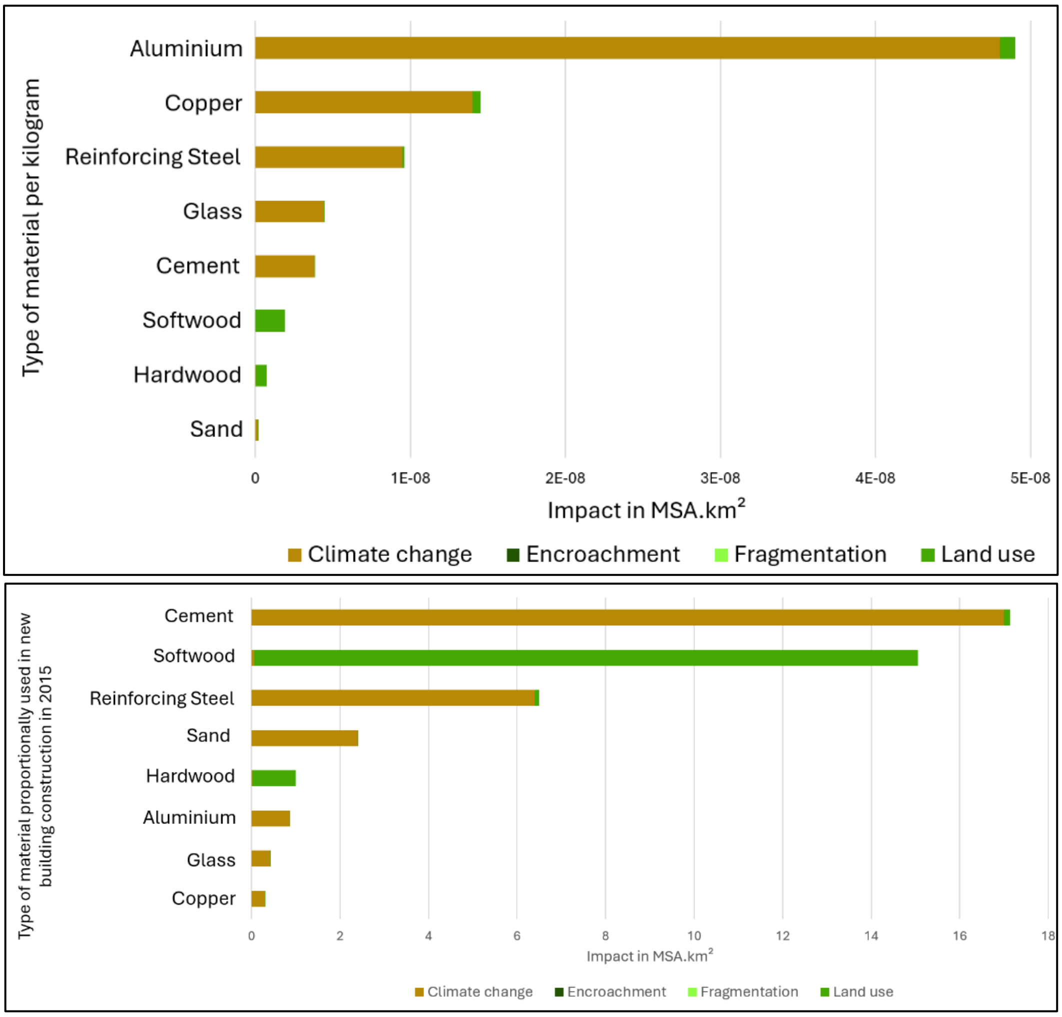


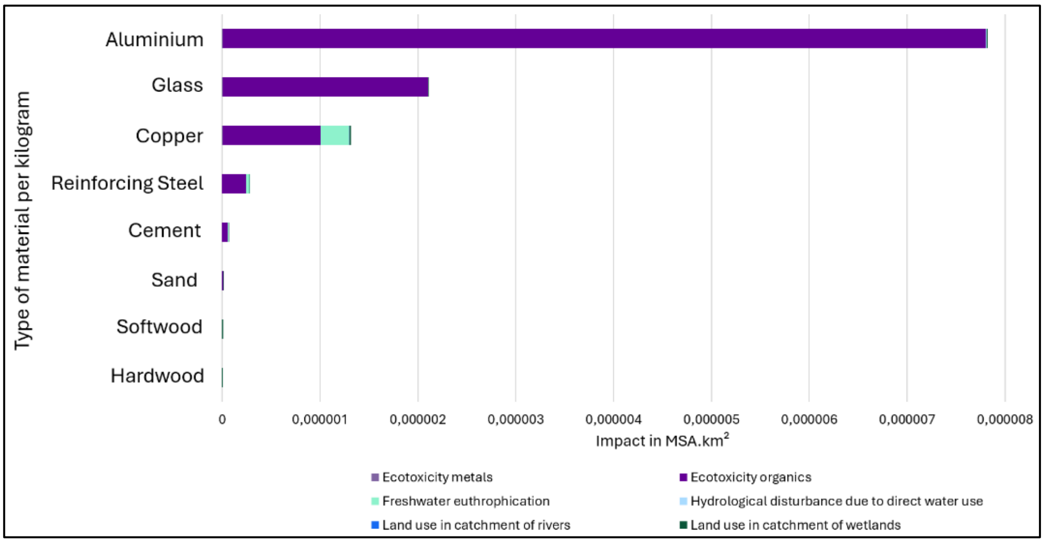
Figure 15: Terrestrial dynamic impacts per kg of material (top) and proportionally used in new buildings in 2015 (bottom) in MSA.km²

The two graphs in Figure 15 show the terrestrial dynamic impacts (all the additional terrestrial impacts occurring during the period assessed – here is year 2024) of construction materials using two different approaches: per kilogram of material (top graph) and according to the actual share used in buildings (bottom graph). In both cases, **steel exhibits a high impact both per kilogram and in proportion to its presence in the building stock**, making it a major contributor. Moreover, cement and sand, which have a respectively moderate and low impact per kg, emerges as ones of the most impactful materials overall due to the large quantities used. These impacts are mainly driven by pressures such as Land use and Climate change, all resulting from material extraction and processing.

Regarding wood, the results show that **softwood has a higher total impact than hardwood because it is far more widely used in construction**. This impact is mainly driven by Land use pressure, further exacerbated by the fact that softwood generally has lower yields on average, thus requiring larger surface areas for its production.

Please note that these two approaches provide relative comparisons, as the orders of magnitude differ significantly between impacts per kilogram and impacts based on actual proportions used in buildings. Therefore, the graphs aim to highlight relative contributions rather than provide directly comparable absolute values.

