PLATFORM ON
SUSTAINABLE FINANCE

# PLATFORM ON SUSTAINABLE FINANCE: TECHNICAL WORKING GROUP

**Supplementary: Methodology and Technical Screening Criteria**

October 2022

This is a long report. Please think before printing.

**DISCLAIMER**

This document is not an official Commission document nor an official Commission position. Nothing in this document commits the Commission nor does it preclude any policy outcomes.

# Table of Contents

# About this report

This report is a supplement to the recommendations published by the Platform on sustainable finance in March 2022 and should be read in that context. The recommendations and criteria set out here includes: Part A – an update on the work undertaken since March 2022, a framework methodology to describe 'enabling activities', and recommendations for the European Commission to consider in its further work on the EU Taxonomy; Part B – additional technical screening criteria that have been developed in the past seven months.

# Part A: Methodology and Recommendations

# Work update since March 2022

As reported in March 2022 a number of activities required further work to be able to form complete criteria. The TWG has worked from April to October with the support of further external experts to complete existing or even develop new criteria for the following activities.

- An additional activity option for agriculture for biodiversity
- Forestry activity for biodiversity
- Manufacturing of basic pharmaceutical products and pharmaceutical preparations
- Manufacturing of chemical products
- Waterborne Transportation

Some activities have been updated following the development of similar activities, or the finalisation of the enabling framework:

- 2.14 Manufacture of chemicals
- 2.18 Manufacture of plastic packing goods
- Various enabling activities (described below).
- Hotels, holiday, camping grounds and similar accommodation (tourism) under the chapter 'restoration and remediation' which originally was under the enabling activities and instead now it has been completed as a standalone substantial contribution to protection and restoration of biodiversity and ecosystems.
- The desalination activity has also been included and which should have been present in the March report but was left out due to error

Some activities are completely new, in the sense that they were not announced in March 2020 report:

- Use of concrete in civil engineering works
- Demolition of buildings and other structures
- Manufacture of copper under manufacturing of basic metals

For the agriculture activity, the additional criteria presented here are for the inclusion of an additional option (option C) to extend the coverage of the activity. The option is added to the following scope

Animal production:

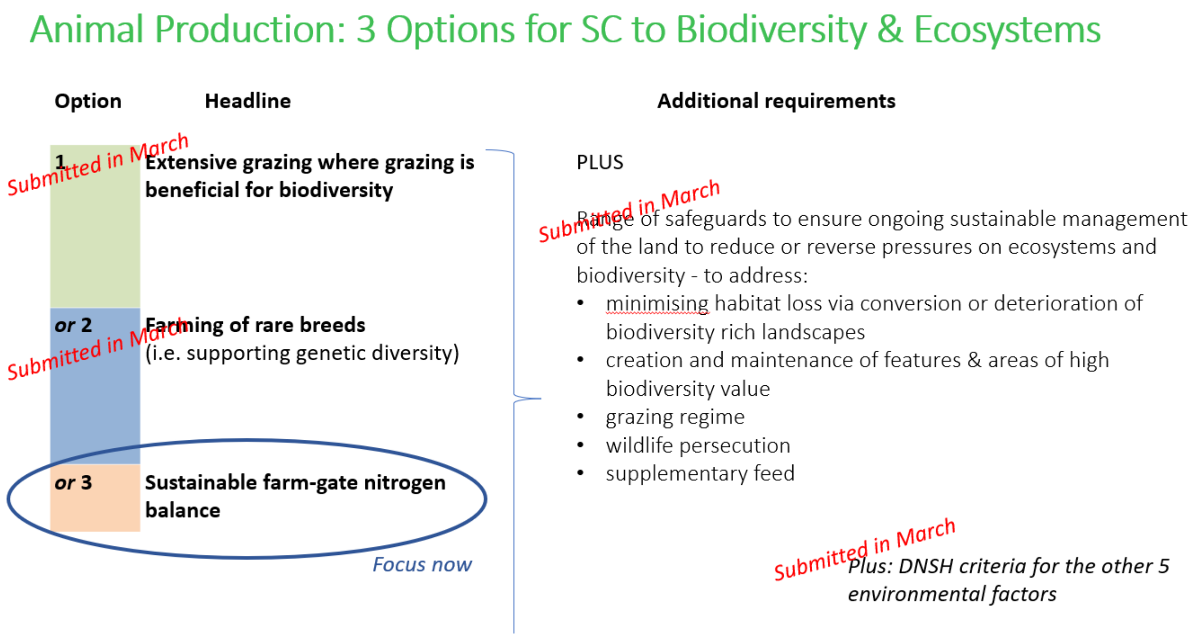
- Dairy cattle; other cattle and buffaloes; horses and other equines; camels and camelids; sheep and goats; swine/pigs; poultry; mixed farming

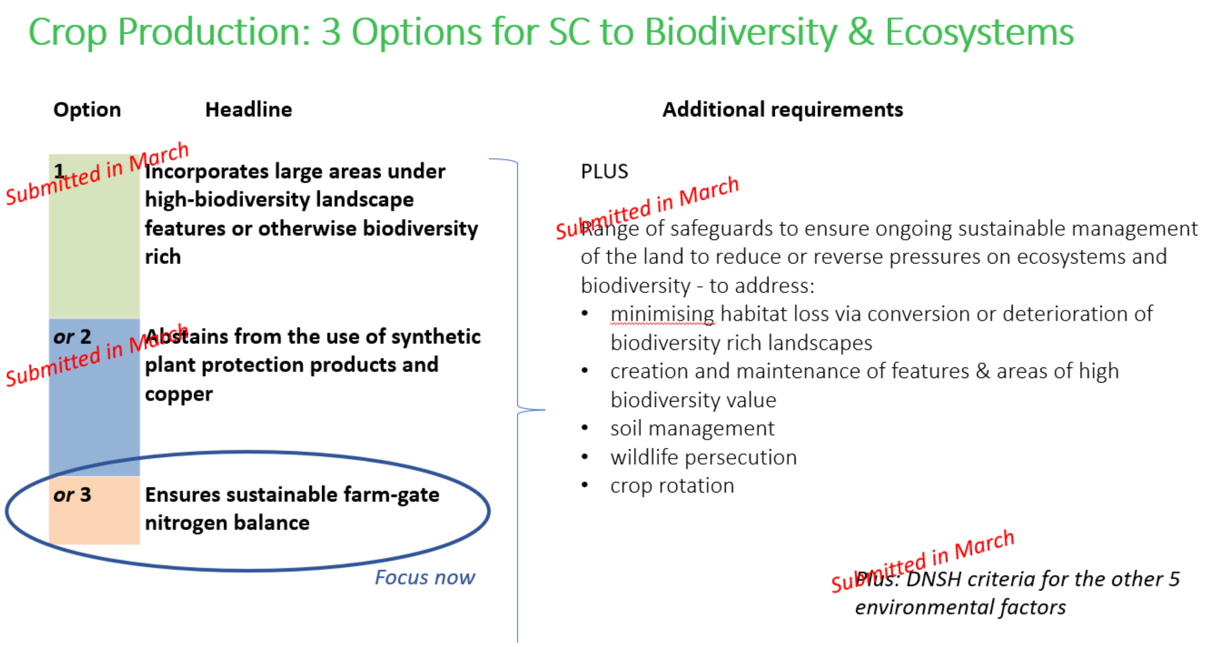
Crop production:

- Growing of non-perennial crops: cereals (except rice), leguminous crops and oil seeds; rice; vegetables and melons, roots and tubers; sugar cane; tobacco; fibre crops; other non-perennial crops; spices, aromatic, drug and pharmaceutical crops;
- Growing of perennial crops: grapes; tropical and subtropical fruits; citrus fruits; pome fruits and stone fruits; other tree and bush fruits and nuts; oleaginous fruits; beverage crops; spices, aromatic, drug and pharmaceutical crops; other perennial crops: mixed farming

N.B. Production in greenhouses and other indoor settings is not included in scope at this time.

