GLOBAL BIODIVERSITY SCORE

CONSTRUCTION BIODIVERSITY FOOTPRINT

Sectoral appendix

May 2022

Version 1 – DRAFT

CDC BIODIVERSITÉ | Caisse des Dépôts GROUPE

Table of contents

A. PURPOSE OF THE DOCUMENT

The current **sectoral appendix** supports the **Construction benchmark factsheet** and provides additional content that could not be included in the factsheet due to space constraints. Such additional content relates to the perimeter of the factsheet, more detailed results and charts and specific methodology and references.

In addition to the sectoral appendix, this factsheet is supplemented by two documents, common to all the factsheets:

- A **general appendix**, which provides methodological elements to understand how the sectoral benchmark factsheets are built and how computations and charts are obtained. It includes all the methodology and references which are common to all the factsheets, as well as guidance on how to read and use the factsheets.

- A **reading guide**, which explains the structure of the factsheets. It provides the main contents, definitions and necessary elements to know how to read the factsheets for readers with limited knowledge about the Global Biodiversity Score.

Figure 1 below encapsulates the four benchmark documents available for each sector.

Figure 1: The four benchmark documents.

B. WHAT DOES THE SECTOR INCLUDE?

In terms of **impact calculation**, the factsheet 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: Specialized construction activities. Furthermore, construction activity in the perimeter of this factsheet 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 tackled in this section.

Figure 2 below shows the correspondence between EXIOBASE and NACE rev 2:

Figure 2: Correspondence between EXIOBASE and NACE rev 2 for the Construction benchmark factsheet

Figure 3 below describes more concretely the perimeter of the Construction factsheet, what are the main resources used by the sector, and in which Scopes the impacts related to those resources are classified:

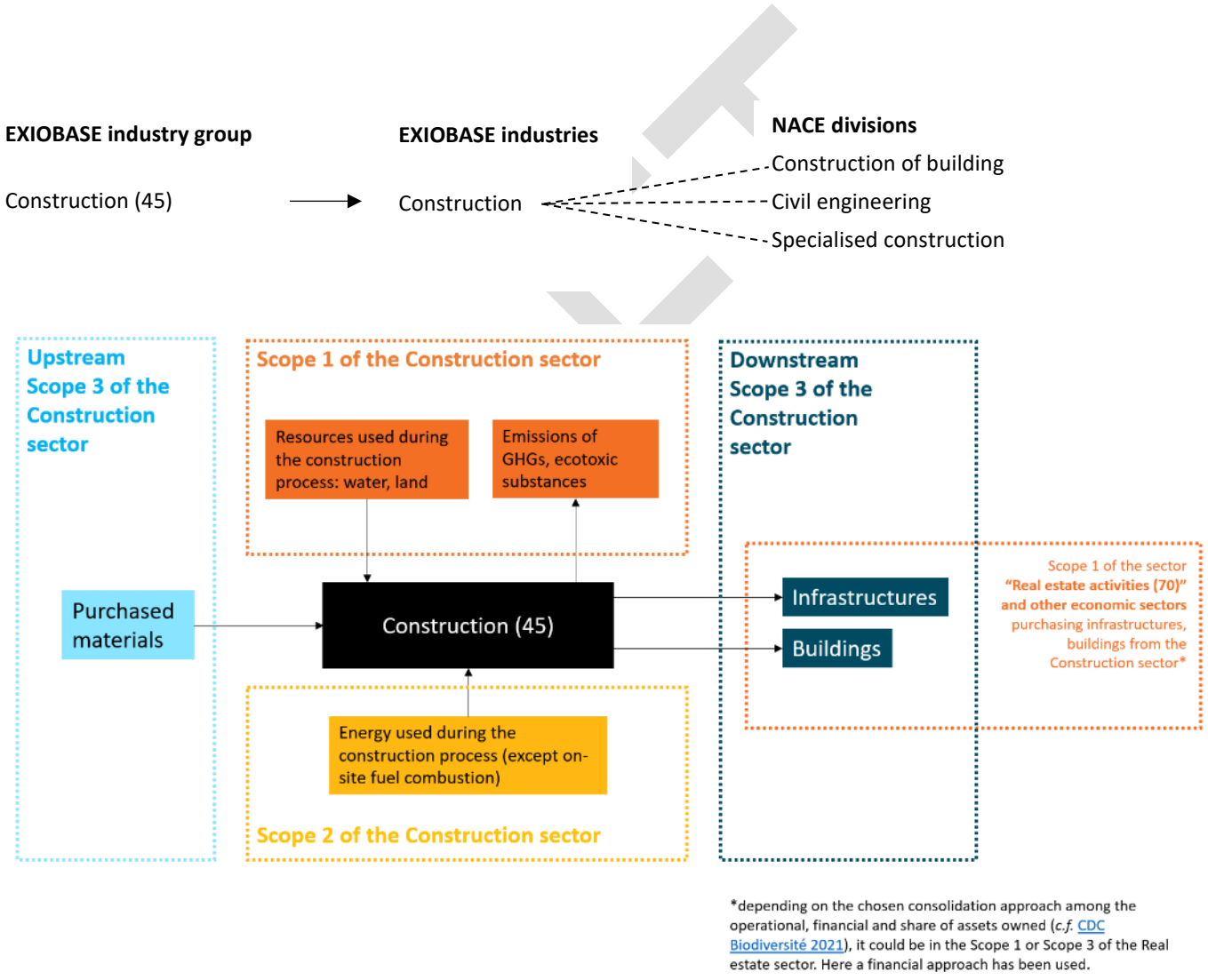


Figure 3: perimeter of the Construction benchmark factsheet and associated Scopes

The **dependencies** of the construction sector are expressed in a score based on ENCORE data, thanks to the method described in Figure 4. The Construction sector corresponds in ENCORE to the sectors "Consumers discretionary" and "Industrial" which includes the sub-industries "Homebuilding" and "Construction & Engineering". Figure 4 shows the correspondence between EXIOBASE and ENCORE for the Construction sector.

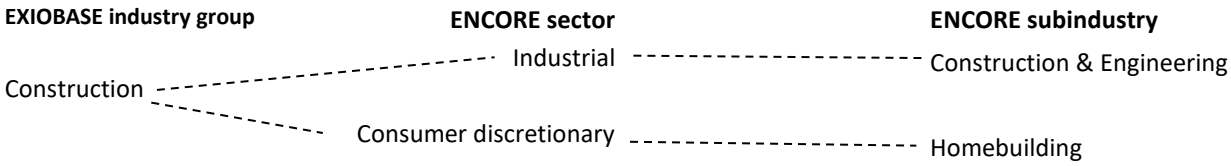


Figure 4: Correspondence between EXIOBASE and ENCORE for the Construction benchmark factsheet

Further on the impact calculation: a detailed description of **section F of NACE rev 2** listing its divisions and sub-divisions extracted from (EUROSTAT 2008) is presented below.

Section F - Construction (NACE rev2)

Construction of building **(41)**

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.

- ## Development of building projects **(41.1)**
  - ### Development of building projects **(41.10)**

    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

- ## Construction of residential and non-residential buildings **(41.2)**

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.

  - ### Construction of residential and non-residential building **(41.20)**

    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

Civil engineering **(42)**

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.

- Construction of roads and railways **(42.1)**
  - Construction of road and motorways **(42.11)**

    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
  - Construction of railways and underground railways **(42.12)**

    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
  - Construction of bridges and tunnels **(42.13)**

    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

- Construction of utility projects **(42.2)**
  - Construction of utility projects for fluids **(42.21)**

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

  - Construction of utility projects for electricity and telecommunications **(42.22)**

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

- Construction of other civil engineering projects **(42.9)**
  - Construction of water projects **(41.91)**

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

  - Construction of other civil engineering projects n.e.c **(42.99)**

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

Specialised construction activities **(43)**

The division 43 gathers all activities under "Specialized 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 Jsuch 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.

• Demolition and site preparation **(43.1)**

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

○ Demolition **(43.11)**

This class includes:

- Demolition or wrecking of buildings and other structures

○ Site Preparation **(43.12)**

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

○ Test drilling and boring **(43.13)**

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

- Electrical, plumbing, and other construction installation activities **(43.2)**

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.

- Electrical installation **(43.21)**

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

- Plumbing, heat, and air-conditioning installation **(43.22)**

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

- Other construction installation **(43.29)**

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

- Building completion and finishing **(43.3)**
  - Plastering **(43.31)**

    This class includes:

    - Application in buildings or other construction projects of interior plaster or stucco, including related lathing materials
  - Joinery installation **(43.32)**

    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
  - Floor and wall covering **(43.33)**

    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.
  - Painting and glazing **(43.34)**

    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

- Other specialised construction activities **(43.9)**
  - Roofing activities **(43.91)**

    This class includes:

    - Erection of roofs

- Roof covering

This class excludes:

- Renting of construction machinery and equipment without operator

- Other construction specialised activities n.e.c **(43.99)**

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

C. ADDITIONAL RESULTS

1. Additional results on the sector's impacts

The following calculations presented in the tables were performed using GBS version 1.4.0 by Camille Breton in March 2022. Table 1 displays the **Scope 1 biodiversity impact figures** of the Construction sector, and Table 3displays the **Vertically Integrated figures** (sum on Scope 1, Scope 2 and Upstream Scope 3). Results are expressed in MSA.m² per kEUR of turnover of the Construction sector. They include impacts linked to the consumption of gravel and sand materials which may be underestimated[1], and some purchases may be overrepresented in the results[2] as shown in Figure 8.

An estimation of the **land use Scope 1 and Downstream Scope 3 impacts** is made in the section "The sector's impact on land use" and the results are added in Table 2 and Table 4.