C.2.3. Aquatic static impacts of materials



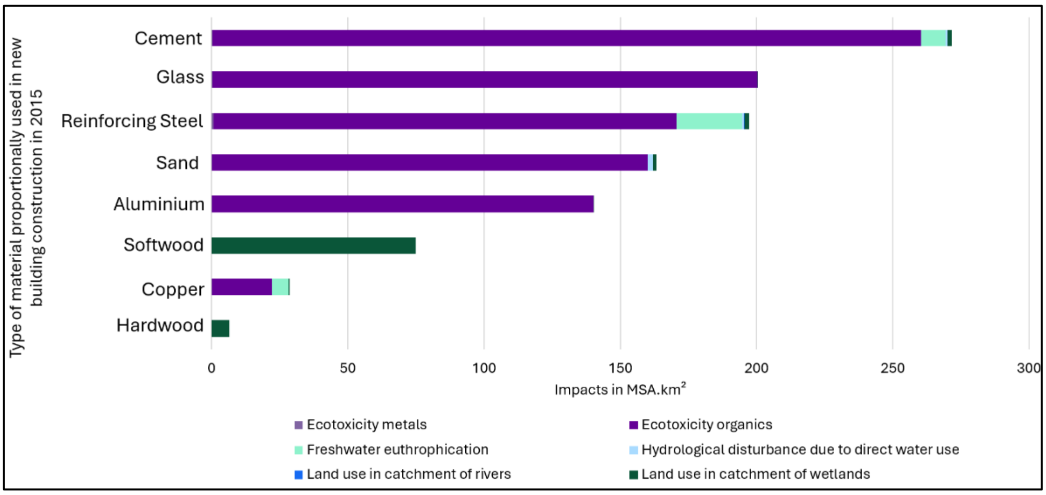


Figure 16: Aquatic static impacts per kg of material (top) and proportionally used in new buildings in 2015 (bottom) in MSA.km²

The two graphs in Figure 16 show the aquatic static impacts (all the accumulated negative past – already existing impacts on freshwater ecosystems) of construction materials using two different approaches: per kilogram of material (top graph) and according to the actual share used in buildings (bottom graph). In both cases, **glass exhibits a high impact both per kilogram and in proportion to its presence in the building stock**, making it a major contributor. Aluminium and copper have the highest impacts per kilogram, but their overall contribution remains limited due to their relatively low usage. Conversely, cement and steel, which has a moderate impact per kg, emerges as one of the most impactful materials overall due to the large quantities used. These impacts are mainly driven by pressures such as Ecotoxicitiy, Land use and pollutions, all resulting from material extraction and processing.

Please note that these two approaches provide relative comparisons, as the orders of magnitude differ significantly between impacts per kilogram and impacts based on actual proportions used in buildings. Therefore, the graphs aim to highlight relative contributions rather than provide directly comparable absolute values.

C.3 Biodiversity labels and certifications

Key findings

Many labels and certifications in the construction sector incorporate environmental requirements and encourage practices that go beyond regulatory standards. However, these labels often fall short in ensuring positive outcomes for biodiversity. Their environmental criteria are not always directly tied to biodiversity, sometimes focusing on general improvements like energy efficiency rather than specific biodiversity protection. Additionally, they frequently lack quantitative thresholds, making it impossible to measure or verify progress in reducing biodiversity loss.

Yet, much of the data needed to analyse the impacts of construction activities—such as material sourcing, land use, and emissions—already exists. We recommend structuring this data to standardize collection and analysis, aligning it with biodiversity footprint requirements and thus surpassing the limitations of current labels.

The aim of this focus is to review the effect of certain labels and certifications on the biodiversity footprint of construction activities. This analysis highlighted three main issues: the perimeter they cover, the absence of quantitative thresholds on impacts, and the lack of uniformity in data sources and methodologies.

PERIMETER COVERED BY THE LABELS

Environmental labels and certifications in the building sector (such as BREEAM, LEED, DGNB) are valuable tools that can go beyond current regulations (Observatoire de l'Immobilier Durable 2024) by encouraging higher ecological performance standards. They also help finance sustainability efforts by enabling projects to be sold at a premium or by gaining competitive market share. However, the scope of these labels remains limited: they are based on voluntary approaches, are sometimes biased, and often do not require a high biodiversity threshold to obtain certification (Brachet 2020). Indeed, the weighting given to environmental themes varies significantly between labels. For example, the DGNB allocates 22.5% of its score to overall environmental quality, while BREEAM attributes only 10% to land use and ecology (Observatoire de l'Immobilier Durable 2024). Furthermore, the specific environmental criteria included, and how biodiversity is defined or addressed, differ from one label to another, making **comparisons and integration into biodiversity footprint tools more complex**. More broadly, most certifications focus primarily on general environmental topics (such as energy, water, waste, or resource management) while biodiversity often remains marginal or underrepresented.

In contrast to these broad international frameworks, some French labels such as BiodiverCity (developed by the CIBI) or Effinature (included within the HQE certification) focus specifically on ecological and biodiversity-related aspects. These schemes offer valuable qualitative insights into in-situ biodiversity performance. However, their scope remains limited to the site scale, and they do not account for upstream impacts (upstream Scope 3), such as those related to construction materials and their supply chains. Yet, these upstream Scope 3 impacts represent the most significant share of the construction sector's impact on biodiversity, particularly in terms of biodiversity pressure and resource extraction.

ABSENCE OF QUANTITATIVE THRESHOLDS

Some of these certifications also incorporate Life Cycle Assessment (LCA) criteria. However, these LCA-related credits are sometimes optional, or included in broader categories rather than directly linked to biodiversity metrics. In addition, the use of LCA remains insufficient for biodiversity assessment: two products with the same environmental label may cause different pressures on biodiversity, and the generic nature of product categories often prevents a clear understanding of their actual composition and biodiversity-related impacts. Moreover, **clear thresholds or mandatory targets** are often lacking, reducing the ability of these certifications to drive meaningful improvements in global biodiversity performance.

Another limitation is that biodiversity is only addressed from an ***in-situ*** perspective (local biodiversity), with no consideration for ***ex-situ*** impacts (global biodiversity) (Brachet 2020). The guidelines of these labels and certifications also mainly focus on habitat loss and threatened species, while overlooking ordinary biodiversity (Brachet 2020). Lastly, the lack of precision in their quantitative indicators and targets limits their integration into biodiversity footprint assessment tools (see Figure 17) (B4B+Club and CDC Biodiversité 2025).

Identified needs for assessing biodiversity (literature and planners)	**Ecology**
Assessment that takes into account all elements of a construction system favorable to biodiversity	No, only the vegetated part is considered
Quantitative assessment of direct impacts related to land use change	Yes
Quantitative assessment of impacts related to climate change	No
Quantitative assessment of impacts related to chemical pollution	No
Quantitative assessment of impacts related to physical pollution	No
Quantitative assessment of impacts related to overexploitation of resources	No
Quantitative assessment of impacts related to the introduction of invasive species	Yes
Aggregation of impacts into a single score	No
In-situ biodiversity assessment, with consideration of 1) local specificities of the area and project, and 2) ordinary biodiversity	Yes
Ex-situ biodiversity assessment	No
Consideration of ecosystem services	Yes, for certain in-situ ecosystem services
Neutral decision-support tool	No
Transparent assessment	Not always
Consensus-based assessment	Yes
Comprehensive and reproducible assessment	Not always (multiplicity of tools and evaluation criteria)
Integrated assessment	No
Existence of tools facilitating the appropriation of the method	Yes
Multi-scale deployment to account for different levels of interaction between urban systems and biodiversity	Yes (plot, neighborhood, and territory scales)
Interoperability with BIM tools and digital models	No
Consideration of efforts already made to reduce impact	Yes (mitigation hierarchy but missing follow-up measures)
Compatibility with future regulatory framework (RE 2020)	No

Figure 17: Extract from the PhD thesis: set of criteria to ensure a reliable and robust biodiversity assessment, and comparison with current assessment practices (ecology column)

LACK OF UNIFORMITY IN DATA SOURCES AND METHODOLOGIES

Beyond these technical limitations, a key barrier is the lack of dialogue between biodiversity footprint methodologies and the logic of existing certifications. To make footprinting approaches more actionable and comparable, it is essential to **engage in discussions with certification bodies, companies and scientific research** in order **to align on relevant indicators and thresholds** (— which is not currently the case).

Finally, a major obstacle lies in the fragmentation and poor usability of available data. Although Building Information Modeling (BIM) already contains a wide range of environmental and material data used by practitioners, these datasets are often disaggregated and difficult to exploit for biodiversity assessments. Yet, if properly structured and integrated, they could offer significant potential for streamlining and harmonizing environmental/biodiversity data within the construction sector.