The following text gives clarity on the criteria proposed here and its relationship to that which was submitted in March 2022 specifically covering just Option C per the following diagrams. Options A & B were submitted in the Platform report to the Commission in March 2022. Hence the DNSH criteria for these criteria were also submitted in March 2022 and have not been repeated here (but a link is given below). Likewise, the ‘additional requirements’ that are cross cutting across all three Options A, B, and C. These ‘additional requirements’ were captured in the March report, and are cross referenced to here.






With regards the work undertaken on forestry and logging a special note is included to introduce the criteria present in part B of this report.

The criteria for the contribution of the activity of 'forestry and logging' to the objective of 'the protection and restoration of biodiversity and ecosystems' is presented with the following notes. These are to recognise that there remain areas where the Technical Working Group (TWG) of the Platform has not found consensus on specific elements of the criteria, and that these should be recognised in the preparation of the Delegated Act. These elements have been discussed and debated in the process set out below and have been addressed iteratively throughout that process. Despite this, it has not been possible to satisfy all perspectives in finding a better or more appropriate way to develop the criteria. As such a dissenting view from two members of the TWG is included in Annex 1 to this report.

Process followed in the development of the criteria for forestry and logging:

*The discussion on the forestry criteria showed that diverging views were forming within the sector team (ST) in charge of developing the criteria. A number of members of the sector team did not support the criteria initially tabled and proposed an alternative approach to the criteria - which had some merits but did not meet with the requirements of the Taxonomy Regulation, or the methodology of the TWG. With the aim to reach a broader common understanding, the European Commission on-boarded additional ad hoc experts with academic backgrounds in spring 2022, which were invited to review the initially tabled criteria. Following the additional expert's opinions, the initial proposal was amended, by addressing some of the concerns raised by ST members and the additional experts. An alternative proposal was also proposed,* *and the two proposals were subject to a careful comparative analysis to highlight strengths and weaknesses of each. Dedicated meetings were also organized with the view to reach consensus, and further amendments to the criteria were made to accommodate dissenting positions.*

The specific elements that have prevented the reaching of full consensus among platform members:

1. That the criteria introduce **categories of forest management that do not fully reflect the diversity of forest ecosystems or how they are managed**. Forest ecosystems and forest management approaches can best be described as points along a spectrum. Yet to develop performance standards to be used in a tool such as the EU Taxonomy, it is necessary to provide categories to allow a differentiated approach in the relevant practices and the required thresholds for management that would deliver a substantial contribution. This is particularly the case for the biodiversity objective, which is fundamentally different to that of the climate mitigation objective. Even with such diversity it is possible to identify similar areas and related benchmarks from which to set performance standards as has been achieved in other activities, such as buildings. Forests are not unique in this regard. It would not be reasonable to try and apply practices to address the full spectrum of forest ecosystem types through a single set of criteria. An alternative that was considered was the creation of a larger set of forest management approaches to attempt to better reflect the diversity of forest conditions and ecosystems and forest management practices (FMAs as used in the criteria proposed). We note however that any categorisation risks the appearance of being arbitrary.

2. That the criteria **list many of the practices as mandatory and offer only some practices as selective** (to be chosen by those implementing the criteria on the ground). Following comments relating to the applicability of the criteria to the diversity of forest conditions and ecosystems and the desire to have a wider range of selective options, variability was introduced into the criteria. To ensure a substantial contribution is achieved for a given objective, the criteria of the EU taxonomy necessarily set performance standards. Recognising in the case of this activity that defining a specific single quantitative threshold for biodiversity outcomes was challenging, we have opted for a practice-based approach. Here the implementation of a set of practices with defined performance thresholds gives reasonable (high) confidence that the resulting impact will deliver the biodiversity result. Striking the right approach on mandatory versus selective criteria is challenging. In the criteria a conscious choice was made to

maintain a substantial number of mandatory practices to increase the confidence that if implemented, a substantial contribution would be achieved.

3. That the **criteria have fixed thresholds that may be hard to achieve in all contexts**. Like the above point (on mandatory / selective criteria), variable thresholds were introduced to address this critique. They were set at a level of 20% reduction in threshold value. This is an arbitrary value, offered in both the absence of any other better alternatives being evident within the criteria development process, and in recognition that the threshold values present in the criteria were at the lower end of the spectrum of ranges evident in the literature supporting the criteria.

4. **Which scientific evidence is relevant and should be used to establish the criteria and whether the full body of evidence relating to forest management and biodiversity has been considered**. In any evidence gathering process it is necessary to use and gather evidence about the question that is being tested - in this case how can a *substantial contribution* to biodiversity and ecosystems, be delivered through the *activity of forestry and logging.* The emphasis and focus of the scientific evidence shall necessarily be on what needs to be done in practice or what level of threshold needs to be reached so that a substantial contribution to the objective is delivered.

5. That the **criteria are complex to implement in practice and present challenges for managed forests to deliver**. Further that **the approach taken does not follow that of the forestry activity in the Delegated Act on Climate** that recognises the co-benefits of forest management. Forest management decisions will reflect a range of interests which may include the economic potential of the forest, its role as a biodiversity refuge, its role as a recreational area, and so on. However, the taxonomy criteria take a more specific focus and seek to define what needs to happen within an activity in order for a substantial contribution to be achieved. These may well present challenges to the way in which an activity is currently undertaken, and this is part of the purpose of the taxonomy to signpost and enable those willing and able to make the necessary change, whilst in receipt of financial support (in one form or another). The criteria follow a different approach to the one in the Climate Delegated Act, as the criteria has been drafted for a different environmental objective (biodiversity) that requires different calibration. The Platform is not bound by the approach taken in the Climate Delegated Act, which was developed for the climate mitigation objective. The role of the Platform, and specifically the Technical Working Group is to provide the recommendation on best way forwards at a technical level, such as the

recommendations present by the Technical Expert Group in March 2022, and the Platform on Sustainable Finance in March 2022.

6. That the criteria are not ambitious enough in terms of contribution to biodiversity objectives and has been raised as an issue in the ongoing development of the criteria. This has been difficult to address whilst responding to the above points.

For the mining activity, the work was developed in two sector teams to be able to work more efficiently considering the complexity of the sector: separating the mining activity from the manufacturing and processing of metal activity. For mining the activity criteria have not been finalized due to the complexity and diversity of the activity and gap in suitable data - detail of this is provided later in this section. The team focusing on manufacturing and processing have successfully submitted the criteria for copper which is included here in this report.