Table 1: Scope 1 impact intensities for the construction benchmark, excluding ecotoxicity impacts and underestimating land use impacts

Accounting category	Realm	Footprint in MSA.m²/kEUR	Footprint in MSAppb/bEUR	Footprint in MSAppb/bEUR
Dynamic	Aquatic	1.4 E-03	0.14	1.1
	Terrestrial	0.14	1.0	
Static	Aquatic	0.015	1.4	4.3
	Terrestrial	0.39	2.9	

*Table 2: **Scope 1** impact intensities for the construction benchmark, excluding ecotoxicity impacts and **including land use impacts (in bold)***

Accounting category	Realm	Footprint in MSA.m²/kEUR	Footprint in MSAppb/bEUR	Footprint in MSAppb/bEUR
Dynamic	Aquatic	$1.4*10^{-3}$	0.14	**10**
	Terrestrial	**1.4**	**10**	
Static	Aquatic	0.015	1.4	4.3
	Terrestrial	0.39	2.9	

[1] In France for example, the Construction sector produced and purchased about 72 million tonnes of gravel and sand according to the default assessment with EXIOBASE inventories, whereas in comparison according to French sector associations, about 126 million tonnes of sand and gravel were produced in France (UNPG, n.d.), and 379 million tonnes of granulates were produced in 2019 (UNICEM 2021).

[2] The Construction sector in France produced and/or purchased about 12 million tonnes of hardwood and softwood, whereas it has been estimated that the demand of wood for the construction, renovation and building management is about 6.3 million tonnes in 2015 (adapted from (Cattelot 2020) and a density of 1.5 tonne/m³). Besides, a significant proportion of the static and dynamic impacts is caused by crops and grass commodities, which does not seem consistent. Among potential sources of error, one concerns possible inaccuracies in EXIOBASE purchases. In all cases, these impacts are not that material compared to other sectors (e.g. the crops and grass impact for the Cattle Farming sector within the industry group "Manufacture of food & beverage").

*Table 3: **Vertically integrated** impact intensities for the construction benchmark, excluding ecotoxicity impacts and **underestimating land use impacts**.*

		Footprint in MSA.m²/kEUR	Footprint in MSAppb/bEUR	Footprint in MSAppb/bEUR
Dynamic	Aquatic	0.10	9.9	44
	Terrestrial	4.5	34	
Static	Aquatic	19	1 800	3 800
	Terrestrial	260	2 000	

*Table 4 : **Vertically integrated** impact intensities for the construction benchmark, excluding ecotoxicity impacts **and including Scope 1 and Downstream Scope 3 and use impacts (in bold).***

		Footprint in MSA.m²/kEUR	Footprint in MSAppb/bEUR	Footprint in MSAppb/bEUR
Dynamic	Aquatic	0.10	9.9	**52**
	Terrestrial	**5.9**	**42**	
Static	Aquatic	19	1 800	**[4 600; 6 000]**
	Terrestrial	**[390; 590]**	**[2 800; 4 200]**	

The following figures display the vertically integrated results per Scope, per pressure or commodity that are **not shown in the factsheet.**

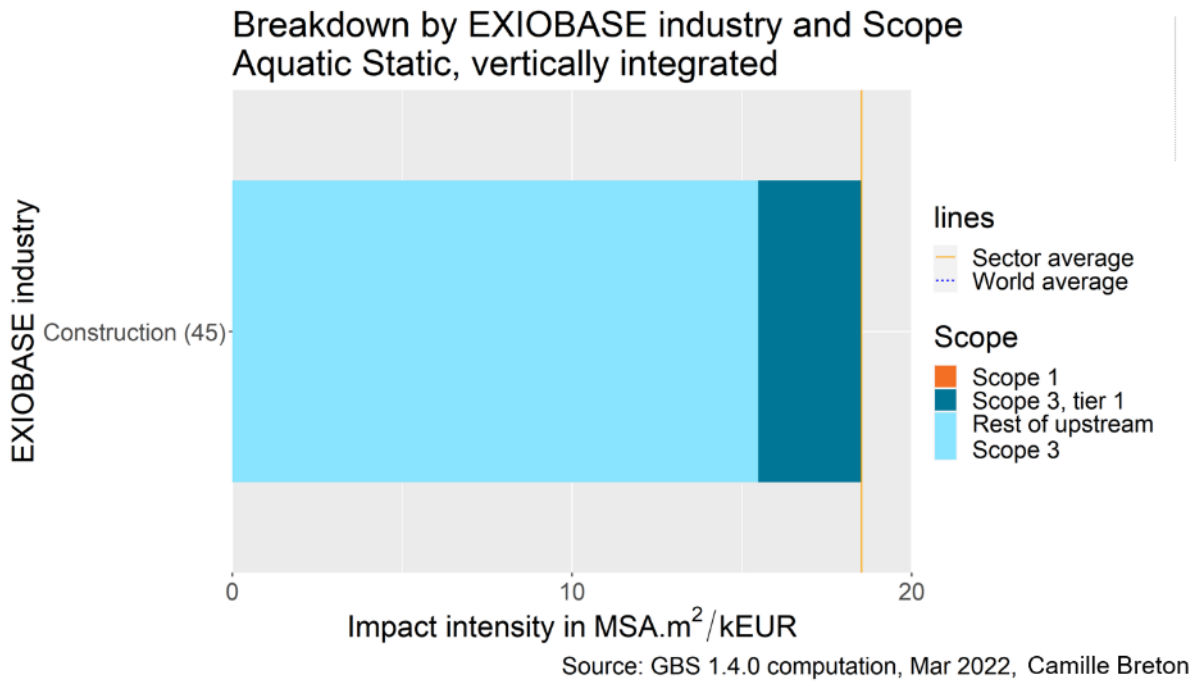


Figure 5: Breakdown by EXIOBASE industry and Scope, aquatic static, vertically integrated

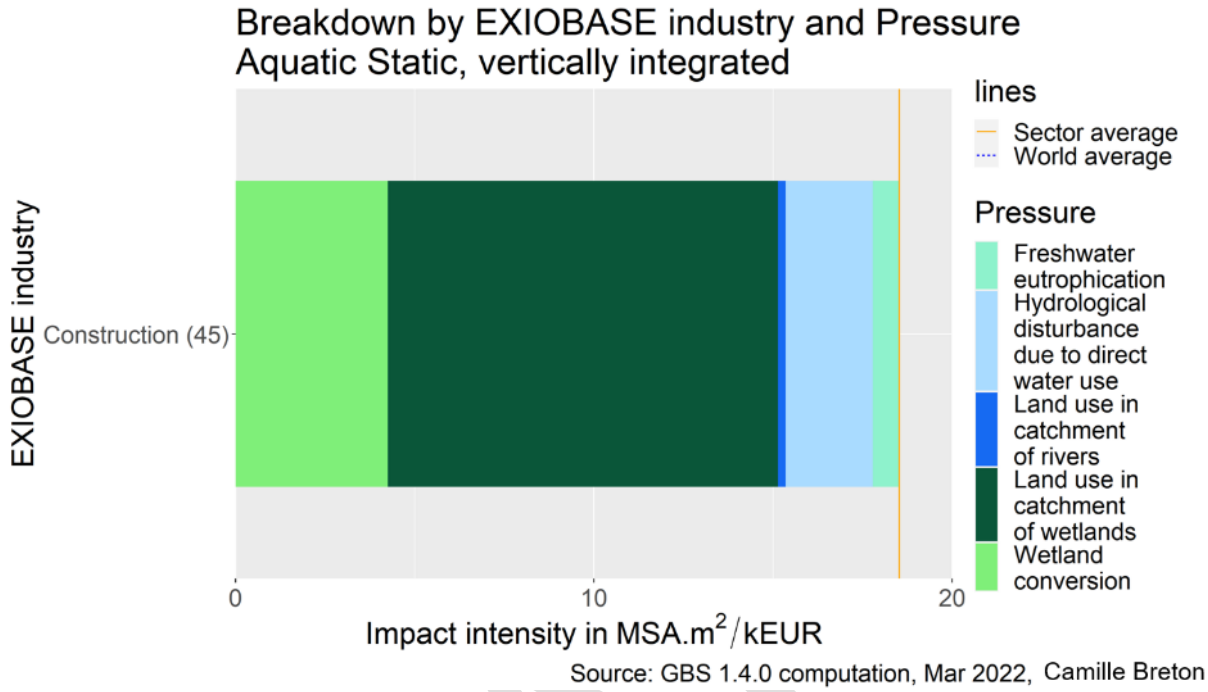


Figure 6: Breakdown by EXIOBASE industry and pressure, aquatic static, vertically integrated