To address the challenge of assessing global biodiversity impacts, a 2020 PhD thesis (Brachet 2020) proposed a promising approach based on the complementarity between LCA and ecological expertise (called HIBOU methodology). This hybrid methodology combines the structured, quantitative framework of LCA with context-specific ecological knowledge, offering a more comprehensive view of biodiversity impacts. Such initiatives illustrate that research is exploring solutions to overcome current methodological limits (Observatoire de l'Immobilier Durable 2022).

CDC Biodiversité is currently developing a methodology to assess the effectiveness of labels and certifications in addressing biodiversity criteria (CDC Biodiversité 2025a) and how these labels and certifications could be translated within the GBS.

C.4 Sector's dependencies

KEY MESSAGES

The construction sector is intrinsically dependent on biodiversity, and the ecosystem services it provides, particularly those that protect against **climatic and hydrological disturbances**. Construction operations and timelines are highly sensitive to weather variability and extreme events such as **storms or floods**, making ecosystems like forests, wetlands, and vegetated soils essential for site **stability and erosion prevention**.

The sector also relies on **water-related ecosystem** services to secure the availability, stability, and quality of water resources. From material processing to dust control and equipment cleaning, a steady supply of clean water is vital, and ecosystems that regulate flow and purify water help ensure uninterrupted construction activities.

In this part are presented additional results on the sector's dependencies. A methodological explanation is available in section 2.4 of the general appendix (CDC Biodiversité 2022).

Since 1.4.10 version of the GBS, the version 2 of ENCORE is used for the dependencies analysis. Now, this database includes cultural services and thus relies on 25 ecosystem services (against 21 for the first version).

Table 9 below displays the average total dependency scores of the Construction sector, broken down by Scope. On average, for the Scope 1 and upstream Scope 3, the results show that the sector has a very low dependency on ecosystem services. However, the sector depends on other sectors (*i.e.* agriculture, raw extraction material) that rely on many more ecosystemic services. As a result, to fully capture the dependency of one sector on services provided by nature it is necessary to consider the dependency of its whole supply chain (World Economic Forum 2020).

Please note that low average scores may mask high dependencies on specific ecosystem services, as a low dependency on one ecosystem can counterbalance a high dependency on another, and companies are rarely highly dependent on all ecosystem services. Therefore, a low overall average dependency score often hides high dependencies on some ecosystem services. (see critical dependency score which evaluates the proportion of a company's activity or value chain which is critically dependent on at least one ecosystem service. A critical dependency is defined as a High or Very High dependency according to ENCORE).

Average aggregated dependency score	Scope 1	Number of ecosystemic services dependencies of Scope 1	Upstream Scope 3
Construction	26%	15 out of the 25	23%

Table 9: Construction average dependency scores on ecosystem services according to different scopes, broken down by Scope. The average is weighted by the industry group turnover (Source: GBS 1.4.10, May 2025, Chloé Nguyen Van)

C.4.1. Scope 1 dependencies analyses

According to Figure 18 below, Scope 1 of the sector depends on many ecosystem services classified in the "protection from disruption" category. The sector relies extensively on **rainfall pattern regulation services** (93%), then moderately on **soil and sediment retention** (67%), **storm mitigation** (60%) and **flood control** (60%).

This reflects a strong vulnerability of construction activities to climatic and hydrological disturbances. Construction operations, infrastructures and timelines are directly affected by weather variability and extreme events such as storms or floods. Therefore, the sector relies heavily on ecosystems that help buffer or regulate these disturbances, such as forests, wetlands, and vegetated soils. The retention of soil and sediments is also crucial for maintaining the stability of construction sites and preventing erosion-related damages.

Please note that for biological control ecosystem service (NA), there is no data available in ENCORE database for this service in this sector (the sector does not have a high dependency on this ecosystem service, otherwise there would have been specific research on this topic).

Moreover, Scope 1 of the sector relies moderately on **water-related ecosystem services** such as **water supply** (49%), **water flow regulation** (56%) and **water purification** (60%).

These dependencies highlight the importance of specific ecological systems such as rivers, wetlands, and vegetated soils in ensuring the availability, stability, and quality of water resources essential to construction activities. Whether for material production on-site (*e.g.*, concrete), dust control, or equipment cleaning, construction sites require a consistent supply of clean water. The regulation of water flow and its natural purification by these ecosystems help maintain suitable conditions for such uses, while also reducing risks linked to pollution, sedimentation, or water shortages.

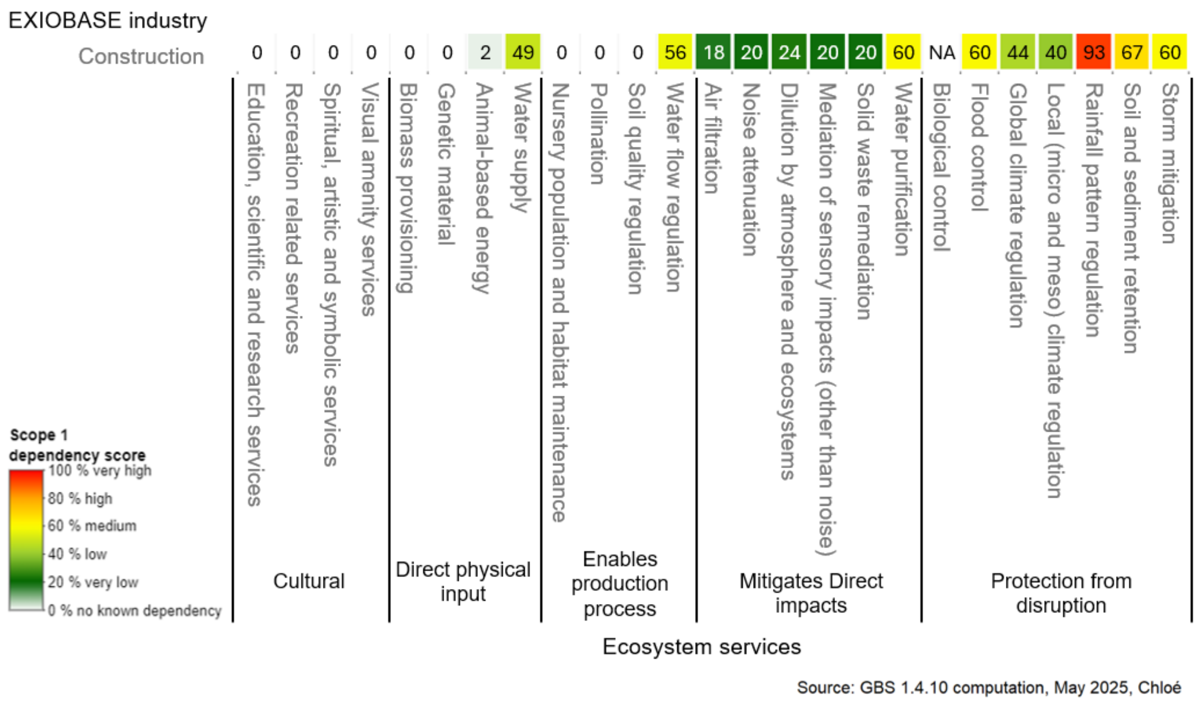


Figure 18: Scope 1 average dependency scores of the Construction sector. Source: GBS 1.4.10, May 2025, Chloé Nguyen Van

C.4.2. Upstream Scope 3 dependencies analyses

We now turn to Scope 3 dependencies, which capture indirect vulnerabilities throughout the supply chain.