The following activities included in the public consultation (August - September 2021) were de-prioritised for publication (due to data gaps, time constraint or missing expertise), but were included in a handover to the Commission for future consideration.

| **Sector** | **Activity** | **Environmental objective** |
|---|---|---|
| Manufacture | Manufacture of durable electrical and electronic equipment | Circular Economy |
| | Manufacture of equipment generating electricity and/or heat | Pollution Prevention and Control |
| | Manufacture of machinery, equipment and solutions | Circular Economy |
| | Manufacture of machinery enabling closed-loop systems, and high-quality collection and waste management | Circular Economy |
| | Manufacture of machinery, equipment and solutions | Pollution Prevention and Control |
| | Manufacture of motor vehicles, trailers and semi-trailers | Pollution Prevention and Control |
| | Manufacture of other transport equipment | Pollution Prevention and Control |
| Energy | Electricity generation from bioenergy for protection and restoration of biodiversity and ecosystems | Biodiversity |
| | Electricity generation using solar photovoltaic technology | Pollution Prevention and Control |
| | Electricity generation using concentrated solar power (CSP) technology | Pollution Prevention and Control |
| | Electricity generation from wind power | Pollution Prevention and Control |
| | Electricity generation from ocean energy technologies | Pollution Prevention and Control |
| | Electricity generation from hydropower | Pollution Prevention and Control |

| | | |
|---|---|---|
| | Electricity generation from geothermal energy | Pollution Prevention and Control |
| | Electricity generation from natural gas | Pollution Prevention and Control |
| | Electricity generation from renewable non-fossil gaseous fuels | Pollution Prevention and Control |
| | Electricity generation from biogas | Pollution Prevention and Control |
| | Power from cogeneration of heat/cool and power from solar energy | Pollution Prevention and Control |
| | Power from cogeneration of heat/cool and power from geothermal energy | Pollution Prevention and Control |
| | Power from cogeneration of heat/cool and power from natural gas | Pollution Prevention and Control |
| | Power from cogeneration of heat/cool and power from renewable non-fossil gaseous fuels | Pollution Prevention and Control |
| | Power from cogeneration of heat/cool and power from biogas | Pollution Prevention and Control |
| Construction | Maintenance of bridges and tunnels (railway, road and cycling) | Circular Economy |
| | Acquisition and ownership of buildings for biodiversity | Biodiversity |
| | Construction of new buildings and major renovations of buildings for protection and restoration of biodiversity and ecosystems | Biodiversity |
| Transport | Sea and coastal freight water transport | Pollution Prevention and Control |
| | Sea and coastal passenger water transport | Pollution Prevention and Control |
| | Retrofit and upgrade of vessels for the transport of freight on vessels designed for operating on sea or coastal waters | Pollution Prevention and Control |
| | Retrofit and upgrade of vessels for the transport of passengers on vessels designed for operating on sea or coastal waters | Pollution Prevention and Control |
| | Inland freight water transport | Pollution Prevention and Control |
| | Inland passenger water transport | Pollution Prevention and Control |
| | Transport by motorbikes, passenger cars and light commercial vehicles | Pollution Prevention and Control |
| ICT | Digital solutions exploiting space-based earth observations enabling climate change mitigation | Climate Change Mitigation |
| | Digital solutions exploiting space-based earth observations enabling climate change adaptation | Climate Change Adaptation |
| | Digital solutions exploiting space-based earth observations enabling the protection and restoration of biodiversity and ecosystems | Biodiversity |

| | | |
|---|---|---|
| | Digital solutions exploiting space-based earth observations enabling pollution prevention and control | Pollution Prevention and Control |
| | Digital solutions exploiting space-based earth observations enabling sustainable use of waters and marine resources, and their protection | Water and Marine Resources |

The final two points here focus on two activities which for the lack of time have not been finalized by the TWG PSF 1.0 and should be included as input to the future work of the Commission building on the work done to date. We note here that the next mandate of the Platform has not yet been finalised and that these two activities are thus not guaranteed to be part of that work.

**For the mining activity**

The purpose of this section is to summarise the progress of the discussions and evidence provided as part of the EU Platform on Sustainable Finance ST2b Mining Working Group (2020 – 2022), towards the inclusion of the mining economic activities as part of the EU Taxonomy.

The report does not aim to present a view of agreement between the working group members across substantial issues, but rather seeks to describe the substantial factors that need to be taken in consideration while designing the technical screening criteria, for both Substantial Contribution (SC) and do-no-significant-harm (DNSH).

Scope of mining economic activities: the group considered designing criteria for Land-based mining and quarrying of minerals other than coal, lignite, crude oil/petroleum or natural gas, including the extraction of solids or liquids by different methods such as underground or surface mining, well operation, etc. and supplementary activities aimed at preparing the extracted materials for marketing, for example, crushing, grinding, cleaning, drying, sorting, and concentrating ores.

The activity is classified under NACE codes B07 & B08 and includes 20:15 insofar as it relates to Potash mining as well (but excludes B05 – Mining of coal and lignite, 08:91 Salt mining B06 – Extraction of crude petroleum and natural gas, B08.92 – Extraction of peat and B07.21 - Mining of uranium and thorium ores) in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. Seabed mining has not been considered as part of the scope of the present document given that the state of scientific research on the environmental impacts of mining on the seabed has not yet been considered by the Technical Working Group (TWG).

The group focused on understanding the possibility that mining economic activities could be recognized for SC to the pollution prevention and control (PPC) and DNSH to the other five environmental objectives. The rsection focuses on the PPC objective, in particular with respect to pollution to water, which was explored in 2022. The sector team has conducted further background research for DNSH to biodiversity which was carried out during 2020-2021 2021 in a different composition of the Sector Team and which is not included in this summary.

Interpreting the pollution prevention and control environmental objective

In its March 2022 report, the EU Platform on Sustainable Finance has clarified the ambition level for the PPC objective, which reads as follows:

“By 2030, pollution sources, sinks and pathways due to human activities have been fully identified and measures have been applied that prevent and eliminate pollution across air, water, soil, living organisms and food resources. By 2030, the production and use of substances, materials and products is safe and taxonomy-aligned.

- Substances of concern have been substituted and their production and use have been minimized, as far as possible. Where substances of concern are still being used, their use, presence in products and articles and quantities is being tracked to ensure adequate risk management throughout their life cycle.
- The sub-group of the most harmful substances (incl. ozone depleting substances) are phased out from products for consumer or professional use, except when their use has been proven to be essential for society.

Legacy pollution is safely remediated and pollutants are destroyed or irreversibly transformed into safe materials. By 2030, pollution resulting from heat, noise, light and vibration has been identified and reduced to prevent, or if prevention is not practicable, minimize any adverse impact on human health and the environment.”

The Platform further emphasizes the importance to identify pollution sources and reduce pollution as consistent with the zero-pollution hierarchy, which follows a prevention, minimize & control, and eliminate and remediate logic. This places pollution in pressure category of the DPSIR framework, and thus activities focus on the reduction of the pressure, rather than achieving a specific state (as is the case for water or biodiversity). This interpretation can be directly implemented to assess the SC and DNSH of existing mining activities. However, in the case of new mines, the group has further discussed but not reached a conclusion on whether it applies in the same manner, or whether new mines putting new pressures on water bodies can be considered for substantial contribution to pollution prevention.

In this respect, the group discussed the consideration of the following requirements, which can serve as a discussion base for the setting of DNSH and potential SC elements, within the technical screening criteria for PPC for mining activities:

1. The establishment and systematic implementation of an environmental management and monitoring system that:
    a. establishes a baseline of air, land, soil and water pollution, either as part of the permitting process or retroactively if it was not done.
    b. predicts the potential effects of the activity on natural resources and implements an adaptive management plan to evaluate and respond to those effects,
    c. tracks and reports the effects of the activity's emissions of pollutants at individual monitoring points in areas affected by the activity,
    d. compares the measured results to baseline values or relevant standards,
    e. implements measures to prevent or where this is not feasible reduce emissions of relevant pollutants,
    f. monitors the effectiveness of the implemented measures taking into account cross-media-effects, and implements corrective actions in a timely manner, as necessary, and
    g. manages significant incidents of pollution and reports them promptly, and takes action to prevent any recurrence
2. For activities started after the implementation of Directive 2011/92/EU the assessment of the activity was covered, where applicable, by an Environmental Impact Assessment (EIA) developed in accordance with Directive 2011/92/EU of the European Parliament and of the Council.
3. For Tailing Management Facilities measures are taken to reduce, prevent, predict seepage in accordance with Directive 2012/18/EU and MWEI BREF.
4. Measures are taken to prevent, predict, and respond to failure of Tailing Management Facilities in accordance with Directive 2012/18/EU.
5. Mining waste is managed in accordance with Directive 2006/21/EC,
6. There is no use of marine, lake or riverine tailings disposal – further discussion needed on tailings disposal vs. water discharges needed.
7. Requirements on public consultations before the authorization is approved
8. Stakeholder engagement is continued as an ongoing process during and after operations, and
9. All pollution prevention and control measures of the authorization are adopted.