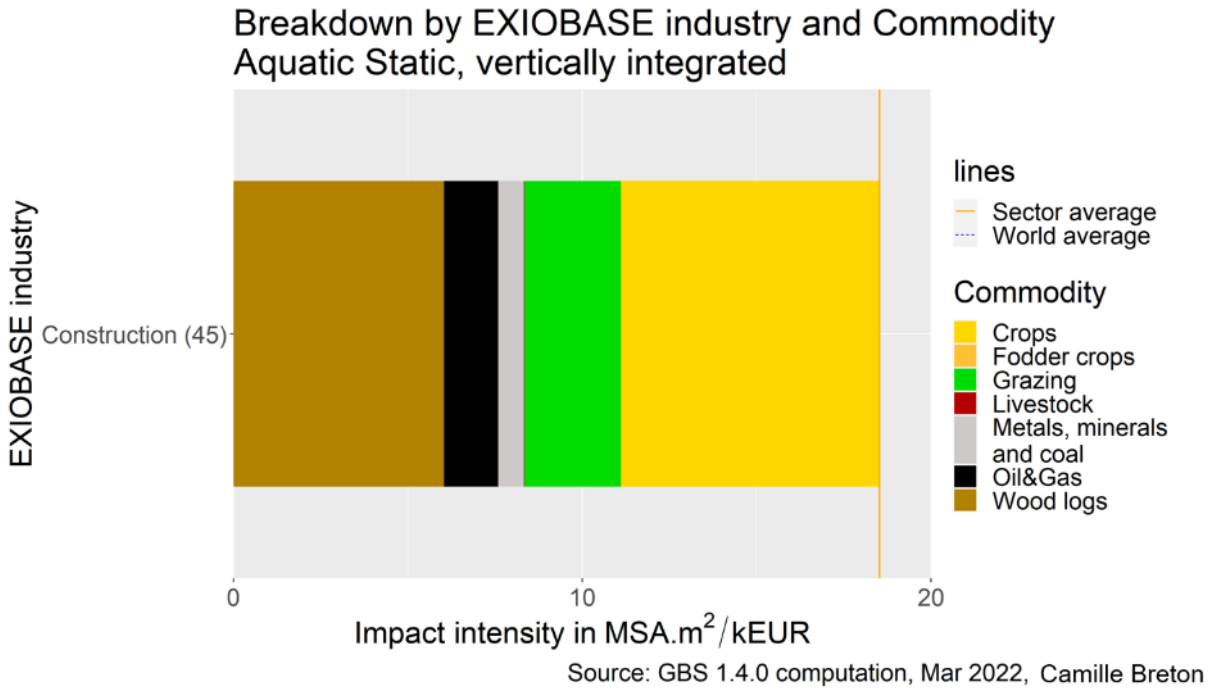


Figure 7: Breakdown by EXIOBASE industry and commodity, aquatic dynamic, vertically integrated

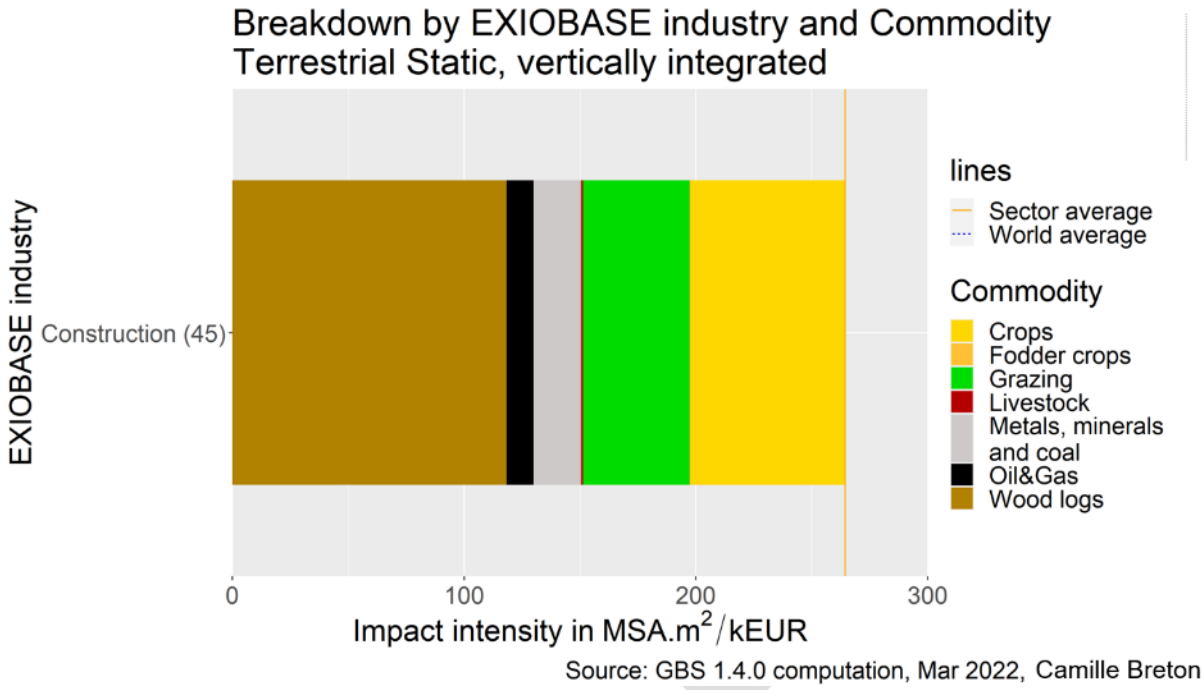


Figure 8: Breakdown by EXIOBASE industry and commodity, terrestrial static, vertically integrated

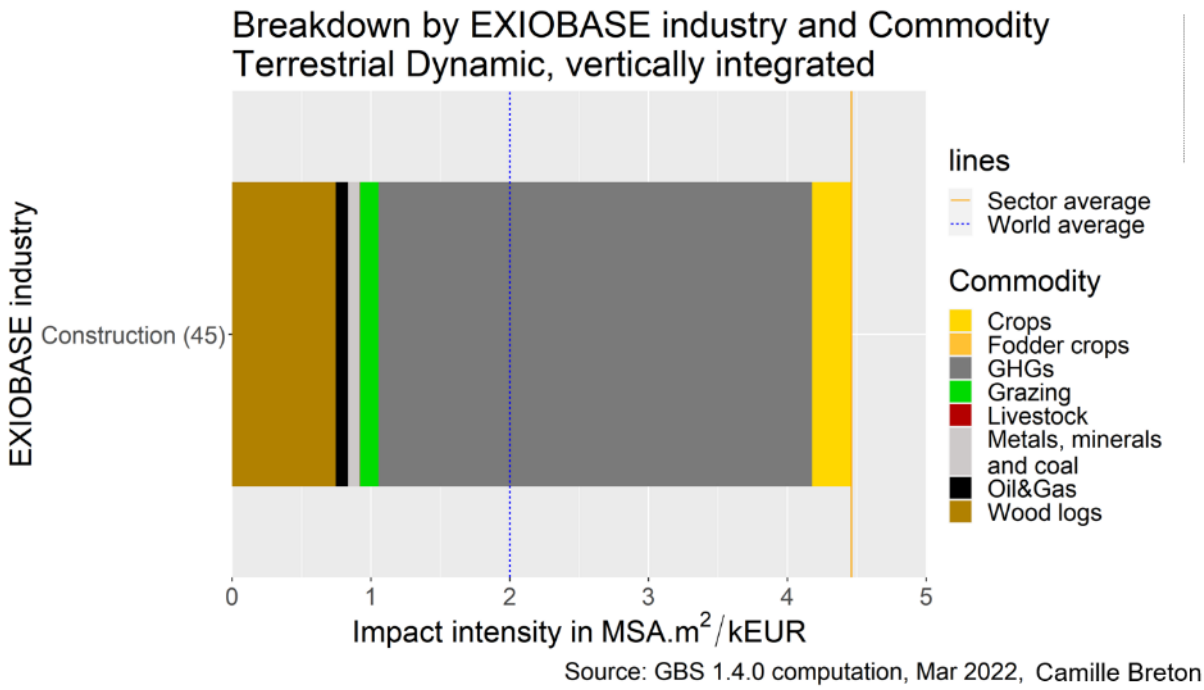


Figure 9: Breakdown by EXIOBASE industry and commodity, terrestrial dynamic, vertically integrated

2. Comparison of the impact of bio-based concrete, traditional concrete and clay-based brick

In this section, the biodiversity impacts of the materials used in the sector are assessed to determine the most impactful ones. For this purpose, several materials were selected based on the consumption of raw materials by the CHEB[3] sector, as shown in Figure 10, adapted from (ADEME et al. 2019).

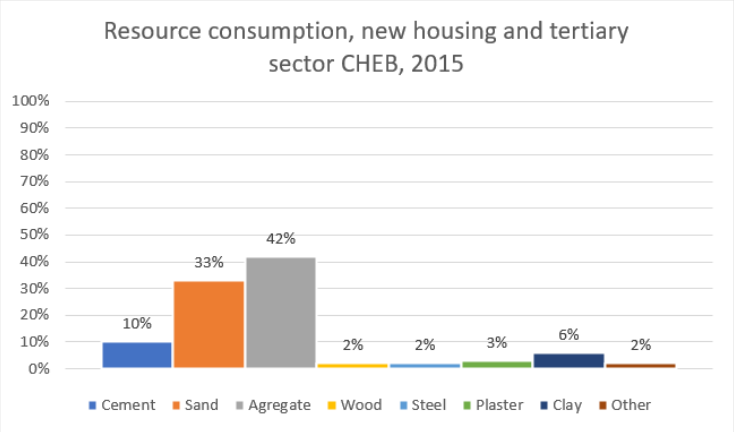


Figure 10: Part of the material use in new housing and tertiary sector

The cement, sand and gravel are the most consumed raw materials according to Figure 10. In addition, they are also the main components of concrete, the most used processed material in the construction sector. For this reason, the following study will focus on 5 structural work materials: three types of concrete based on sand and gravel (traditional concrete, mixed concrete, recycled concrete) made in France, a hemp-concrete made in France and a clay-based material (brick) made in Spain. The study is limited to these European countries due to lack of data. Table 5 summarises the main components of each material and their origin, and the life cycle assessment studies used to collect data.

Table 5: Components and origin of each material studied

Material	Main component	Origin	Data source
Traditional concrete	Sand and gravel	France	(Serres, Braymand, and Feugeas 2014)
Mixed concrete	Sand and gravel	France	(Serres, Braymand, and Feugeas 2014)
Recycled concrete	Sand and gravel	France	(Serres, Braymand, and Feugeas 2014)
Hemp concrete	Bio-material	France	(Laidoudi et al. 2015)
Clay-based brick	Clay	Spain	(Marcelino-Sadaba et al. 2017)

[3] Commerces de grande distribution, hôtels, enseignement, bureaux (Retail, hotels, education, offices)

Table 6 summarises the different system boundaries for each material and the different steps of their life cycle considered in the data source papers. The clay-based life-cycle study used a cradle-to-gate[4] approach whereas the perimeter of traditional concrete, mixed concrete and recycled concrete life-cycle study is from cradle-to-grave[5]. For hemp concrete, only the use phase is not included in the life cycle-study. Thus, the comparison of the results obtained with these papers should be taken with caution as the papers' perimeter are not the same.