Figure 19 below, shows low upstream Scope 3 reliance on ecosystem services, but this reflects the diversity of companies within Scope 3, which dilutes the dependency score rather than indicating a true absence of dependence. However, it relies moderately on **water-related ecosystem services** such as **water flow regulation** (51%) and **water supply** (47%) as well as ecosystem services classified in the “protection from disruption” category: **flood control** (50%), **storm mitigation** (50%) and **soil and sediment retention** (45%).

This apparent low level of dependency may be misleading, as it reflects a narrow view that does not account for the full environmental footprint and vulnerabilities embedded in the supply chain. Many of the upstream activities that provide inputs to the construction sector—such as raw material extraction, manufacturing of construction products, and transportation—do in fact rely on many ecosystem services for stable operations (see sectorial appendix of raw material and manufacturing of metals, for example). Furthermore, the ongoing transition toward bio-based construction materials—motivated by their renewable nature, recyclability, and lower pollutant output—could gradually increase the sector’s dependency on **biomass provisioning** services. This growing reliance introduces a new form of ecological pressure that must be managed carefully to avoid simply shifting the burden from one set of ecosystem services to another.

The medium reliance on water-related and disruption-protection services reveals that natural systems still play a significant role in maintaining upstream activities. For instance, steady water flow and availability are critical for material processing and industrial operations, while flood and storm regulation services reduce the risk of production halts or infrastructure damage. Soil and sediment retention also ensures land stability, which is vital for mining and quarrying operations involved in supplying the construction sector.

The results indicate that the construction sector and its value chain show relatively limited direct dependencies on ecosystem services. However, many upstream industrial and resource-related activities still depend, both indirectly and intrinsically, on ecological functions.

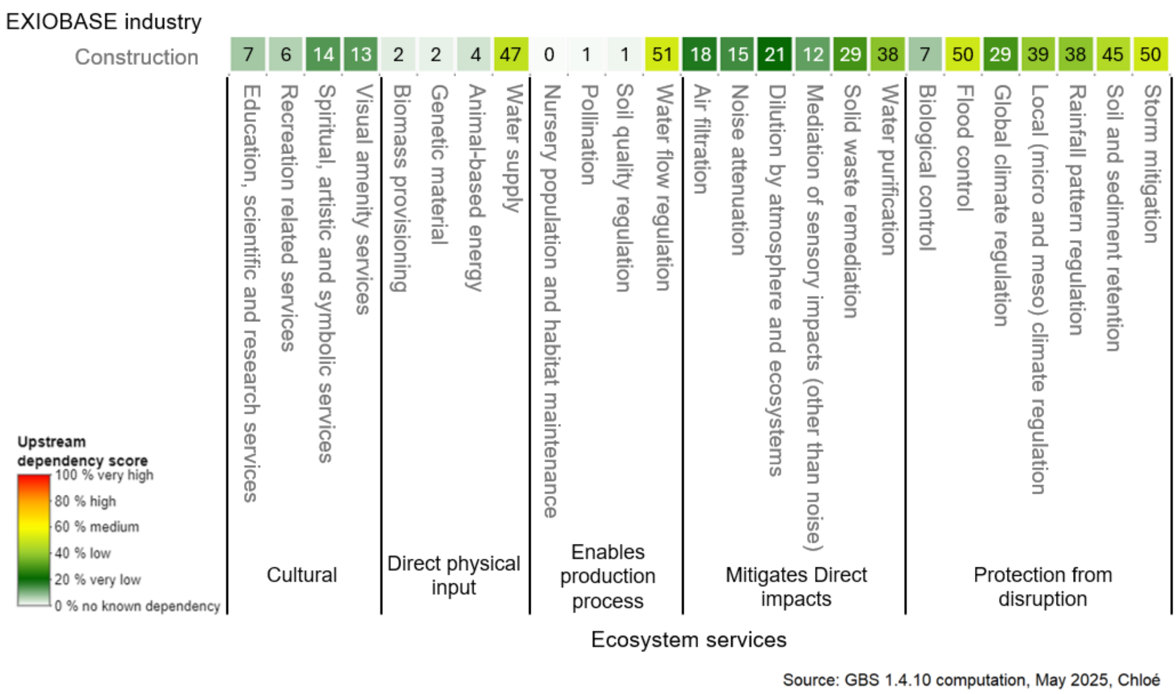


Figure 19: Upstream Scope 3 average dependency scores of the Construction sector. Source: GBS 1.4.10, May 2025, Chloé Nguyen Van

C.5 To go further: limits and uncertainties

After presenting the impacts and dependencies, we now discuss key methodological limits and uncertainties that frame their interpretation.

C.5.1. Use of financial data

When calculated with financial data, the GBS results do not provide Scope 1 impacts due to spatial pressures of industrial buildings, offices, parking lots, etc., because **land occupation** data is not available. All the land use impacts computed with financial data are computed through **commodities.** This means that industries that do not produce commodities (such as construction or real estate) will have no Scope 1 Land use impacts. Thus, Scope 1 impacts due to spatial pressures are underestimated. This limit can be overcome by adding land use data to the GBS input information (see LU focus section).

Moreover, turnover data are quite outdated (from 2011).

C.5.2. Downstream Scope 3

Downstream Scope 3 of the sector -and any sector of the GBS- are not represented as they are difficult to estimate. due to the complexity of attributing environmental impacts across diverse and long value chains.

C.5.3. Ecotoxicities uncertainties

Since version 1.4.7, ecotoxicity impacts are separated between organic and metals ecotoxicity, as recommended by LCIA frameworks (Owsianiak et al. 2023).

To ensure a meaningful footprint assessment, we recommend integrating organic ecotoxicity results for aquatic ecosystems into the overall impact calculation. If these results appear particularly high, this could be due to input data uncertainties, such as ecotoxicity emissions estimated from LCA data (Ecotoxicity results derived from the *"Product"* or *"Finance"* files are considerably more uncertain than those from the *"Ecotoxicity"* file, where actual emission data is provided). **Metallic ecotoxicity** and **organic ecotoxicity in terrestrial ecosystems** can be excluded from the total footprint due to their high uncertainty. However, instead of omitting them entirely, we advise reporting them separately—especially if the impact values are significantly high. This helps highlight potential ecotoxic risks, even if these values are not directly comparable to other impact categories. Uncertainty levels for ecotoxicity can reach a factor of 100. If ecotoxicity impacts are more than 100 times higher than other pressures, it means that the risk of impact is substantial and is worth investigating further—particularly by seeking more precise input data, such as direct emission measurements.

C.5.4. Environmental safeguards

In addition to the limitations of the GBS, there are significant pressures and other biodiversity aspects not covered by the GBS that should still be considered when defining action plans for industries in the sector. These include avoiding **the establishment of activities on or near areas of high environmental value or developing a specific management plan for such sites, ensuring that farmers refrain from harmful practices such as deforestation in line with the EU Deforestation Regulation, implementing measures to detect and eliminate the spread of invasive species, and conducting systematic reviews to identify priority ecosystem services, among other measures.**

Furthermore, while biodiversity consists of three components—ecosystem diversity, species diversity, and genetic diversity—the GBS focuses solely on ecosystem diversity, leaving the other two components unaddressed. For a full list of environmental safeguards to implement, refer to the GBS review report on “Quality Assurance” (CDC Biodiversité 2020b) (International Finance Corporation 2012).

D. How can the sector transition towards nature-positive practices

To guide the sector toward reducing its environmental impacts and aligning with global biodiversity goals, we propose a trajectory-based approach tailored to the sector.

D.1 Trajectories to align with the Global Biodiversity Framework

As detailed in previous sections, the construction sector causes large impacts on biodiversity. At the current level, the sector is not aligned with global biodiversity goals. To reach alignment, the sector will have to reduce the rate at which it causes biodiversity degradation and ultimately generate positive impacts. This section explores the possible trajectories that the sector should follow to align with the Global Biodiversity Framework.