The group further discussed the potential application of technical screening criteria (TSC) as potentially applying to:

- all pollutant emissions of relevance for the specific mining activity during the full mine life cycle (exploration, construction, operation, closure, post-closure),
- point-source as well as diffuse emissions (e.g., from pits, underground workings, comminution, milling and beneficiation facilities, tailing management facilities, heap or dump leach facilities, mine water impoundments),
- all pathways of relevant pollutants to air, land/soil as well as ground and surface waters (e.g., effluents, run-off, erosion, seepage, leakage, gaseous emissions, dust),
- emissions of geogenic pollutants caused by the economic activity (e.g., acid rock and metalliferous drainage, emissions of radioisotopes),
- emissions of anthropogenic hazardous substances added by the economic activity (e.g., spills from transport, use and storage of chemicals, water quality effects from the use of blasting agents or cyanide), and
- wider pollution issues such as the management of noise and vibration, and the recycling/re-use of applicable non-mining waste.

Key Questions to Answer on the Road to Substantial Contribution to PPC for the Mining and Quarrying Sectors

The group has also approached the questions below, with various levels of progress:

1. Can the current implementation of the Water Framework Directive for mining and quarrying ensure DNSH as required by the Taxonomy legislation? This issue is explored in more depth in the next section, however, answering it robustly would entail a comparison across permitting rules for annual or monthly average concentrations and maximum allowable concentrations for different pollutants across the different Member States. Neither fully quantitative nor fully qualitative/ process based criteria would be able to capture the complexities of pollution prevention in mining. The links between the ecological, chemical and physical status of water needs to be reflected further to match the current implementation of the WFD across the member states.
2. How can substantial contribution be set if the DNSH level for a mine is at a level of non-deterioration? Approaches to prevention vs. reduction of pollution would need further discussion.
3. To what extent will the status of the receiving body be considered in setting the criteria (i.e. whether it has good or poor status)? Here the distinction between new and existing mines is relevant to be considered, as well as combining metrics from the receiving body with the end of pipe pollution. The key challenges here include accounting for concentration variations in the receiving body which depend on the mine discharge as well as other relevant non-mining pollution inputs, and the receptor's natural

hydrological variation. Such approaches require more discussion to understand how they can be appropriately applied.

4. What is the distribution in pollution releases across different types of mining with respect to emissions to air, water, and land for different types of pollutants? Further datasets would need to be explored and analysed to be able to answer this question fully. Here the group encountered significant challenges as The European Pollutant Release and Transfer Register, the US Toxic Emissions Release inventory, as well as the equivalent Australian pollution registry only record pollution data for mines in terms of mass / quantity emitted but not in terms of concentrations in the discharge, which the group concluded would be a more appropriate indicator, or at least an alternative, to base any quantitative assessment on.

**For the waterborne transportation activities**

The team has worked on additional activities which have not yet been published within the mandate of this platform. A summary of the work undertaken is provided here.

The activities have been considered in the context of the Pollution Prevention and Control objective and consist of:

1. Sea and coastal passenger water transport (H50.2.0)
2. Retrofit and upgrade of vessels for the transport of freight on vessels designed for operating on sea or coastal waters
3. Inland Freight Water Transport (H50.4)

<u>H50.2.0 - Sea and coastal PASSENGER water transport</u>

The scope of this activity was defined as purchase, financing, chartering (with or without crew) and operation of vessels designed and equipped for performing passenger transport, on sea or coastal waters, whether scheduled or not. The economic activities in this category include operation of ferries, water taxis and excursions. Cruise ships and super yachts with crew are excluded.

The activity could be associated with several NACE codes, in particular H50.10, N77.21 and N77.34 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

Key enablers of this activity include:

- Ship manufacturers (NACE code: C 30.1)
- Ship Recycling (NACE code: E 38.31)

The TSC for substantial contribution to Pollution Prevention and Control have been defined aiming to zero direct emissions (such sa Sox, NOx and PM) and with other criteria which refer to the operational phase by defined threshold of the most relevant parameters which affect the environmental impact.

<u>Retrofit and upgrade of vessels for the transport of freight on vessels designed for operating on sea or coastal waters</u>

The economic activities in this category could be associated with several NACE codes, in particular H52.2, H50.2 and C33.15 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

The TSC for substantial contribution to Pollution Prevention and Control recognizes all activities which report the vessel to be in compliance with the criteria reported in the *Sea and coastal PASSENGER water transport activity.*

<u>Inland Freight Water Transport (H50.4)</u>

Freight inland water transport of any kind, the activity is classified under the Nace Code H50.4 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. The next activities are not within the scope of the activity:

- Vessels used principally for the carriage of passengers
- Vessels used for ferrying purposes
- Vessels used solely for non-commercial purposes by port administration and public authorities
- Vessels not used for the carriage of goods such as floating workshops, houseboats and pleasure craft.

In this case it was important to exclude those activities related to the transportation of fossil fuels and fossil fuel bunkering as well as hazardous waste and a number of other cases given their environmental impact. Also in this case the first TSC refer to zero tailpipe direct emissions fleet during the navigation and the other criteria focus on the regulation of the operational phase introducing limits to a few parameters or management measures to reduce as much as possible the impact generated.

## Enabling methodology and enabling activities

A number of proposals for enabling activities that had been developed by the TWG and presented in consultation paper of August 2021, but were not released in the TWG Platform report in March 2022. These activities were re-assessed by the Enabling taskforce following the development of the Horizontal Framework. Due to limited resources and tight deadlines, efforts were focussed on a number of proposals where experts were available. The following proposals were taken forward and are presented in this report:

- Marketplace for the trade of second-hand goods for reuse
- Provision of IT/OT data-driven solutions and software that provide a substantial contribution to circular economy
- Provision of IT/OT data-driven solutions that provide a substantial contribution to the use and protection of water and marine resources
- Manufacture and installation of, and associated services for leakage control systems enabling a substantial contribution to sustainable use and protection of water and marine resources
- Manufacture, installation, and servicing of high, medium and low voltage electrical equipment for electrical transmission and distribution that result in or enable substantial contribution to climate change mitigation

A number of other proposals that were included in the August 2021 consultation paper are not published in this report, the reasons for which are explained below:

- Manufacture of machinery, equipment and solutions enabling SC to CE:

*Work was undertaken on this proposal, however further methodological considerations are needed to ensure consistency with the framework, so will require further work to complete.*

- Manufacture of machinery enabling closed-loop systems, and high-quality collection and waste management enabling SC to CE;
- Manufacture of machinery, equipment and data solutions enabling SC to PPC;

*There was a lack of specific expertise to develop these proposals further within the timeframe available.*

- Digital solutions exploiting space-based earth observations enabling SC to climate mitigation;
- Digital solutions exploiting space-based earth observations enabling SC to climate adaptation;
- Digital solutions exploiting space-based earth observations enabling SC to biodiversity;
- Digital solutions exploiting space-based earth observations enabling SC to PPC;

- Digital solutions exploiting space-based earth observations enabling SC to Water:

*For these activities, the existing proposals did not fit with enabling framework and there was a lack of specific expertise to develop further within the timeframe available.*

# Horizontal Framework for Enabling Activities: Guidance for Platform Members

## Aim of this guidance

The aim of this document is to provide a robust framework and guidance for members of the current or future Platforms, and for the European Commission, in developing criteria for enabling activities. The purpose of the document is **not** to provide guidance for companies' self-assessment of the enabling nature of their activities.