Table 6: Perimeter of the collected data - steps covered

	Resources production	Transport	Transformation	Use	End of life
Traditional concrete	Included	Included	Included	Included	Included
Mixed concrete	Included	Included	Included	Included	Included
Recycled concrete	Included	Included	Included	Included	Included
Hemp concrete	Included	Included	Included	Not included	Included
Clay-based brick	Included	Included	Included	Not included	Not included

To compute and compare the biodiversity impact of each of these materials using the GBS, a functional unit of 1 m^3 of material was selected. Thus, life cycle results expressed with a functional unit per tonne were converted to m^3 using conversion factors presented in Table 7. Due to a lack of data about mixed and recycled concrete weight, we assume that their weight is the same as Traditional concrete.

Table 7 Mass to volume conversion table

Kind of material	1 m^3 of material
Traditional concrete	2.3 t
Mixed concrete	2.3 t
Recycled concrete	2.3 t

[4] Cradle-to-gate is an assessment of a partial product life cycle from resource extraction (cradle) to the factory gate
[5] Cradle-to-grave is a life-cycle assessment from the resource extraction to the product end-of-life

Hemp concrete	1.5 t
Clay based brick	0.33 t

Other conversions were necessary, such as nutriment emissions which needed to be converted from PO_4^{3-} emission into $P_{content}$. The following conversion was thus performed:

*1kg P_{eq} = MPO_4^{3-}/MP * kg PO_4^{3-}* *M = Molecular weight*
M(P) = 31g/mol *PO_4^{3-}= Phosphate ion*
M(O) = 16g/mol
*M(PO_4^{3-}) = (31 + 4*16) g/mol*
1kg P_{eq} = 3,07kg PO_4^{3-}

Data are available or partly available for the pressures Climate change, Freshwater eutrophication and Hydrological disturbance due to water use, Ecotoxicity is only available for clay-based brick. However, some of GBS's relevant pressures such as Land use are currently missing in the assessment due to a lack of data. For this reason, the analysis should be taken with caution. Other impact indicators are evaluated in the life cycle assessment used, such as Photochemical ozone creation, but are currently not covered in the GBS.

Table 8 summarizes the different pressures covered and the missing data in this analysis. Besides, our assessment does not consider the positive impact of the carbon sequestration of hemp concrete.

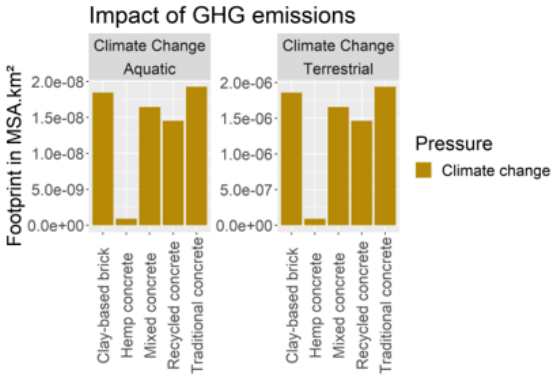
Table 8: collected data about different construction materials

	Climate Change (kg CO_2-eq)	**Freshwater Eutrophication (kg-P content)**	**Hydrological disturbance du to water use (m^3)**	**Ecotoxicity (kg 1,4- dichlorobenzene eq.)**	**Land Use**
Traditional concrete	444	0.071	780	Missing Data	Missing Data
Mixed concrete	379	0.055	667	Missing Data	Missing Data
Recycled concrete	335	0.042	585	Missing Data	Missing Data
Hemp concrete	20.91	0.026	1.80	Missing Data	Missing Data
Clay-based brick	425	0.014	Missing Data	5.37	Missing Data

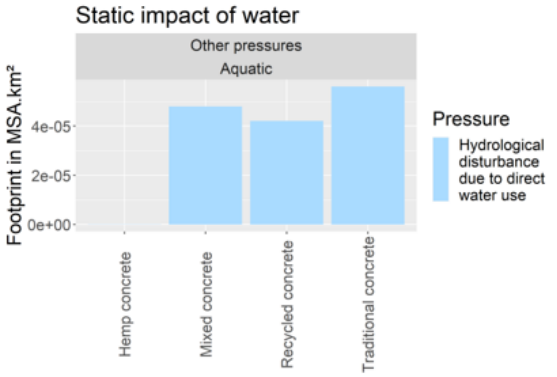
Figure 11 displays the raw results in MSA.km^2 obtained for the studied materials (functional unit = 1 m^3).

Table 9 and Table 10 display the results in MSAppb, a metric aggregating terrestrial and freshwater impacts.

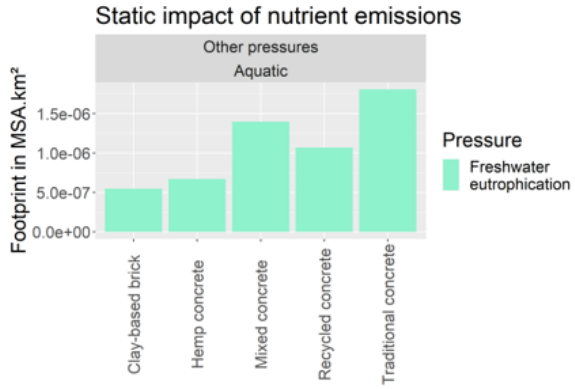
	Climate Change	Hydrological disturbance due to climate change	Freshwater Eutrophication	Hydrological disturbance due to water use	Ecotoxicity	Land Use	Total MSAppb
Traditional concrete	0	0	1.70E-04	5.40E-03	Missing Data	Missing Data	5.60E-03
Mixed concrete	0	0	1.40E-04	4.70E-03	Missing Data	Missing Data	4.80E-03
Recycled concrete	0	0	1.10E-04	4.10E-03	Missing Data	Missing Data	4.21E-03
Hemp concrete	0	0	6.50E-05	1.20E-05	Missing Data	Missing Data	7.70E-05
Clay-based brick	0	0	5.3E-05	Missing Data	5.20E-02	Missing Data	5.20E-02



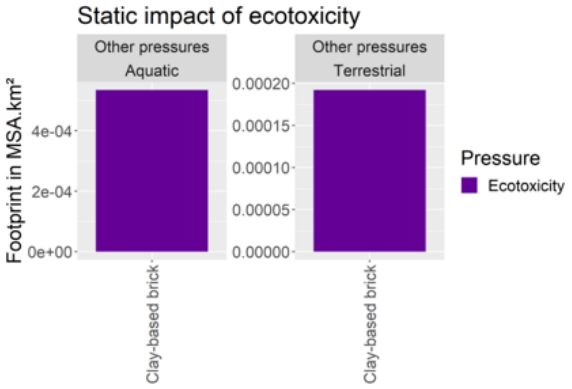
Source: GBS 1.3.1.0 computation, Dec 2021, Camille Breton



Source: GBS 1.3.1.0 computation, Dec 2021, Camille Breton



Source: GBS 1.3.1.0 computation, Jan 2022, Camille Breton



Source: GBS 1.3.1.0 computation, Dec 2021, Camille Breton

	Climate Change	Hydrological disturbance due to climate change	Freshwater Eutrophication	Hydrological disturbance due to water use	Ecotoxicity	Land Use	Total MSAppb
Traditional concrete	0	0	1.70E-04	5.40E-03	Missing Data	Missing Data	5.60E-03
Mixed concrete	0	0	1.40E-04	4.70E-03	Missing Data	Missing Data	4.80E-03
Recycled concrete	0	0	1.10E-04	4.10E-03	Missing Data	Missing Data	4.21E-03

Hemp concrete	0	0	6.50E-05	1.20E-05	Missing Data	Missing Data	7.70E-05
Clay-based brick	0	0	5.3E-05	Missing Data	5.20E-02	Missing Data	5.20E-02

Table 9: Static impact of construction materials in MSAppb per m^3 of material

Table 10 Dynamic impact of construction materials in MSAppb per m^3 of material

	Climate Change	**Hydrological disturbance due to climate change**	**Freshwater Eutrophication**	**Hydrological disturbance due to water use**	**Ecotoxicity**	**Land Use**	**Total MSAppb**
Traditional concrete	1.40E-05	1.80E-06	0	1.40E-07	Missing Data	Missing Data	1.60E-05
Mixed concrete	1.30E-05	1.60E-06	0	1.20E-07	Missing Data	Missing Data	1.50E-05
Recycled concrete	1.10E-05	1.50E-06	0	9.70E-08	Missing Data	Missing Data	1.30E-05
Hemp concrete	6.90E-07	8.80E-08	0	2.90E-10	Missing Data	Missing Data	7.80E-07
Clay-based brick	1.40E-05	1.70E-06	1.20E-08	Missing Data	1.70E-06	Missing Data	1.60E-05

Hemp concrete is the less impactful material with excellent performance in Climate change (almost ten time less impact due to this pressure compared to the other materials). Clay-based brick, by contrast, generates the highest impact on biodiversity among the five materials studied. The ecotoxicity impacts of Clay-based brick, which contributes about 10 % to its impacts (and are not accounted for for the other materials), are subject to more uncertainties in the GBS.