The Kunming-Montreal Global Biodiversity Framework (GBF) aims to reach at least a global no net loss of biodiversity in 2030 (interpreted as a global dynamic impact of 0 in 2030) and restore biodiversity between 2030 and 2050. CDC Biodiversité suggests interpreting the GBF using global MSA trajectories and distributing required efforts across economic sectors and companies.

Four allocation systems are proposed here to distribute the efforts across sectors: they encapsulate different ethical points of view that the society could consider when asking companies to contribute to biodiversity gains.

Table 10 and Table 11 below describe the data used in the calculation of each trajectory depending on the allocation system. General explanation about the methodology to obtain the global and the sectoral trajectories is available in *Accounting for Positive and Negative Impacts throughout the Value Chain*. No. 49. MEB's Report (CDC Biodiversité. 2023).

Allocation	Approach	Parameter	Parameter data source	Sector's figures	Comparison with global total
Equality	Everyone has the same right	Number of employees in the sector **in Europe**	Eurostat (2018)	15 million people	**6,4%** of the total global workforce

Efficiency	Cost-effectiveness	Cost of restoration (EUR/[MSA.m²])	CDC Biodiversité internal estimation	20€/MSA.m²	% global average (weighted by the sector's turnovers)
Capability	Industries' ability to pay	Turnover (EUR)	EXIOBASE (2011)	7 500 billion euros	**7.4%** of the total global turnover
Sovereignty	Grandfathering	2020 dynamic impact (MSA.km²/year)	GBS computation	4 100	**1.7%** of the total global 2020 dynamic impact

Table 10: Allocations and data used to draw sectoral trajectories

Allocation	Absolute dynamic impact (MSA.km²)				%2020 sectoral dynamic impact		
Year	**2020**	**2030**	**2040**	**2050**	**2030**	**2040**	**2050**
Equality	4 100	0	32 000	270 000	0%	-780%	-6 700%
Efficiency	4 100	620	5 900	55 000	15%	-150%	-1 400%
Capability	4 100	15 000	52 000	330 000	-380%	-1 300%	-8 100%
Sovereignty	4 100	0	8 300	72 000	0%	-200%	-1 800%

Table 11: Construction targeted absolute and relative dynamic impacts compared to its 2020 dynamic impacts, according to each allocation

Figure 20 illustrates a science-based trajectory of the Scope 1 dynamic impacts over time for the Construction sector from 2020 to 2050 according to the different allocation systems. The dynamic impacts are expressed as a proportion of the 2020 dynamic impact of the sector (implicitly assuming 2020 is taken as the baseline year against which the trajectory is set). For instance, impacts from the Construction sector should be 92 % of their 2020 level in 2021 if the Efficiency allocation system is chosen (meaning a reduction of 8 % compared to the baseline).

The green area between the maximum and minimum values in Figure 20 thus delineates the likely boundaries of the path companies will have to follow to answer societal expectations. The Construction sector for instance should expect to aim for gains of biodiversity between -1 400 % (Efficiency system) to -8 100 % (Capability system) of its 2020 baseline by 2050. In other words, a company from the industry with a dynamic loss of +100 MSA.km² in 2020 would have to achieve gains of -1 400 to -8 100 MSA.km² by 2050. Interestingly Figure 20Figure 20 Targeted reduction of Construction's dynamic impacts under different allocation systems highlights that in the Equality allocation system, the Construction industry would be allowed more impacts until 2027 than its 2020 baseline impacts: its large number of employees means it could be allowed more impacts (whereas other industries already exceed their budget based on this allocation system).

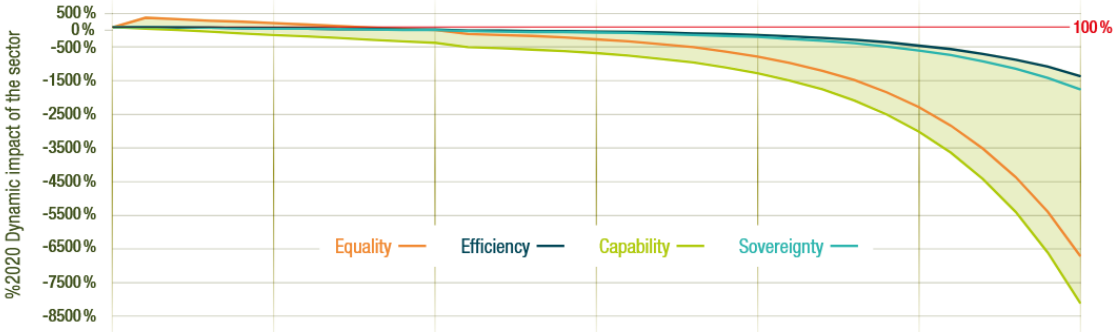


Figure 20 Targeted reduction of Construction's dynamic impacts under different allocation systems

Limitations:

Please note that the data of the turnover and the number of employees is somewhat outdated (2011 and 2018); Moreover, the baseline of 2020 to calculate the dynamic impact is being discussed as it might not accurately reflect the evolution of the impacts.

D.2 Possible actions to reach the trajectories

D.2.1. Suggestion of actions for the sector

Many actions are available for the construction sector to reduce its impacts and align with global goals. This section proposes a list of possible actions allowing the sector to reduce its impacts. The following recommendations apply to the construction sector's direct operations and upstream value chain.

01
DIRECT OPERATIONS

Direct Operations — *Highest immediate control & accountability*

› Apply the **mitigation hierarchy** (avoid, reduce, restore & offset) to all construction-related impacts
› Limit **noise, pollution, and encroachment** during the construction phase for both wildlife and nearby residents

› Implement **permeable surfaces** or **soil decompaction** techniques to cancel soil sealing and prevent net land artificialisation
› Encourage **renovation** of old or unoccupied buildings to limit new land take
› Favour architectural designs that **minimise land use**

› Design sites to **create and maintain ecological corridors**, ensuring **ecological continuity**
› Integrate **green spaces** and infrastructures using native species and pollinator-friendly habitats

02 ENERGY USE DIRECT OPS	**Energy Use for Direct Operations** › Use **renewable energy sources** with demonstrated low impact on biodiversity during the construction phase › Optimise construction processes and machinery to **reduce energy consumption and noise** › **Electrify construction equipment** where possible and monitor the carbon footprint of purchased electricity
03 UPSTREAM PHASES	**Upstream Phases —** *Greatest leverage on biodiversity — upstream phases drive 95% of impacts* › Source materials from suppliers **with full environmental certifications** and **supply chain traceability** › Integrate **biodiversity criteria in site selection**, based on early environmental impact assessments, avoided areas rich in biodiversity, habitats of endangered species, and protected areas › Use **alternative materials** to replace conventional concrete where possible (*e.g.*, geopolymers, recycled aggregates, bio-based materials)
04 DOWNSTREAM PHASES	**Downstream Phases** › Optimise building design to facilitate dismantling, reuse and recycling (design for disassembly, modular construction) › Improve the recyclability of construction waste and develop partnerships with local recycling facilities › Optimise the building energy performance through passive design (orientation, natural ventilation, insulation), use of natural light, and biodiversity-friendly renewable technologies (e.g., bird-safe solar panels) › Use construction materials that **support biodiversity** (*e.g.*, porous surfaces as habitats for insects, mosses, lichens)

D.2.2. Nature-based solutions and ecological engineering for the Construction sector

In a context of increasing pressures on biodiversity — driven by urban sprawl, soil sealing, resource extraction and climate change — and considering the essential services provided by ecosystems, the adaptation of the building and construction sector represents an environmental, economic, and social challenge. Implementing Nature-based Adaptation Solutions (NbS) and ecological engineering can help strengthen this role (Office Français de la Biodiversité and ADEME 2024).