## Enabling activities in the Taxonomy Regulation

Enabling activities are referred to in Articles 10-15 of the Taxonomy Regulation. The articles define the conditions under which a substantial contribution to the six environmental objectives of the taxonomy can be made. According to the articles (except Art.11), an economic activity can make a substantial contribution to an environmental objective by 'enabling any of the activities[1] listed in points (…) of this paragraph in accordance with Article 16.' Due to the differing intrinsic nature of the adaptation to climate change objective, Article 11 defines adaptation enabling activities to be those that "provide adaptation solutions that, in addition to satisfying the conditions set out in Article 16, contribute substantially to preventing or reducing the risk of the adverse impact of the current climate and the expected future climate on people, nature or assets, without increasing the risk of an adverse impact on other people, nature or assets." This means that in addition to enabling the resilience of other economic activities, activities enabling adaptation can also have the broader objective of enabling adaptation or resilience of people or nature directly. To capture all aspects of what an enabling activity may enable, the document refers to *target activities and objectives*.

**Definition of enabling activities in the Taxonomy Regulation**

Enabling activities are defined in Article 16 of the Taxonomy Regulation as follows:

[1] In fact, the Articles list activities, and in some cases, objectives not tied to a particular activity e.g. improving energy efficiency.

*"An economic activity shall qualify as contributing substantially to one or more of the environmental objectives set out in Article 9 by directly enabling other activities to make a substantial contribution to one or more of those objectives, provided that such economic activity:*

*(a) does not lead to a lock-in of assets that undermine long-term environmental goals, considering the economic lifetime of those assets; and*

*(b) has a substantial positive environmental impact, on the basis of life-cycle considerations."*

The definition highlights a number of important characteristics of enabling activities. The activity **directly enables** another activity to make a **substantial contribution** to one or more of the six environmental objectives. That is, there is a clear link between the enabling activity and the target, resulting in a substantial positive environmental impact of the target activity, which the enabling activity "enables" - whilst considering life cycle impacts of the enabling activity on all six environmental objectives. It is interpreted that the enabled substantial positive environmental impact should relate to the objective for which a substantial contribution is targeted, rather than enabling a target activity to meet DNSH requirements for other objectives.

Where the activity enables a broader objective rather than another economic activity, as for adaptation or resilience, the conditions of Art. 16 apply to the identified "beneficiaries" of the enabling effect (e.g. a specific community or natural area).

It also has to be ensured that the enabling activity **does not lead to a lock in of assets** that could be detrimental to long-term environmental goals. In some cases, an enabling activity may benefit some end uses without lock in, but cause lock in elsewhere. For example, in adaptation, safeguards against maladaptation need to be in place to not inadvertently "increase the risk of an adverse impact on other people, nature or assets" while having positive effect elsewhere.

The specific nature of these aspects is crucial to assess when formulating technical screening criteria for enabling activities.

Enabling activities may include not only upstream activities from the target, but also horizontal activities that are closely related to the enabling activity, for example, not only the manufacturing of rotor blades for wind turbines, but also their installation, maintenance and repair. Where value chain activities are closely related, they may be summarised in one taxonomy activity and, where appropriate, be subject to one set of SC and DNSH criteria. However, each activity has to pass the test steps for enabling activities – as outlined below –

by itself. Where activities require different criteria, separate taxonomy activities should be established

Economic activities should only be classified as enabling if own performance criteria for the environmental objective being targeted do not exist. If the analysis of an activity's life cycle impacts suggests that rather than being classified as enabling, it should be included in the Taxonomy based on own performance criteria, this path should be given priority and the activity be considered for future TWG work.

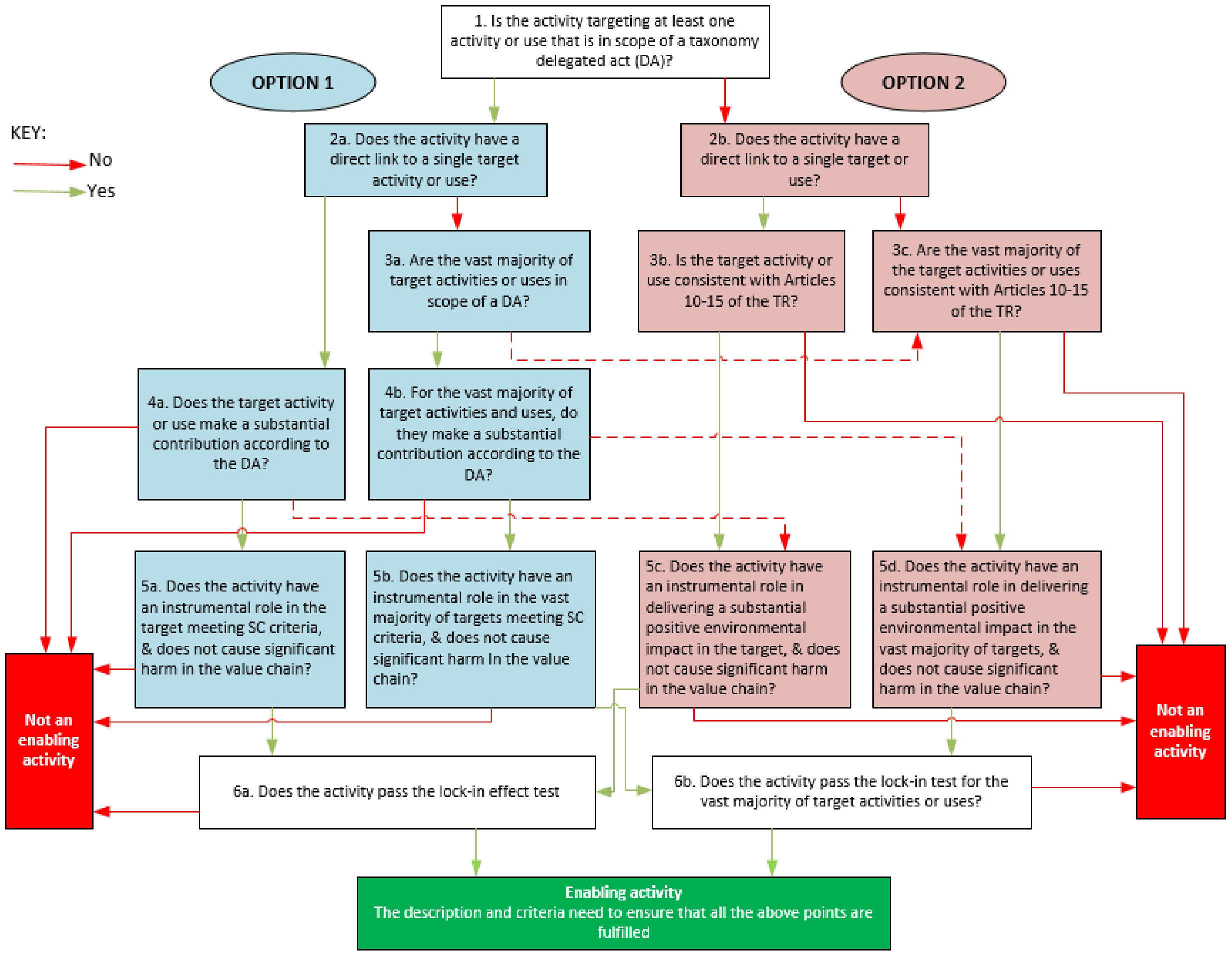
Further consideration should be given by the Commission and the Platform as to whether or not an activity could be included in the taxonomy as an enabling activity for one environmental objective, and as own performance for a different objective, as this relates to wider ongoing Platform discussions on "objective shopping". If an activity is classified as an enabling activity for one environmental objective and own-performance activity for another objective, the own-performance substantial contribution criteria will be more ambitious than the DNSH criteria of the same objective that apply when the activity is classified as enabling. In such cases, companies may not have the incentive to comply with the own performance substantial contribution criteria, but rather classify their activity as enabling and comply only with DNSH. In addition, if an activity is classified as both enabling and own performance, it is unclear how to report its status under Art. 8, where enabling activities need to be marked as such. The case of an activity being both enabling and own performance is not foreseen in the Art. 8 DA.