3. The sector's impact on land use

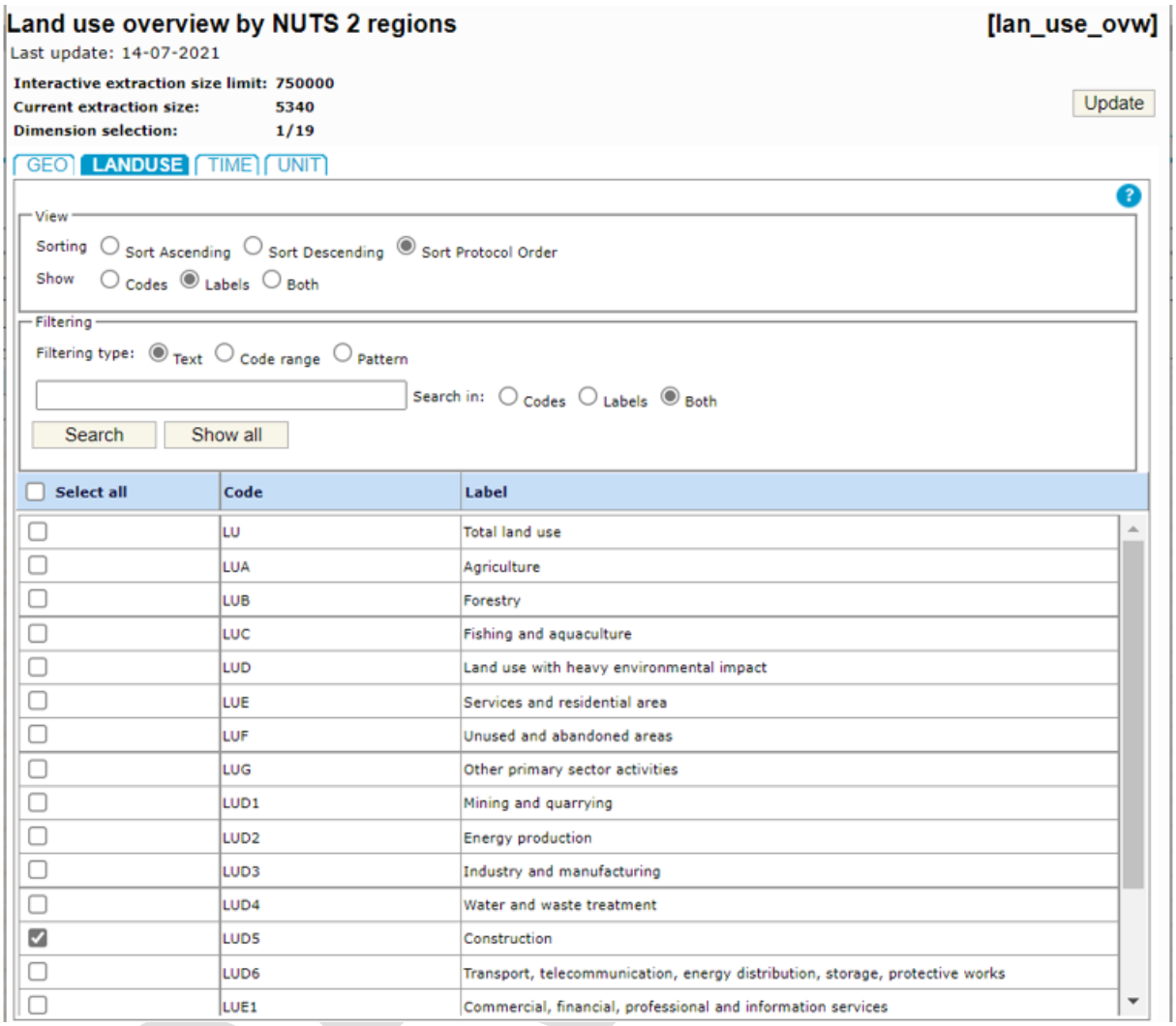
The first biodiversity impact results obtained for the Construction sector thanks to a default computation (with EXIOBASE inventories) underestimate the land use impact of the sector. The following analysis aims to give an order of magnitude of this impact. The construction process contributes to land artificialisation and in the ENCORE database, the biodiversity impact of the process "Infrastructure builds" has a "Very high materiality rating" (Natural Capital Finance Alliance (Global Canopy, UNEP FI, and UNEP-WCMC) 2021).

Data used for the assessment

To assess more precisely the impact of land use of the construction sector, **Eurostat data are used as input data (E4.LUCAS (ESTAT) 2018)**. The database used provides the land use data of the construction sector of European country and is named **(lan_use_ovw).**

The LUCAS technical reference document is the reference classification document for the land use class in this database. It provides an overview of the different categories of land use attributed to Europe and what they include. The classification is presented by the letter U and three digits referring to an economic activity of NACE rev 2. The following classification is an extract of the technical reference document LUCAS (E4.LUCAS (ESTAT) 2018) and provides a characterization of economic **activity U330 which was used in the following computations**.

Land Use classification (LUCAS SU LU)
U330 Construction. Areas used for construction whatever the degree of completion (NACE F, except agricultural activities under F43.12) This section includes general construction and specialized construction activities for buildings and civil engineering works. It includes new work, repair, additions and alterations, the erection of prefabricated buildings or structures on the site and construction of a temporary nature. Thus, the construction of entire dwellings, office buildings, stores and other public and utility buildings, farm buildings etc., or the construction of civil engineering works such as motorways, streets, bridges, tunnels, railways, airfields, harbours and other water projects, irrigation systems, sewerage systems, industrial facilities, pipelines and electric lines, sports facilities etc. This class includes: - Construction of buildings - Civil engineering - Specialised construction activities (e.g. demolition) This class excludes: - Field construction related to agriculture (e.g. agricultural land terracing, drainage, preparing rice paddies etc.)



Land use overview by NUTS 2 regions [lan_use_ovw]

Last update: 14-07-2021

Interactive extraction size limit: 750000
Current extraction size: 5340
Dimension selection: 1/19

Update

GEO | LANDUSE | TIME | UNIT

View
Sorting: Sort Ascending / Sort Descending / Sort Protocol Order
Show: Codes / Labels / Both

Filtering
Filtering type: Text / Code range / Pattern
Search in: Codes / Labels / Both
Search | Show all

Select all	Code	Label
	LU	Total land use
	LUA	Agriculture
	LUB	Forestry
	LUC	Fishing and aquaculture
	LUD	Land use with heavy environmental impact
	LUE	Services and residential area
	LUF	Unused and abandoned areas
	LUG	Other primary sector activities
	LUD1	Mining and quarrying
	LUD2	Energy production
	LUD3	Industry and manufacturing
	LUD4	Water and waste treatment
☑	LUD5	Construction
	LUD6	Transport, telecommunication, energy distribution, storage, protective works
	LUE1	Commercial, financial, professional and information services

After having selected the type of data according to the definitions of the LUCAS document, the database is filtered to select only the data corresponding to our research perimeter.

The database “lan_use_ovw” presents several kinds of Land Uses in Europe. Figure 12 shows the different parameters of the database. A filter from the "GEO" tab was used to remove the detail of the data by region and keep only the total data per country. Regarding the Label in the ‘LANDUSE’ tab:

- For the **dynamic impact** computation: only the “LUD5” data linked to the sector “Construction” are kept. These areas correspond to all the construction works in progress.
- For the **static impact** computation: please refer to the section “Static impacts: persistent artificialized areas” below

Only data about European Union countries are available. Our objective being to determine the impact of construction worldwide, an extrapolation is made due to the lack of global data and is explained in the sections below.

Dynamic impacts: supplementary artificialization

Result in Europe (European Union)

After filtering the database and entering data from Eurostat as "urban area" data in the GBS (areas that are more than 80% built-up), the Scope 1 dynamic impact of the construction sector was calculated. These results are obtained by filtering the EUROSTAT land use data only on the Construction sector, *i.e.* "U330 construction" from the LUCAS classification which is linked with Section F of NACE rev 2 entitled "Section F – Construction" as shown in the LUCAS classification above. These impacts are caused by **all the construction works in progress and thus considered as contributing to supplementary artificialization, or in other words dynamic impacts**. Note that construction works can happen on an area that is already artificialized: the methodology used overestimates dynamic impacts.

The **dynamic impact of the European Union (including the United Kingdom due to the year of the data) is estimated to amount to about 3900 MSA.km², which is equivalent to destroying all the biodiversity of a pristine area roughly twice the size of Luxembourg every year** (a total of 4123 km² is occupied by the construction sector). Five major countries (Germany, France, Italy, Poland and the United Kingdom) contribute to more than 50% of the impact.

Result in the rest of the world excluding the European Union

A calculation of the impact on the rest of the world excluding the European Union is then carried out. The area linked to the construction sector is computed, assuming **the European ratio of areas linked to construction over total land area applies globally**:

$$A_{U330\ world\ excluding\ the\ EU} = \frac{A_{U330\ EU28}}{A_{EU28}} \times (A_{World} - A_{EU28})$$

Where the variables are:

- $A_{U330\ world\ excluding\ the\ EU}$: area linked to the construction sector (U330) worldwide excluding the European Union
- $A_{U330\ Europe}$: area linked to the construction sector (U330) in the European Union (at 28), which was 4 123 km² in 2018
- A_{Europe}: European Union surface which was 4 233 000 km²
- A_{World}: world surface which is 148 000 000 km²

World surface occupied by "U330 construction" excluding European union is estimated to be 140 031 km².

From this data, the Land use footprint (in MSA.km²) of the construction sector in the world excluding the European Union was computed. **The dynamic footprint of the construction sector in the World excluding the European Union is 130 000 MSA.km².**

Therefore, the resulting Land use Scope 1 dynamic footprint caused by the construction sector worldwide is about 140 000 MSA.km² which is equivalent to destroying a pristine surface equivalent to the Greece and correspond to a biodiversity loss of one thousandth of the global terrestrial surface each year. However, the calculated impact assumed that the ratio of areas linked to the construction sector over the whole continent is

constant across the world, so this data should be taken with caution as it may not perfectly reflect reality (maybe overestimation as Europe is more urbanized), but it does provide an estimate of the global impact.