This is particularly relevant given the sector's dependency on ecosystem services, especially those related to water and soil: ensuring water infiltration from the design phase, preserving the soil matrix ("brown infrastructure") throughout all stages of construction, including demolition.

Nature-based solutions (NbS) offer an innovative and sustainable response to today's environmental and urban challenges. Inspired by ecosystems and how they function, they aim to restore or mimic natural processes to meet human needs while generating co-benefits for biodiversity and the climate. In the construction sector—which significantly contributes to land artificialization, energy consumption, and greenhouse gas emissions—their integration represents a major opportunity for ecological transition.

NbS can be applied at various scales and in diverse forms. At the building level, green roofs and walls are effective solutions, acting simultaneously as thermal insulators, humidity regulators, and habitats for biodiversity. They help reduce urban heat islands while extending the lifespan of structures, provided they are well designed and maintained. The creation of green spaces around buildings, rain gardens, or hedgerows helps reconnect built environments to the natural cycles of water, carbon, and life. In dense urban areas, the rehabilitation of brownfields through phytoremediation or the establishment of ecological corridors can restore ecological value to degraded spaces while improving quality of life.

On a larger scale, NbS can also be integrated into linear infrastructures such as roads or dikes. Wildlife crossings and vegetated embankments help restore ecological connectivity disrupted by development (Cerema 2021). These solutions are technically feasible but often require strong political will and interdisciplinary coordination. They are especially relevant for public infrastructure projects, which can embed biodiversity targets into their specifications. However, technical and regulatory complexities tend to slow their implementation compared to smaller-scale projects.

From an economic standpoint, NbS often involve higher upfront costs during construction. Bio-based materials, extensive vegetation, or ecological management techniques can add 10% to 30% to initial budgets depending on the case (Cerema 2017). However, these costs are largely offset in the long term through energy savings, lower maintenance, greater resilience to climate hazards, and increased real estate value—not to mention indirect benefits for health, air quality, and overall well-being. These positive externalities are still insufficiently accounted for in traditional cost-benefit analyses.

The durability of constructions incorporating NbS is generally satisfactory, and in some cases superior to conventional solutions. A well-maintained green roof protects the underlying waterproofing membrane; a vegetated wall can provide lasting insulation and stable habitats for wildlife. However, these systems require specific maintenance, differentiated management, and technical expertise that is still not widespread in the building industry. Training of stakeholders (architects, urban planners, builders, developers) is thus a key lever for scaling up.

A notable difference is observed in ease of implementation depending on the scale of the project. Individual houses or small buildings allow for simpler and faster integration of NbS: green features, water harvesting, composting, and the use of sustainable materials are more easily managed. However, their ecological impact remains limited to the local scale. In contrast, large-scale infrastructure and urban projects offer far greater systemic potential (ecological networks, urban resilience), but face stronger regulatory, technical, and economic barriers.

Nature-based solutions therefore represent a promising path to transform the construction sector toward a more sustainable and resilient model. Their implementation is technically feasible, economically viable in the long term, and ecologically meaningful. However, it requires a paradigm shift:

to view urban planning and building not as isolated objects within their environment, but as living systems embedded in natural, social, and territorial dynamics.

Opportunities:

Despite the high impact of the sector on biodiversity and the global trends towards urban sprawl, the growing awareness of the sector's impact on natural capital is leading various stakeholders to take greater account of biodiversity in construction. Adopting an eco-conception approach at the design stage would ensure that the materials chosen can be dismantled, reused or recycled. Integrating eco-conception in the planning and design of buildings would for instance encourage to build on brownfield sites hosting less biodiversity, instead of converting natural habitats.

E. Glossary and units

Glossary

BFA: Biodiversity Footprint Assessment
BREEAM: Building Research Establishment Assessment Method
CIBI: Conseil International Biodiversité et Immobilier
Climate change (CC): excess of emitted greenhouse gas leads to disturbance of the global climate. The global mean temperature increase (GMTI) and the induced climate change modify the repartition areas of different biomes, which threatens the survival of numerous species who cannot adapt fast enough to this phenomenon.
CSRS: Corporate Sustainability Reporting Directive
DNSH: Do No Significant Harm
DGNB: German Sustainable Building Council
ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure database
ESRS: European Sustainability Reporting Standards
EXIOBASE: global, detailed Multi-Regional Environmentally Extended Supply-Use Table (MR-SUT) and Input-Output Table (MR-IOT)
GBF: Global Biodiversity Framework
GBS: Global Biodiversity Score
GDP: Gross Domestic Product
GICS: Global Industry Classification Standard
GRI: Global Reporting Initiative
HQE: Haute Qualité Environnementale certification
IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN: International Union for Conservation of Nature

LEAP approach: Locate, Evaluate, Assess, Prepare

LEED: Leadership in Energy and Environmental Design certification delivered by the US Green Building Council

MSA: Mean Species Abundance

NACE: Statistical Classification of Economic Activities in the European Community

NbS: Nature-based Solutions

SBTN: Science Based Targets Network

Spatial pressures:

- **Land use (LU):** land uses in which natural areas are converted can have significant impacts on natural habitats by reducing or destroying viable space for original species.
- **Fragmentation of natural habitats (F):** the pressure caused by the reduction and subdivision of natural habitats and the disappearance of ecological corridors preventing species movement and limiting their living spaces.
- **Human encroachment (E):** direct (noise, pollutions, etc.) and indirect impacts (right of way for hunting, tourism, etc.) from anthropogenic activities in otherwise natural areas.

Terrestrial ecotoxicity (X): the pressure caused by chemical substances on terrestrial ecosystems

TNFD: Taskforce on Nature-related Financial Disclosures

Vertically integrated (VI): value chain boundaries if the company had integrated all its supply chain (instead of relying on external suppliers): sum of the Scope 1, Scope 2 and Upstream Scope 3 impacts

WBCSD: World Business Council for Sustainable Development

World terrestrial static intensity compatible with planetary boundaries:

$$= \frac{terrestrial\ static\ impact\ compatible\ with\ planetary\ boundary}{global\ turnover}$$