For the adaptation objective, due to the specific nature of adaptation, in particular the limitation of the reporting of own performance activities to adaptation investments, activities may also be included with own performance criteria and enabling criteria at the same time (so called "adapted-enabling" activities).

## Overview of the assessment process for enabling activities

The following decision tree summarizes the steps required in the assessment of enabling activities for potential inclusion in the Taxonomy, which are described in more detail below. These steps shall guide the development of the description and technical screening criteria of enabling activities by the Platform or EC when working on development of new activities for inclusion in the Taxonomy. They are not intended as a guide for companies' self-assessment of their activities' compliance with Art. 16. Note that "target activities and objectives" is shortened to "target" for convenience in the decision tree.

## FIGURE 1: DECISION TREE



## Detailed Assessment Process

The guidance in this section is presented according to the steps in the decision tree above. Some steps are common for development of all enabling activity criteria, whereas others depend on which of the two options are taken. The decision tree should be followed to guide the reader to appropriate steps when consulting the guidance document.

**Step 1: Is the activity targeting at least one activity or use that is in scope of a taxonomy delegated act?**

This first step is to identify which of two options will be taken for testing potential enabling activities for developing their criteria. If at least one target activity or objective is in-scope of the taxonomy (taxonomy "eligible" in the terminology of the delegated act on Art. 8 TR[2]), Option 1 will be taken. Otherwise, Option 2 should be followed.

Where the target activity or objective is within the scope of the Taxonomy's delegated acts, the target activity and enabled objective should be noted (including the number in the respective delegated act) in the rationale for the enabling activity prepared by the Platform team.

**Option 1: Assessment for the preferred avenue of activities enabling Taxonomy-target activities**

**Introductory comments:** This avenue should be pursued where possible for all enabling activities that relate to target activities or objectives that are included in a Taxonomy delegated act. The steps described below are designed to "test" whether this option for defining technical screening criteria for an enabling activity can be used, and to guide the development of criteria. Under Option 1, the enabling activity can be defined more broadly than under Option 2, e.g., based on its functional contribution to the target activity, as long as the following steps can be confidently performed for the entire scope of the activity described. A "functional" contribution

[2] In the document, the term "eligible" is not used for the following reason: "eligible" refers to the reporting of the company performing the target activity. But not all companies performing the target activity necessarily report the Taxonomy eligibility of their activities, because they don't fall under the NFRD/CSRD. In addition, when drafting the criteria, experts cannot know the reporting decisions of the respective companies, they can only make their own judgements as to whether the target activity is included in a Taxonomy DA.

could be, e.g., providing energy storage for electric vehicles rather than manufacturing iron-phosphate batteries, or manufacturing devices that power wind turbines rather than manufacturing rotor blades.

**Step 2a: Does the activity have a direct link to only one target activity or use, rather than multiple?**

As part of the assessment of a potential enabling activity under the Taxonomy, the link between this activity and potential target activities or objectives must be assessed. In the simplest case, *single use activities* can be linked to one concrete target activity. For example, rotor blades of wind turbines are only used in wind turbines, or batteries for electric vehicles are only used in electric vehicles. Some enabling activities may, however, be used in multiple target activities (*multi-use activities*), where the target activities can be rather similar (e.g., renaturation and restoration), but also cover a broader scope (e.g., different kinds of adaptation activities). If multiple target activities or uses are identified, the analysis continues with Step 3a.

Interpretation of a ‘’direct” link

Art. 16 requires that the enabling activity “directly” enables its target activities to make a substantial contribution. However, this does not mean that the enabling activity has to be *the* single decisive activity in enabling the target activity or use to make a substantial contribution. For many target activities or uses that make a substantial contribution to one or more environmental objectives, there will be more than one enabling activity causing the target activity or use to make this contribution. Further, some of these enabling activities may be more than one step removed in the value chain. Accordingly, “directly” enables does not mean that only one immediate upstream activity per target activity or use can qualify as enabling. Activities further upstream can also be considered as enabling activities, provided that there is a clear and non-contested link between the enabling activity and the substantial contribution of the target activity. This clear and non-contested link may be established, e.g., based on market data showing a close supply chain connection, or the existence of a direct functional connection where the functioning of the target depends on the enabler.

**Step 3a: Are the vast majority of target activities or uses in scope of a taxonomy delegated act?**

Where there are multiple target activities or uses, if the vast majority of target activities or uses (with an estimated share of more than 95%) are included in Taxonomy delegated acts, the test can be assumed to be passed. The threshold of 95% is based on the fact that some exceptions are likely in most cases, but these should remain a very small proportion if the test is to be passed. Careful drafting of the description of the enabling activity and the use of scope exclusions, where appropriate, will help to decrease this share. Scope exclusions can either be general in nature covering all enabling technologies listed in the activity, or target specific enabling technologies in the activity. Depending on the nature of the activity and the scope exclusions it may be preferable to include the exclusions in the description or the substantial contribution criteria of the activity. When deciding where to include scope exclusions, the following should be considered:

- Including scope exclusions in the description decreases the share of eligible activities relative to non-eligible activities in the Art. 8 reporting of the company, and increases the share of aligned relative to eligible activities. This may be preferable if products or technologies vary and the scope exclusion regards the function of an enabling product or technology, e.g., water meters measuring leakage within a system (inflow and outflow of piping) vs. water meters that measure consumption of end-users.

- Including scope exclusions in the substantial contribution criteria increases the share of eligible activities of the company and decreases the share of aligned relative to eligible activities. This may be preferable if the scope exclusion regards the environmental performance of an enabling product or technology, or where products and technologies are identical but their use differs.

Independent of where scope exclusions are included, they need to specify the outputs which are aimed at certain uses – *unintended uses* that don't pass the tests – cannot be counted as enabling. The specification needs to be based either on characteristics of the enabling activity itself (such as product details) or based on market share data which can be assumed to be available/obtainable for entities performing the enabling activity. The way scope exclusions are to be proven has to be specified in the description or criteria and should be subject to third-party verification. For enabling activities whose output can commonly be resold or reused, scope exclusions cannot be applied since the exclusion of final uses cannot be traced or verified.

Some enabling activities may provide services for which unintended use can – if at all – only be excluded at high economic costs. Examples include adaptation activities that lead to the climate change resilience of entire locations, irrespective of the economic activities performed there, but also the upgrade or extension of power grids, which cannot reasonably be limited to the use by renewable energy generators. In these cases, the relevance of the intended vs. unintended uses has to be weighted in light of achieving the environmental objectives.

The market share of the different target activities should be estimated, to establish if indeed the vast majority of target activities pass the test. This can help in assessing the overall impact of the enabling activity in later steps. It should also be assessed whether the impacts arising from the remaining <5% unintended uses are not damaging to an extent that contradicts the intended uses.