Dynamic intensity computation

Now, from these MSA.km² data, the calculation of the intensity of Scope 1 dynamic Land use can be done to determine the dynamic intensity of the Construction sector linked to the Land Use pressure in Scope 1 (per turnover of the sector). The following calculation is made:

$$Intensity\ Land\ Use\ Scope\ 1\ dynamic\ world = \frac{MSA.m^2Europe + MSA.m^2World}{World\ production\ kEUR}$$

Where variables are:

$Intensity\ Land\ Use\ Scope\ 1\ dynamic\ world$: The impact MSA.m² per thousand euro of turnover of the Construction sector

$MSA.m^2Europe$: The Land use Scope 1 footprint of the construction sector in Europe

$MSA.m^2World$: The Land use Scope 1 footprint of the construction sector in the world except Europe

$World\ production\ kEUR$: Total production (turnover) of 2011 the sector Construction worldwide from EXIOBASE

The intensity of the construction sector worldwide is computed as below:

$$\frac{3\ 947\ 000\ 000 + 130\ 000\ 000\ 000}{106\ 830\ 000\ 000} = 1.3\ MSA.m^2/kEUR$$

The intensity of the Scope 1 dynamic construction sector worldwide is estimated to be **1.3 MSA.m²/kEUR** which is **three time higher than the first GBS intensity assessment of the Scope 1 presented in** Table 1 which only include *inter alia* the impacts of raw material worldwide. Compared to the Agrifood sector, the static intensity of the direct impact of the construction sector is about two thousand times lower. As a reminder, this computed dynamic impact reflects **the impacts of all the construction works in progress and not all the existing buildings and arterialized areas**, which are the properties or operated by other sectors (notably Real estate). This **static impact is estimated in the next section**.

Static impacts: persistent artificialized areas

Accounting framework

As explained in the section above, **construction activity** is a temporary activity in the NACE register of economic activities, this category concern **only construction site in progress**. This particularity distinguishes it from other sectors of economic activity and affects the methodology of static 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** such as Real estate or other economic activities clients of the Construction sector. Table 11 explains more in detail the Scopes accounting of this situation. Note that it is a simplified representation for explanation purposes. Regarding the static impacts: in the year N, the Construction sector has a static impact linked to the construction works done in the precedent

year N-1, which are then transferred to the downstream sector (similar to a "purchase"), **leading to a net static impact of 0 in the Scope 1 of Construction**.

Perimeter: **Construction (45) in EXIOBASE = NACE rev2 41, 42, 43**

	Scope 1 Dynamic	Scope 1 Static	Downstream Scope 3 dynamic	Downstream Scope 3 static
Year N	Impacts linked to EUROSTAT U330 areas in **year N** = all construction works ongoing [chantiers en cours]	Impacts linked to EUROSTAT U330 areas in **year N-1** - Impacts linked to EUROSTAT U330 areas in **year N-1** (sold to other sectors) **= 0**	Impacts linked to EUROSTAT U330 areas in **year N-1** (bought to Construction) transaction	All persistant artificialised areas constructed by Construction sector **before year N-1**, owned / managed by other sectors
Year N+1	Impacts linked to EUROSTAT U330 areas in **year N+1** = all construction works ongoing [chantiers en cours]	Impacts linked to EUROSTAT U330 areas in **year N** - Impacts linked to EUROSTAT U330 areas in **year N** (sold to other sectors) **= 0**	Impacts linked to EUROSTAT U330 areas in **year N** (bought to Construction) transaction	All persistant artificialised areas constructed by Construction sector **before year N**, owned / managed by other sectors

Table 11: accounting framework for the Construction's static impact related to the pressure Land use.

In this section, we thus compute the Downstream Scope 3 impacts related to Land use caused by the constructed infrastructures and buildings attributed to all the economic sectors benefiting from the construction processes.

Land use data selection

To compute this impact, the same methodology used to compute the dynamic impact will be employed, but in this case, with the **land use areas occupied by buildings and infrastructures that are operated by the sectors downstream to the Construction sector (residential, services, real estate and other industries)**. Areas linked to agriculture, agroforestry, fishing and aquaculture have been excluded, considering that they do not represent in majority (in terms of area) infrastructures and buildings produced by the Construction sector. **The following sectors have been chosen for the computation (in bold),** and the PRIMA document (Bezlepkina et al. 2011) has been used to cross-reference with the EUROSTAT database and define with more precision the subcategory of each label in the Eurostat database:

- Land uses with heavy environmental impact (LUD) except for Construction (LUD5):
  - **[LUD1] Mining and quarrying**
  - **[LUD2] Energy production**
  - **[LUD3] Industry and manufacturing**
  - **[LUD4] Water and waste treatment**
  - **[LUD6] Transport, telecommunication, energy distribution, storage, protective works**
- Services and residential area (LUE) except for Natural reserves (LUE5):
  - **[LUE1] Commercial, financial, professional and information services**

  - **[LUE2] Community services**
  - **[LUE3] Arts, entertainment and recreation**
  - **[LUE4] Residential area**

- **[LUG] Other primary sector activities**

- ***[LUF] Unused and abandoned areas (see below)***

Finally, the **"abandoned and unused area" (LUF)** Land use category represents more than half of Europe's land use, and includes industrial brownfield, but also areas such as agricultural abandoned area (fallow lands for example) which are not concerned by the construction sector. As we do not know the proportions of the contribution of each to this data, two assessments will be carried out, one including all kind of abandoned areas and another excluding them to propose a range of values in which is presented the impact of construction.

Downstream Scope 3 static impact related to Land use

From the data entered, the **GBS calculated for the European Union an static impacts from 400 000 MSA.km² to 1 040 000 MSA.km², without unused areas and with unused areas respectively.**

The impact in the **rest of the world without Europe** has been computed following the same assumptions than in the previous section on dynamic impacts. It leads to a **static impact about 14 000 000 MSA.km² to 35 000 000 MSA.km² (without unused areas and with respectively).**

To conclude, **the cumulated downstream Scope 3 impact of the Construction sector linked to Land use impact is from 14 000 000 MSA.km² to 36 000 000 MSA.km²** which is equivalent of destroying a pristine area as big as the Russia or twice its size. As a reminder, the result including “Unused and abandoned area” as described in LUCAS classification leads to an overestimation as it included areas such as fallow lands where the Construction sector has not intervened.

According to the first scenario excluding “Unused and abandoned area”, the **Scope 3 downstream intensity of the Construction sector linked to Land use** is about **130 MSA.m²/kEUR of turnover of the Construction sector**, whereas in the second scenario including the “Unused and abandoned area”, the intensity of construction sector is about **330 MSA.m²/kEUR**. This scenario is therefore 3 time higher than the scenario excluding the “Unused and abandoned area” and create a rather large interval proportional to the interval of the MSA.km² computation. The methodology to compute the intensity is the same as in the previous section on dynamic impacts.

However, all these results must be taken with caution, **many countries in the European Union are among the most artificialized countries in the world according to their total surface** and could overestimate our result extended to the world. Besides, the intensity might be computed with the turnover data of all the downstream sectors to the Construction which should lower these intensities results.

D. EU TAXONOMY GUIDELINES

1. Conditions for making a substantial contribution to the EU Green Taxonomy environmental objectives

The EU Green taxonomy classifies environmentally sustainable activities within the economy. The basis for this taxonomy was published in June 2020, in particular establishing six environmental objectives:

1. Climate change mitigation
2. Climate change adaptation
3. The sustainable use and protection of water and marine resources
4. The transition to a circular economy
5. Pollution prevention and control
6. The protection and restoration of biodiversity and ecosystems

To determine a list of sustainable activities, technical screening criteria for each of these objectives are needed. In June 2021, criteria for the first two objectives were adopted in a first delegated act. (European Commission 2021)

In August 2021, the Platform on Sustainable Finance (PSF) provided draft technical screening criteria to prepare the second draft delegated act, which should be adopted in the first half of 2022. The Construction sector should refer to these criteria for qualitative analysis of its biodiversity impact.

According to Figure 13, the PSF has identified the following priority activities to tackle for the sector and provided conditions for making a substantial contribution to 4 environmental objectives (in column).

ST7 Construction and buildings + ICT + Emergency Services							
Economic Activities	**NACE codes**	**Mitigation**	**Adaptation**	**Water**	**Circular economy**	**Pollution**	**Biodiversity**
Construction	F						X
Construction of buildings	F41				X		
Civil engineering	F42		X		X		
Implementation of nature based solutions for flood risk prevention and protection for both inland and coastal waters	F42.91			X			
Construction of flood risk prevention and protection infrastructure for inland and coastal floods	F42.91			X			

Figure 13. Extract of (European Commission 2021): activities and environmental objectives prioritised for the Construction sector

Extracts on the criteria described in the draft are given below (Platform on sustainable finance: Technical working group 2021b; 2021a).