$$= \frac{28\%MSA\ *total\ emerged\ land\ surface}{global\ turnover}$$

WWF-US: World Wildlife Fund US

Units

MSA.m²

MSA.m²/kEUR

MSAppb per bEUR

MSAppb* per bEUR

F. Appendix

Appendix 1: Impact overview per Scope and pressure

Drivers of change	Impact drivers	Impact types*	Overview of processes that can cause impact			
			Upstream	Direct operations	Downstream	
			Material extraction & production	Design & construction	Operations & maintenance	Demolition & waste
Landwater-/sea use change	Terrestrial ecosystem use	Change in habitat extent	Land clearing for extraction of materials (habitat loss) Land clearing for timber production	Land clearing for building (habitat loss)		Habitat loss from land clearing during demolition of large-scale projects, mainly of old buildings that have provided nesting sites for birds like swifts, sparrows
		Change in habitat condition	Poor habitat quality due to intensive forestry practices (in case of non-certified timber) Habitat degradation due to mining activities, raw materials processing, transport	Habitat degradation due to construction activities e.g., temporary drainage of groundwater	Reduced capacity of green spaces to buffer water, pollution and noise due to inappropriate management of open/green spaces at building sites in urban areas	
		Change in habitat connectivity	Habitat fragmentation due to location of extraction sites and access roads/transport infrastructure	Reduced connectivity between habitats due to location of new buildings		
	Freshwater ecosystem use	Change in habitat extent	Habitat loss and quality reduction due to sand and gravel quarries in rivers and lakes	Wetland destruction for building construction		
		Change in habitat condition		Effect on freshwater habitats due to temporary drainage of groundwater		
	Marine ecosystem use	Change in habitat extent	Habitat loss and quality reduction due to sand and gravel mining			
		Change in habitat condition				
Resource exploitation	Water use	Change in groundwater/surface water level	Falling groundwater tables due to water withdrawal for resource production	Reduced groundwater availability due to water use for construction activities (e.g., mixing cement onsite) Lower groundwater tables due to freshwater use for dust control, cleaning purposes	Reduced groundwater availability due to potable water use in bathrooms, kitchens, laundries and outdoor taps and other cleaning processes Reduced infiltration and water-logging due to low permeability and hard surfaces	Lower groundwater tables due to freshwater use for dust control, cleaning purposes
Climate change	GHG emissions	Climate change impacts	Increased GHG emissions due to energy use for building materials production, transport	Increased GHG emissions due to energy use during construction (machinery)	Increased GHG emissions due to electricity use and mobility	Increased GHG emissions due to energy use during demolition (in machinery, e.g.)
			GHG release from soils/seabeds	GHG release from disturbance of soils/seabeds	Net reduction in GHG emissions with renewable energy use	
Pollution	Non-GHG air pollutants	Change in air quality	More release of dust and particulate matter during extraction and production processes	Increased release of dust and particulate matter during construction Release of noxious vapors from oils, glues, thinners, paints, treated woods, plastics, cleaners and other hazardous chemicals	Depending on building heating system	More dust and particulate matter during demolition
	Water pollutants	Change in water quality	Chemicals leakage and spills during extraction Untreated wastewater from extraction activities	Chemicals leakage and spills during construction	Depending on presence of sewerage system and wastewater treatment	Chemicals leakage and spills during demolition
	Soil pollutants Solid waste	Change in soil quality	Chemicals leakage and spills during extraction/ production	Chemicals leakage and spills during construction	Pesticide use	Chemicals leakage and spills during demolition
		Change in solid waste quantity	Extraction site/production process waste disposal	Uncontrolled waste disposal (e.g., of packaging waste)	Depending on solid waste collection and disposal system	Depending on solid waste collection and disposal
Invasive species and others	Disturbance	Change in soil/seafloor	Soil compaction due to heavy machinery use on-site	Soil compaction due to heavy machinery use on-site		
		Change in sound/lightscape	Temporary impact on light- and sound-scape during extraction process	Temporary impact on light- and sound-scape during construction	Fauna disturbance due to site operations (e.g., light pollution, noise)	Temporary impact on light- and sound-scape during demolition
	Invasive alien species (IAS)	Change in habitat condition		IAS introduction by shipping vessels/international transport. Spread of IAS in connection with soil storage, soil management and trucks movement	Rapid spread of IAS due to lack of IAS management	

Impact scale					
	High/very high impact		Medium impact		Low impact

Source: Roadmaps-to-Nature Positive-Foundations-for-the-built-environment-system.pdf

Figure 21: Overview of the impact of the sector per Scope and per pressure

Appendix 2: EXIOBASE "background noise"

THE ISSUE

Almost all of the industries' Upstream impacts include a proportion of impacts caused by Grass, Crops and Wood logs. These "*incompressible*" or "*background noise*" impacts also affect industries unrelated to biomass and may represent significant proportion of their vertically integrated impacts.

EXPLANATIONS OF INCOMPRESSIBLE IMPACTS

Two main sources explain those impacts:

1. All the industries have purchases embedding biomass, either directly or further in their supply chain.
    - Biomass is embedded in:
        - Food for employee's catering (if a company provides catering to its employees), which is associated to crops and grass (for direct consumption or for feed for animals consumed by humans).
        - Wood logs embedded into paper products used for prints, or cardboard used for packaging.
    - Even if a company does not directly provide catering to employees or does not use paper products or packaging, some companies within its supply chain do.
2. Companies classified within one industry in national accounting may have multiple activities and thus some impacts related to crop cultivation, livestock husbandry or wood logging (or their downstream buyers) may end up in the figures of unrelated industries.
    - For example, photovoltaic electricity production is sometimes conducted by farmers: they may have a legal entity registered as Electricity production to national statistics agencies but also produce crops. As a consequence, crops production may be reported for the Production of electricity by solar photovoltaic industry.
    - Overall, such cases are rare, affect only a few countries, and do not significantly alter the figures globally.

Note: industries may also purchase or produce non-biomass commodities (e.g. metals, etc.) for the same reasons. But impacts related to crops, grass and wood logs stand out in GBS-calculated impacts because biomass requires a lot more land to be grown and thus the land use (in particular) impacts are especially large.

HOW TO INTERPRET IMPACTS FROM INDUSTRIES WITH INCOMPRESSIBLE IMPACTS

Overall guidelines for interpretation

Incompressible impacts are real impacts a company should account for, but it makes sense to provide the breakdown of incompressible vs activity-specific impacts when disclosing impacts.

A company/sector can hardly act upon the incompressible impacts within its supply chain. Those impacts should not be ignored but the analysis should focus on impacts beyond this “background noise”.

These impact results provide a clearer understanding of the sector’s contribution, which is mainly upstream in the value chain. The next section details the impact of construction materials, compares renovation with new construction, assesses the effectiveness of construction labels, and proposes a method to improve the calculation of land use.

Appendix 3: Extract from NACE rev. 2 (Eurostat 2008)

This section contains extracts from the NACE rev. 2 classification (EUROSTAT 2008) and details the sectors covered by the Construction sectoral report.

Section F - Construction

41. Construction of building

The division 41 gathers all activities under "Construction of buildings". Are concerned: new work, repair, addition and alteration, erection of prefabricated building and structure as well as construction of temporary nature.

41.1. Development of building projects

41.10. Development of building projects

This class includes:

- Development of building projects for residential and non-residential building by bringing together financial, technical, and physical means to realise the building projects for later sale

This class excludes:

- Construction of buildings (included in 41.2)
- Architectural and engineering activities
- Project management services related to building projects

41.2. Construction of residential and non-residential buildings

This group includes the construction of complete residential or non-residential building, on own account for sale or on a fee or contract basis. Outsourcing parts or even the whole construction process is possible. If only specialised part of the construction process is carried out, the activity is classified in division 43.

41.20. Construction of residential and non-residential building

- This class includes:
  - Construction of all type residential building like single family houses, multi-family buildings, including high-rise buildings
  - Construction of all type of non-residential building like buildings for industrial production, factories, workshop, assembly plants… hospitals, schools, office buildings, hospitals, schools, office buildings, hotels, stores, shopping mall, restaurants, airport buildings, indoor sports facilities, parking garages, including underground parking garages, warehouses, religious buildings
  - Assembly and erection of prefabricated constructions on the site
  - Remodelling or renovating existing residential structures

This class excludes:

- Construction of industrial facilities, except buildings (included in 42.9)
- Architectural and engineering activities
- Project management for construction

42. Civil engineering

The division 42 gathers all activities under "Civil engineering". Are concerned in that division, general construction for civil engineering objects like new works, repair additions and alterations, erection of prefabricated structures on the site and construction of temporary nature.
That division included for instance: heavy construction such as motorways, streets, bridges, tunnels, railways, airfields, harbours and other water projects, irrigation systems, sewage systems, industrial facilities, pipelines and electric lines, out-door sports facilities… This work can be carried out for own account or on a fee of contract basis. Portion of the work and sometimes even the whole practical work can be subcontracted out.