When identifying multiple target activities, the direct link from the enabling activity has to be assessed for each potential target activity or use separately. If an enabling activity is more than one step removed from the target activity, the direct link has to be ensured for each step along the value chain.

The guidance in relation to the interpretation of the “direct” link presented in Step 2a also applies in Step 3a when considering multiple target activities or uses.

**Step 4a: Does the target activity or use make a substantial contribution according to the TR delegated act?**

Only activities that enable a target activity or use that makes a substantial contribution to one or more environmental objectives can be considered as enabling (Art. 16) under Option 1.

There are different cases for which a substantial contribution of the target activity has to be assessed:

1. The target activity is included in a Taxonomy delegated act and there are no substantial contribution criteria defined, e.g., electricity generation from wind power. In this case, a substantial contribution can be assumed for the target activity.

2. The target activity is included in a Taxonomy delegated act and there are substantial contribution criteria defined. If the description and criteria of the enabling activity can ensure that the target activity fulfills the substantial contribution criteria, a substantial contribution can be assumed.

3. The target activity is included in a Taxonomy delegated act, substantial contribution criteria are defined, but the activity description and criteria of the enabling activity cannot ensure that substantial contribution is achieved for the vast majority of cases (>95%). In this case, a substantial contribution cannot be assumed. As an alternative, Option 2 may be considered for such cases.

Scope exclusions can be employed to achieve compliance with Step 4a, under the conditions outlined under step 3a. Compliance with the scope exclusion criterion needs to be reported by the company performing the enabling activity, supported by evidence in reporting, and third-party verified.

**Step 4b: For the vast majority of target activities and uses, do they make a substantial contribution according to the TR delegated act?**

In determining whether an enabling activity should be included in the taxonomy, the analysis of step 4a must be performed for all identified target activities where there are multiple uses. If the description and criteria of the enabling activity can ensure a substantial contribution is achieved for the vast majority of target activities or uses, a substantial contribution can be assumed overall.

Scope exclusions can be employed to achieve compliance with Step 4b, under the conditions outlined under step 3a. Compliance with the scope exclusion criterion needs to be reported by the company performing the enabling activity, supported by evidence in reporting, and third-party verified.

**Step 5a: Does the activity have an instrumental role in the target activity or use meeting substantial contribution criteria, and does not cause significant harm in the remaining value chain?**

Article 16 refers to both *substantial contribution* of target activity or use, and *substantial positive environmental impact* of the enabling activity. These two aspects should not be confused. *Substantial contribution* of target activities or uses refers to the SC criteria defined in a Delegated Act (see step 4). *Substantial positive environmental impact* on the basis of life-cycle considerations refers to the actual environmental impact of an enabling activity on the target activity or use, and on its wider life cycle impact. *Substantial positive environmental impact* also refers to all six environmental objectives rather than only the objective that is addressed by the substantial contribution of the target activity or use.

Step 5 tests whether an enabling activity has a substantial positive environmental impact in the value chain in general, and when employed in the target activity in particular. This test encompasses a number of aspects presented below.

Ensuring the instrumental role of the enabling activity in the target activity or use meeting the substantial contribution criteria

The instrumental role can be assumed if, for example,

- without the enabling activity the substantial contribution of the target activity or use cannot be reached for any but exceptional cases,

- without the enabling activity the substantial contribution of the target activity or use can be reached, but the target activity or use cannot be scaled while ensuring its substantial contribution (e.g., because the availability or applicability of alternatives is limited),

- without the enabling activity the substantial contribution of the target activity or use can be reached, but at a significantly higher cost than with the enabling activity, where the cost difference would impair market take-up of the SC target activity or use.

Note that the instrumental role refers to the substantial contribution of the target activity, not merely its general functioning. For example, to test whether a 'component' is instrumental, it could be proven and documented that the component is necessary for the functioning of the capabilities of a machinery or process that makes a substantial contribution. In some cases, this can be assessed by comparing the target activity's performance (to reach SC) with and without the component. In other cases, the assessment may be based on quantifying the extent to which the environmental performance of the target activity that makes it reach SC depends on the performance of the enabling activity. For instance, in the case of a wind turbine, the blades and the gearbox would be assumed to be instrumental for the functioning of the system performance (e.g. reliability of gearbox → uptime / energy gain of wind turbine). In contrast, standard screws used to assemble the turbine or its cement base would not be assumed to be instrumental for the substantial contribution, although they are instrumental for the general functioning of energy generating installations.

Where an activity has a direct link with the target activity but does not have an instrumental role in delivering a substantial positive environmental impact, then this should not be considered an enabling activity.

Where the substantial contribution criterion of the target activity has multiple components, and the enabling activity enables only one of them, it should be assessed under option 2. With a direct link to only one component of the SC criteria it cannot be ensured that the target activity always makes a substantial contribution.

<u>Ensuring that the enabling activity doesn't cause significant harm in the remaining value chain</u>

In addition to securing the instrumental role in the target activity reaching SC level, the enabling activity should also not cause significant harm in the remaining value chain and for all six environmental objectives. This should be obtained by designing criteria covering all relevant life cycle aspects. Aspects regarding the environmental objective addressed by the substantial contribution of the target activity have to be included under the enabling activity's description and SC criteria, and aspects regarding the other five objectives under the DNSH criteria. It is preferred that the SC and DNSH criteria address the life cycle effects directly, e.g., by including thresholds, rather than requiring life cycle analysis on the side of the companies performing the enabling activity. For the life cycle effects, the level of ambition should match the one of DNSH criteria of own performance activities in the same sector. If life cycle assessments have to be performed by the companies, reference to appropriate methods and standards should be included in the criteria where relevant.

**Step 5b: Does the activity have an instrumental role in the vast majority of target activities and uses meeting substantial contribution criteria, and does not cause significant harm along the remaining value chain?**

The analysis of step 5a needs to be performed for all identified target activities and yield a positive result for the vast majority of target activities or uses. If scope exclusions are used, excluded target activities can be left out of the analysis if the conditions for scope exclusions outlined under step 3a are fulfilled.

**Step 6a: Does the activity pass the lock-in test?**

The enabling activity must not lead to a lock-in of assets that could be detrimental to environmental objectives. Lock-in can occur, for example, if the target activity has a level of performance that is unlikely to meet substantial contribution criteria in future: The target activity, although making a substantial contribution to one or more environmental objectives at the moment, does not have the potential to keep contributing to the environmental objective in future. Sometimes this inability is captured explicitly in the TR delegated acts by adding sunset clauses for the relevant activities.

For example, for energy intensive industry sectors which are transitional activities, research, development and innovation (RDI) in technologies aiming at only meeting current thresholds may result in lock-in of technologies that will not meet more stringent thresholds in future. The climate DA addresses this point for RDI by setting criteria requiring the targeting of emission levels substantially below current SC criteria thresholds so as to avoid such lock-in.

Similarly, a plug-in hybrid vehicle may be able to reach initial emission criteria until 2025 but never zero-emissions. An activity enabling the hybrid technology would therefore lead to a lock-in after 2025, while an activity enabling the electric technology does not.

In the case of adaptation enabling activities, they should not lead to a lock-in in adaptation measures that may result in increasing the risk of an adverse impact on people, nature or assets over time. For example, research into or components of adaptation solutions which can only address climate change related risk up to a certain extent and are not scalable or easily combinable with other solutions to increase the level of protection as necessary to avoid significant adverse impact would lead to a lock-in.