"Construction of new buildings and major renovation of buildings" (F41) sector making a substantial contribution to the protection and restoration of biodiversity and ecosystems

A substantial contribution to biodiversity is considered to have been made when **both criteria A and B** are met:

A

A biodiversity strategy or biodiversity management plan for the site has been produced by a suitably qualified ecologist that respects the mitigation hierarchy[399] and addresses, as a minimum:
1. Measures taken to protect any species found on the site that are classified by the European and IUCN Red Lists[400] as Vulnerable, Endangered or Critically Endangered, including, where appropriate; scheme redesign, relocation of works, changes to work methods or timing, monitoring of species and habitat during and after works and any other measures deemed necessary by the suitably qualified ecologist.
2. An ex-ante assessment of the proposed design measures confirming that these will deliver biodiversity net gain, including a gain in number of native species. The implementation must also be confirmed by an ex-post assessment of the site.
3. Measures to mitigate impacts during the construction phase including phasing or timing of construction works to avoid destruction of active nests or disruption of breeding activities of native species and the attenuation of noise and vibration.
4. A plan for ongoing maintenance of green and biodiversity infrastructure included in the development.
5. Consideration for how the development contributes to the aims and objectives of relevant local, national, regional and international strategies for biodiversity and green infrastructure, including connecting the site to urban green infrastructure networks or corridors, where these exist.

And all green infrastructure features have been designed and installed in line with appropriate best practice guidance (examples are listed in footnotes 429 and 431 below).

B

-At least 60% of the external horizontal surface area (excluding surface area that is required for renewable energy sources in order to comply with mandatory local requirements), is dedicated to natural habitat or biotopes (eg green roofs[401])
-At least 80% of all exposed horizonal surfaces on the site (including roofs[402]) are permeable to water (including open water surfaces).
-Provision has been made of additional biodiversity infrastructure such as artificial, building-integrated nesting boxes for bats and birds and free-standing or building-integrated insect habitats ('insect hotels'). As a minimum, one such feature must be provided per residential unit[403] or per 100m$_2$ of site for non-residential development.
Compliance may also be demonstrated through the application of a locally applicable Green Space Factor (GSF) [404] method and the appropriate locally defined thresholds for the type of development, provided these are not lower in overall ambition than the above thresholds.
Where not already included in the local Green Space Factor (GSF) method, provision must also be made of additional biodiversity infrastructure such as artificial, building-integrated or free-standing nesting boxes for bats and birds and insect habitats ('insect hotels'). As a minimum, one such feature must be provided per residential unit[405] or per 100m$_2$ of site for non-residential development.

"Construction of new buildings and major renovation of buildings" (F41) making a substantial contribution to the transition to a circular economy

The activity complies with the following criteria:

1. At least 90 % (by weight) of the non-hazardous construction waste* (excluding naturally occurring material referred to in category 17 05 04 in the European List of Waste established by Commission Decision 2000/532/EC479) generated on the construction site is prepared for re-use or recycling.
2. A life cycle assessment[390] of the entire building or of the renovation works has been calculated according to Level(s) and EN 15978, covering each stage in the life cycle and the results are disclosed to investors and clients on demand.
3. Construction designs and techniques support circularity and in particular demonstrate how they are designed to be more resource efficient, adaptable, flexible and easy to dismantle to enable reuse and recycling. This should be demonstrated with reference to Level(s) indicators 2.3391 (design for adaptability) and 2.4392 (design for deconstruction) at Level 2, in accordance with ISO 20887:2020, EN 15643, and EN 16309.
4. The asset contains at least 30% (by weight) of recycled content, re-used content, re-manufactured content and/or by-products
- provided that this is in accordance with technical standards and;
- provided that the CO2 emissions generated through the production process and the transportation of the recycled or re-used material are not higher than the CO2 emissions generated through the production process and the transportation of virgin material.**
5. The design promotes material and resource efficiency by following relevant national or international standards393 or best practice design guidance on material efficiency.
6. Components and materials used in the construction do not contain asbestos nor substances of very high concern as identified on the basis of the list of substances subject to authorisation set out in Annex XIV to Regulation (EC) No 1907/2006 of the European Parliament and of the Council unless authorised or exempted for the specific use through the appropriate processes in REACH.
7. Digital tools that support preserving and extending service life and future adaptation and reuse have been deployed to produce, as a minimum:
- Detailed material specification records as part of a building information model / digital twin or in a separate schedule or material passport, covering at least the structural elements, facades and HVAC equipment.
- A maintenance schedule including a technical description of the building and its systems and a schedule for future maintenance
For buildings with floor area above 5000m2, an as-built computer model (digital twin)
All of the above should be held at the site or by the building owner and evidence disclosed to clients and investors on demand.
**Construction waste is the waste generated through the construction process, excluding excavation and demolition waste.*
** *The calculation is based on* FprEN 17472 *or equivalent.*

"Civil engineering" (F42) making a substantial contribution to the transition to a circular economy

1. At least 90 % (by weight) of the non-hazardous construction waste* (excluding naturally occurring material referred to in category 17 05 04 in the European List of Waste established by Commission Decision 2000/532/EC479) generated on the construction site is prepared for re-use or recycling.

2. Construction designs and techniques support circularity and in particular demonstrate how they are designed to be more resource efficient, adaptable, flexible and easy to dismantle to enable reuse and recycling. This can be demonstrated with reference to ISO 20887:2020 "Sustainability in buildings and civil engineering works — Design for disassembly and adaptability — Principles, requirements and guidance" or equivalent.

3. The asset contains at least 30% (by weight) of recycled content, re-used content, re-manufactured content and/or by-products
- provided that this is in accordance with technical standards and;
- provided that the CO_2 emissions generated through the production process and the transportation of the recycled or re-used material are not higher than the CO2 emissions generated through the production process and the transportation of virgin material.**

4. Electronic tools are used to describe the characteristics of the built asset, including the materials and components used, for the purpose of future maintenance, recovery and reuse. The information is stored in a digital logbook or equivalent and is made available to the owner of the asset.

5. Bridges, tunnels, dikes and sluices are equipped with monitoring functions to predict maintenance needs such as in-built predictive maintenance.

*Construction waste is the waste generated through the construction process, excluding excavation and demolition waste.
** The calculation is based on FprEN 17472 or equivalent.

Focus on "Maintenance of roads and motorways" (F42) to a circular economy

The activity complies with the following criteria:
1. The maintenance operation is mainly dedicated to pavement management and is linked to the following main elements of the road:
-base course and/or
-binder course and/or
-surface course.
2. Where main road elements are demolished, 100% (by weight) of the non-hazardous waste (excluding naturally occurring material referred to in category 17 05 04 in the European List of Waste established by Commission Decision 2000/532/EC479) is prepared for re-use and recycling.
3.Where renewed, the sum of the newly installed road elements contains at least 30% by weight of recycled content, re-used content and/or by-products
-provided that this is in accordance with technical standards and;

-provided that the CO2 emissions generated through the production process and the transportation of the recycled or re-used material are not higher than the CO2 emissions generated through the production process and the transportation of virgin material.*
4. Where renewed, the newly installed binder course has a service lifetime no shorter than 20 years.
Where renewed, the newly installed base course has a service lifetime no shorter than 40 years.
* *The calculation is based on* FprEN 17472 *or equivalent.*

Focus on "Maintenance of bridges and tunnels" (F42) to a circular economy

The activity complies with the following criteria:
1. The maintenance operation documents that it leads to an extension of the service life by
a) remedying defects in the structure which pose a risk to the asset's structural health or;
b) strengthening the asset's loadbearing capacity in order to restore or enhance its strength compared to what was deemed necessary during their design.
2. Where generated, at least 90% of the non-hazardous construction and demolition waste (excluding naturally occurring material referred to in category 17 05 04 in the European List of Waste established by Commission Decision 2000/532/EC479) are prepared for re-use or recycling.

3. The sum of the newly installed elements contains at least 30% by weight of recycled content, re-used content and/or by-products
- provided that this is in accordance with technical standards and;
- provided that the CO2 emissions generated through the production process and the transportation of the recycled or re-used material are not higher than the CO2 emissions generated through the production process and the transportation of virgin material.*
** *The calculation is based on* FprEN 17472 *or equivalent.*

"Civil engineering" (F42) making a substantial contribution to the transition to climate change adaptation

The economic activity has implemented physical and non-physical solutions ('adaptation solutions') that substantially reduce the most important physical climate risks that are material to that activity.
2 The physical climate risks that are material to the activity have been identified from those listed in Appendix A to Annex II of the first Delegated Act supplementing Regulation (EU) 2020/852 by performing a robust climate risk and vulnerability assessment with the following steps:
(a) screening of the activity to identify which physical climate risks from the list in Appendix A to Annex II of the Delegated Act may affect the performance of the economic activity during its expected lifetime;
(b) where the activity is assessed to be at risk from one or more of the physical climate risks listed in Appendix A to Annex II of the Delegated Act, a climate risk and vulnerability assessment to assess the materiality of the physical climate risks on the economic activity;

(c) an assessment of adaptation solutions that can reduce the identified physical climate risk.

The climate risk and vulnerability assessment is proportionate to the scale of the activity and its expected lifespan, such that:
(a) for activities with an expected lifespan of less than 10 years, the assessment is performed, at least by using climate projections at the smallest appropriate scale;
(b) for all other activities, the assessment is performed using the highest available resolution, state of-the-art climate projections across the existing range of future scenarios[382] consistent with the expected lifetime of the activity, including, at least, 10 to 30 years climate projections scenarios for major investments.
3. The climate projections and assessment of impacts are based on best practice and available guidance and take into account the state-of-the-art science for vulnerability and risk analysis and related methodologies in line with the most recent Intergovernmental Panel on Climate Change reports[383], scientific peer-reviewed publications and open source[384] or paying models.
4.The adaptation solutions implemented:
(a) do not adversely affect the adaptation efforts or the level of resilience to physical climate risks of other people, of nature, of cultural heritage, of assets and of other economic activities;

(b) favour nature-based solutions[385] or rely on blue or green infrastructure[386] to the extent possible;
(c) are consistent with local, sectoral, regional or national adaptation plans and strategies;
(d) are monitored and measured against pre-defined indicators and remedial action is considered where those indicators are not met;
(e) where the solution implemented is physical and consists in an activity for which technical screening criteria have been specified in this Annex, the solution complies with the do no significant harm technical screening criteria for that activity.
5. In order for an activity to be considered as an enabling activity as referred to in Article 11(1), point (b), of Regulation (EU) 2020/852, the economic operator demonstrates, through an assessment of current and future climate risks, including uncertainty and based on robust data, that the activity provides a technology, product, service, information, or practice, or promotes their uses with one of the following primary objectives:
(a) increasing the level of resilience to physical climate risks of other people, of nature, of cultural heritage, of assets and of other economic activities;
(b) contributing to adaptation efforts of other people, of nature, of cultural heritage, of assets and of other economic activities.