42.1. Construction of roads and railways

42.11. Construction of road and motorways

This class includes:

- Construction of motorway, streets, road, other vehicular and pedestrian ways
- Surface work on streets, road, highways, bridge, or tunnel like asphalt paving of roads, road painting and other marking, installation of crash barriers, traffic signs and the like
- Construction of airfield runway

This class excludes:

- Installation of lighting and electrical signals (included in 43.2)
- Architectural and engineering activities
- Project management for construction

42.12. Construction of railways and underground railways

This class includes:

- Construction of railways and subways

This class exclude:

- Installation of lightning and electrical signals
- Architectural and engineering activities
- Project of management for construction

42.13. Construction of bridges and tunnels

- This class includes:

- Construction of bridges, including those for elevated highways
- Construction of tunnels

This class excludes:

- Installation of lightning and electrical signals
- Architectural and engineering activities
- Project of management for construction

42.2. Construction of utility projects

42.21. Construction of utility projects for fluids

This class includes the construction of distribution lines for transportation of fluids and related building and structures that are integral part of these systems.

- This class includes:
  - Construction of civil engineering construction for long-distance and urban pipelines, water main and line construction, irrigation systems (canals), reservoirs
  - And construction of sewer systems, including repair, sewage disposal plants, pumping stations
  - Water well drilling

This class excludes:

  - Project management activities related to civil engineering works

42.22. Construction of utility projects for electricity and telecommunications

- This class includes:
  - Construction of civil engineering construction for long-distance and urban communication and power lines, power plants

This class excludes:

  - Project management activities related to civil engineering works

42.9. Construction of other civil engineering projects

42.91. Construction of water projects

- This class includes:
  - Construction of waterway, harbour and river work, pleasure port, locks, dams, and dikes
  - Dredging of waterway

This class excludes:

  - Project management activities related to civil engineering works

42.99. Construction of other civil engineering projects n.e.c

- This class includes:
  - Construction of industrial facilities except building such as refineries and chemical pants
  - Construction work, other than building such as outdoor sports facilities
  - Land subdivision with improvement
- This class excludes:
  - Project management activities related to civil engineering works
  - Installation of industrial machinery and equipment
  - Land subdivision without land improvement

43. Specialised construction activities

The division 43 gathers all activities under "Specialised construction activities". It concerns construction of part of building and civil engineering works or preparation. These activities concern similar work for different structures, which requires specialised skill or equipment such as scaffolding, stone setting brick laying... Specialised construction activities are mostly carried out under subcontract. However, in the case of repair construction, projects are carried out directly for the owner of property.

Furthermore, this division includes the installation of all kinds of utilities that make the construction function as such even if all or part of work is done in a special shop such as plumbing, installation of heating air-conditioning system, antennas, electrical work, insulation (water, heat, sound) work, installation of illumination and signalling system of road etc… and include their repair activities. Are also included finishing work of construction such as glazing, plastering, painting, carpets, wallpaper *etc*. The renting of equipment with operator is classified within the associated construction activities.

43.1. Demolition and site preparation

This group includes activities of preparing a site for subsequent construction activities, including the removal of previously existing structures.

43.11. Demolition

- This class includes:
    - Demolition or wrecking of buildings and other structures

43.12. Site Preparation

- This class includes:
    - Clearing of building sites
    - Earth moving, excavation, landfill, levelling, and grading of construction sites, trench digging, rock removal, blasting etc…
    - Site preparation for mining, overburden removal and other development and preparation of mineral properties and sites, except oil and gas sites
    - Building site drainage
    - Drainage of agricultural or forestry land
- This class excludes:
    - Drilling of production oil or gas wells
    - Decontamination of soil
    - Water well drilling
    - Shaft sinking

43.13. Test drilling and boring

- This class includes:
    - Test drilling, test boring and core sampling for construction, geographical or similar purposes

This class excludes:

- Drilling of production oil or gas wells
- Test drilling and boring support services during mining activities
- Water well drilling
- Shaft sinking
- Oil and gas field exploration, geophysical, geological, and seismic surveying

43.2. Electrical, plumbing, and other construction installation activities

This group includes installation activities that support the functioning of a building as such, including installation of electrical system, plumbing (water, gas and sewage systems), heat and air-conditioning system, elevator etc.

43.21. Electrical installation

This class includes the installation of electrical systems in all kinds of building and civil engineering structures of electrical systems.

This class includes:

- Installation of electrical wiring and fitting, telecommunication wiring, computer network and cable television wiring, including fibre optic, satellite dishes, lighting systems, fire alarms, burglar alarm systems, street lighting and electrical signals, airport runway lighting, electric solar energy collector
- Connecting of electric appliance and household equipment, including baseboard heating

This class excludes:

- Construction of communications and power transmissions lines
- Monitoring and remote monitoring of electronic security systems, such as burglar alarms, including their installation and maintenance

43.22. Plumbing, heat, and air-conditioning installation

This class includes the installation of plumbing, heating, and air-conditioning systems, including additions, alterations maintenance and repair.

This class includes:

- Installation in building or other construction projects of heating systems (electric, gas and oil), furnace, cooling tower, non-electric solar energy collector, plumbing and sanitary equipment, ventilation and air conditioning equipment and ducts, gas fitting, steam piping, fire sprinkler systems, lawn sprinkler systems
- Duct work installation

This class excludes:

- Installation of electric baseboard heating

43.29. Other construction installation

This class includes:

- Installation in buildings or other construction projects of elevator, escalators, including repair and maintenance, automated and revolving doors, lightning conductors, vacuum cleaning systems, thermal, sound or vibration insulation

This class excludes:

- Installation of industrial machinery

43.3. Building completion and finishing

43.31. Plastering

- This class includes:
  - Application in buildings or other construction projects of interior plaster or stucco, including related lathing materials

43.32. Joinery installation

This class includes:

- Installation of doors (except automated and revolving), windows, door and window frames, of wood or other materials

- Installation of fitted kitchens, built-in cupboards, staircases, shop fitting and the like
- Interior completion such as ceiling, movable partitions etc…

This class excludes:

- Installation of automated and revolving doors

43.33. Floor and wall covering

- This class includes:
  - Laying, tiling, hanging, or fitting in buildings or other construction projects of ceramic, concrete or cut stone wall or floor tiles, ceramic stove fitting, parquet and other wooden floor coverings, wooden wall coverings, carpets and linoleum floor coverings, including of rubber or plastic, terrazzo, marble, granite or slate floor or wall coverings, wallpaper.

43.34. Painting and glazing

- This class includes:
  - Interior and exterior painting of buildings
  - Painting of civil engineering structures
  - Installation of glass, mirror etc…

This class excludes:

- Installation of windows

43.9. Other specialised construction activities

43.91. Roofing activities

- This class includes:
  - Erection of roofs
  - Roof covering

This class excludes:

- Renting of construction machinery and equipment without operator

43.99. Other construction specialised activities n.e.c

- This class includes:
  - Construction activities specialising in one aspect common to different kind of structures, requiring specialised skill or equipment such as construction of foundation, including pile driving damp proofing and water proofing work, dehumidification of buildings, shaft sinking, erection of steel elements, steel bending, bricklaying and stone setting, scaffolds and work platform erecting and dismantling, excluding renting or scaffolds and work platforms, erection of chimney and industrial ovens, work with specialist access requirements necessitating climbing skills and the use of related equipment, working at height on tall structures
  - Surface work
  - Construction of outdoor swimming pools
  - Steam cleaning, sand blasting and similar activities for building exteriors
  - Renting of cranes and other building equipment, which cannot be allocated to a specific construction type, with operator

This class excludes:
Renting of construction machinery and equipment without operator

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