"Flood risk prevention and protection infrastructure for inland river and coastal floods" (F42.91) sector making a substantial contribution to climate change adaptation

1. The economic activity has implemented physical and non-physical solutions ('adaptation solutions') that substantially reduce the most important physical climate risks that are material to that activity.
2 The physical climate risks that are material to the activity have been identified from those listed in Appendix A to Annex II of the first Delegated Act supplementing Regulation (EU) 2020/852 by performing a robust climate risk and vulnerability assessment with the following steps:
(a) screening of the activity to identify which physical climate risks from the list in Appendix A to Annex II of the Delegated Act may affect the performance of the economic activity during its expected lifetime;
(b) where the activity is assessed to be at risk from one or more of the physical climate risks listed in Appendix A to Annex II of the Delegated Act, a climate risk and vulnerability assessment to assess the materiality of the physical climate risks on the economic activity;

(c) an assessment of adaptation solutions that can reduce the identified physical climate risk.
The climate risk and vulnerability assessment is proportionate to the scale of the activity and its expected lifespan, such that:
(a) for activities with an expected lifespan of less than 10 years, the assessment is performed, at least by using climate projections at the smallest appropriate scale;

(b) for all other activities, the assessment is performed using the highest available resolution, state-of-the-art climate projections across the existing range of future scenarios[548] consistent with the expected lifetime of the activity, including, at least, 10 to 30 years climate projections scenarios for major investments.
3. The climate projections and assessment of impacts are based on best practice and available guidance and take into account the state-of-the-art science for vulnerability and risk analysis and related methodologies in line with the most recent Intergovernmental Panel on Climate Change reports[549], scientific peer-reviewed publications and open source[550] or paying models.
4.The adaptation solutions implemented:
(a) do not adversely affect the adaptation efforts or the level of resilience to physical climate risks of other people, of nature, of cultural heritage, of assets and of other economic activities;
(b) favour nature-based solutions[551] or rely on blue or green infrastructure[552] to the extent possible;
(c) are consistent with local, sectoral, regional or national adaptation plans and strategies;
(d) are monitored and measured against pre-defined indicators and remedial action is considered where those indicators are not met;
(e) where the solution implemented is physical and consists in an activity for which technical screening criteria have been specified in this Annex, the solution complies with the do no significant harm technical screening criteria for that activity.
5. In order for an activity to be considered as an enabling activity as referred to in Article 11(1), point (b), of Regulation (EU) 2020/852, the economic operator demonstrates, through an assessment of current and future climate risks, including uncertainty and based on robust data, that the activity provides a technology, product, service, information, or practice, or promotes their uses with one of the following primary objectives:
(a) increasing the level of resilience to physical climate risks of other people, of nature, of cultural heritage, of assets and of other economic activities;
(b) contributing to adaptation efforts of other people, of nature, of cultural heritage, of assets and of other economic activities.

"Nature based solutions (Nbs) for flood risk prevention and protection for both inland and coastal waters" (F42.91) sector making a substantial contribution to sustainable use and protection for water and marine resources

The activity is eligible to substantially contribute only if it meets the following three criteria:
1. The activity is a quantifiable and/or time bound measure to achieve the objectives for flood risk reduction in accordance with a Flood Risk Management Plan (FRMP) coordinated at river basin scale and developed under the Floods Directive. For countries outside the EU the activity is identified as a flood risk reduction measure either in an Integrated Water Resources Management (IWRM) plan at river basin scale or in an Integrated Coastal Zone Management (ICZM) plan along a coast. These plans pursue the objectives for the management of flood risks to reduce adverse consequences where applicable for human health, the environment, cultural heritage and economic activity.

2. The activity demonstrates specific ecosystem co-benefits which contribute to achieving good water status in accordance with WFD[563] and nature restoration targets defined in the EU 2030 Biodiversity Strategy (which will be further refined under the proposal on the EU nature restoration regulation[564] expected by the end of 2021). Each Member State develops ecosystem action plan with clear and binding targets and timelines and definition of criteria either on restoration or conservation which is operationalized at regional or local level. The involvement of local stakeholders from the outset in the planning and design phases is required to ensure the full delivery of multiple benefits and the successful implementation of the activity. The restoration action plan is based on the principles outlined by IUCN Global Standard for NbS[565]. For countries outside EU, National Biodiversity Strategies and Action Plans[566] are the equivalent reference documents for developing ecosystem restoration action plans.

3. A monitoring programme is in place to evaluate the effectiveness of an NbS scheme to improving the status of the affected water body and changing climate conditions allowing for flexibility meaning the adaptive management approach. The programme is required to be periodically reviewed by an ad-hoc committee composed of sector experts (including ecologists) and the relevant regional or local managing authorities following the cyclical approach of the River Basin Management Plans and the Flood Risk Management Plans. For countries outside EU where there are no RBMPs or FRMPs equivalent documents in place, the programme is periodically reviewed at intervals not exceeding 10 years. The programme adheres to and aligns with the prevailing legal and regulatory provisions, being clear on where legal responsibilities and liabilities lie. The programme actively engages local communities and other affected stakeholders.

"Demolition or wrecking of buildings and other structures" (F43.1.1) sector making a substantial contribution to a circular economy

1. The demolition is carried out in accordance with the checklist of the EU Demolition and Construction Waste Protocol or an equivalent at national level.

2. At least 90 % (by weight) of the non-hazardous demolition waste (excluding naturally occurring material referred to in category 17 05 04 in the European List of Waste established by Commission Decision 2000/532/EC479) is prepared for re-use or recycled.

2. Additional DNSH Guidelines

The main Do No Significant Harm criteria for the sector (EU Technical Expert Group on Sustainable Finance 2020a) are provided in the factsheet. Additional criteria which did not fit within the factsheet are listed below (EU Technical Expert Group on Sustainable Finance 2020b).

To prevent damage of vulnerable ecosystems activities should ensure that:

The new construction is not built on protected natural areas, such as land designated as Natura 2000, UNESCO World Heritage and Key Biodiversity Areas (KBAs), or equivalent outside the EU as defined by UNESCO and / or the International Union for Conservation of Nature (IUCN).

The new construction is not built on arable or greenfield land of recognized high biodiversity value and land that serves as habitat of endangered species (flora and fauna) listed on the European Red List and / or the IUCN Red List.

For renovation project covering more than 1000 m2 of floor area and all new construction projects at least 80% of all timber products used in the renovation/ construction for structures, cladding and finishes must have been either recycled/reused or sourced from sustainably managed forests as certified by third-party certification audits performed by accredited certification bodies, e.g. FSC/PEFC standards or equivalent.

Infrastructure for low carbon transport on land and water should have completed an Environmental Impact Assessment (EIA), in accordance with EU Directives on Environmental Impact Assessment (2014/52/EU) and Strategic Environmental Assessment (2001/42/EC) or other equivalent national provisions.

Use the assessments to, at the very least, identify, evaluate, and mitigate any potential negative impacts of the designated activities, projects, or assets on ecosystems and its biodiversity and it should be assessed and conducted in compliance with the provisions of the EU Habitats and Birds Directives.

Invasive plants are appearing very often along transport infrastructure and are sometimes even spread due to transport infrastructure, which might negatively impact natural ecosystems (e.g. natural fauna). Care should be taken not to spread any invasive plants through proper maintenance.

Wildlife collisions are prevented and that solutions are applied for the detection and avoidance of potential traps that may cause the unnecessary death of animals.

Mitigation options exist and different types of measures can be beneficial for wildlife, such as:

- Wildlife warning systems combined with heat sensors can reduce the number of collisions.
- Fences along areas with high strike risk.
- Viaducts, tunnels, overpasses and bridges, etc.
- Warning signals that are triggered by approaching traffic, particularly in areas of high strike risk.

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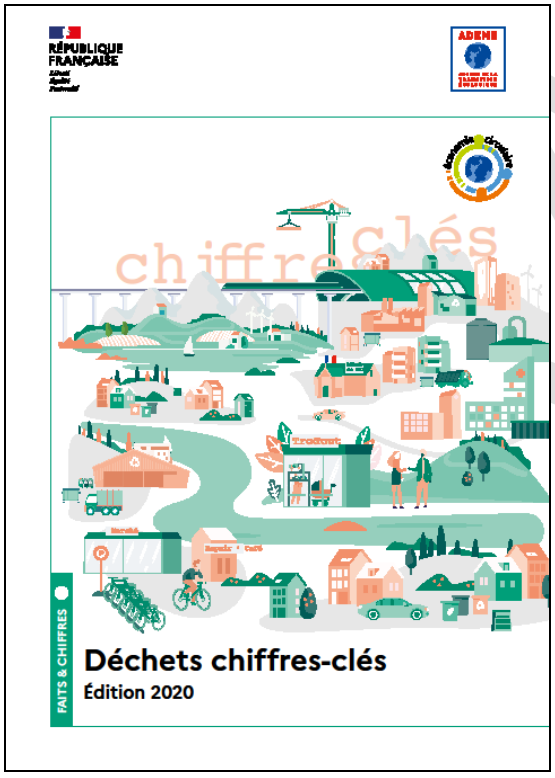

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