In general, special attention should be paid if the target activity is a transitional activity. Then it has to be distinguished whether the nature of the activity is compatible with the long-term environmental objectives of the EU (e.g., carbon neutrality, zero pollution, completely circular economy) and the activity can, if developed further, reach the necessary performance level – or not. In addition, it has to be ensured that the enabling activity has an instrumental role in ensuring the target activity reaches the likely performance level required by the long-term environmental objectives. The potential lock-in effect should be assessed in relation to the expected life span of an enabling technology.

A full assessment of potential lock-in issues should be undertaken and criteria developed to address these issues where needed. The lifetime of enabling and target activities, and the investment cycles of both are important considerations in this assessment.

**Step 6b: Does the activity pass the lock-in test for the vast majority of target activities or uses?**

The analysis of step 6a needs to be performed for all identified target activities, and yield a positive result for the vast majority of target activities or uses. If scope exclusions are used, excluded target activities can be excluded from the analysis if the conditions for scope exclusions outlined under step 3a are fulfilled.

**Option 2: Assessment of activities enabling target activities or objectives that are not in scope of the Taxonomy or do not comply with the substantial contribution criteria of the respective target activities**

**Introductory comments:** Option 2 should be pursued for enabling activities that relate to target activities and objectives that are not included in a Taxonomy delegated act, or otherwise fail any of the test steps outlined under Option 1. Option 2 is aimed at activities that themselves have such a strong positive environmental impact that their enabling character should be acknowledged, although compliance with substantial contribution criteria of the target activity cannot be assumed.

**Step 2b: Does the activity have a direct link to only one rather than several target activities or uses?**

See Step 2a above.

**Step 3b: Is the target activity or use consistent with the provisions in Art. 10-15 of the TR?**

If the target activity is not included in a Taxonomy delegated act, it should be ensured that the target activity or use is consistent with one or more of the six environmental objectives in Article 10-15 of the Taxonomy Regulation. Annex A2 of the TWG March 2022 report[3] provides guidance on relevant targets and reference points for the non-climate environmental objectives, which may be a useful reference point to assist in performing this assessment. The TEG report on the EU Taxonomy[4] is a useful reference point for the climate objectives.

The description of the enabling activity should include a direct reference to the Article describing the target activity (in the description of the activity rather than the criteria, i.e., not to create a reporting obligation for the reporting entities (traceability)).

**Step 3c: Are the vast majority of target activities or uses consistent with the provisions in Art. 10-15 of the TR?**

The test in step 3b should be carried out for each target activity or use.

If one or more target activities or uses are identified which are not consistent with provisions of Article 10-15 of the Taxonomy Regulation, scope exclusion should be applied, where relevant (see point 3a for details).

**Step 5c: Does the activity have an instrumental role in delivering a substantial positive environmental impact in the target activity or use, and does not cause significant harm in the remaining value chain?**

Article 16 refers to both *substantial contribution* of target activity or use, and *substantial positive environmental impact* of the enabling activity. These two aspects should not be confused. *Substantial contribution* of target activities or uses refers to the SC criteria defined

[3] Platform on Sustainable Finance: Technical working group - Methodological report (europa.eu)

[4] Technical expert group on sustainable finance (TEG) | European Commission (europa.eu)

in a Delegated Act (see step 4 of Option 1). *Substantial positive environmental impact* on the basis of life-cycle considerations refers to the actual environmental impact of an enabling activity on the target activity or use, and on its wider life cycle impact. *Substantial positive environmental impact* also refers to all six environmental objectives rather than only the objective that is addressed by the substantial contribution of the target activity or use.

Step 5 tests whether an enabling activity has a substantial positive environmental impact in the value chain in general, and when employed in the target activity in particular. This test encompasses a number of aspects presented below.

Under Option 2 the activity definition and SC criteria of the enabling activity are not directly linked to the SC criteria of a target activity or use. Therefore, the assessment of 'substantial positive environmental impact' is much more critical, to be able to justify inclusion of such enabling activities in the Taxonomy. To ensure a conservative approach, Option 2 will typically entail development of closed lists of identified activities where there is significant confidence in delivery of substantial environmental benefits. Such closed lists were applied in the Climate Delegated Act, for example for manufacture of energy efficiency equipment for buildings (3.5), and installation, maintenance and repair activities (7.3 to 7.6). Alternatively, if the activity enables an environmental objective directly, as for example for adaptation, the specific characteristics and parameters of the enabling activity itself may be described in detail to ensure high confidence in it delivering a substantial adaptation enabling effect.

<u>Ensuring the instrumental role of the enabling activity in the target activity or use meeting the substantial contribution criteria</u>

For Option 2 the criteria for the enabling activity cannot be linked to the SC criteria of the target activity. However, the SC criteria of the target activity can provide, where appropriate, a reference point in terms of level of ambition upon which criteria for enabling activities may be developed. For example, manufacture of energy efficiency equipment for buildings are important enabling activities to support climate mitigation in buildings. Whilst the SC criteria of such granular activities cannot be linked to the overall SC criteria for the construction or renovation of a building, criteria could be set in a way so that manufacture of equipment with very high energy performance levels is included. Whilst such equipment could be sold for use in any building, it will definitely be needed to enable buildings to meet SC criteria.

For target activities or uses that are in scope of a TR delegated act and SC criteria are defined, the instrumental role can be assumed if, for example,

- without the enabling activity the substantial contribution of the target activity or use cannot be reached for any but exceptional cases,

- without the enabling activity the substantial contribution of the target activity or use can be reached, but the target activity or use cannot be scaled while ensuring its substantial contribution,

- without the enabling activity the substantial contribution of the target activity or use can be reached, but at a significantly higher cost than with the enabling activity, where the cost difference would impair market take-up of the SC target activity or use.

For target activities that are not included in a Taxonomy delegated act, where substantial contribution criteria have not yet been defined, the environmental impact should be assessed, taking into account the characteristics of the target activity or objective. When the target activity is not in scope of the taxonomy, a conservative approach to selecting appropriate enabling activities and setting criteria must be applied. It is strongly recommended that development of substantial contribution criteria of target activities is undertaken in conjunction with, or before associated enabling activities, to help guide thinking on criteria. If an enabling activity is to be included without SC criteria for the target activity being defined, the environmental objectives ambition levels as outlined in the TWG March 2022 report and the TEG Report on Taxonomy should be used as guidance.

For target activities or uses that are not in scope of a TR delegated act, the instrumental role can be assumed if, for example,

- without the enabling activity the target activity or use cannot reach a level of environmental performance in line with relevant ambition levels for any but exceptional cases,

- without the enabling activity the target activity or use can reach a level of environmental performance in line with the relevant ambition levels, but the target activity or use cannot be scaled while ensuring this performance level,

- without the enabling activity the target activity or use can reach a level of environmental performance in line with relevant ambition levels, but at a significantly higher cost than with the enabling activity, where the cost difference would impair market take-up of the target activity or use at this performance level.

Where an activity has a direct link with the target activity or use but does not have an instrumental role in delivering a substantial positive environmental impact, then this should not be considered an enabling activity.

Irrespective of whether a target activity is in scope of a delegated act or not, the enabling activity must be (one of) the best available option(s) in relation to the environmental objective being supported. For example, for manufacture of equipment that is enabling substantial positive environmental improvement for climate mitigation in target manufacturing activities, where appropriate, specific best available technology or technologies in terms of GHG emissions should be defined, or thresholds defined allowing a range of the top performing options in terms of GHG emission.

Ensuring that the enabling activity doesn't cause significant harm in the remaining value chain

In addition to securing the instrumental role in the target activity reaching SC level, the enabling activity also has to be ensured not to cause significant harm in the remaining value chain and for all six environmental objectives. This should be obtained by designing criteria covering all relevant life cycle aspects, where aspects regarding the environmental objective addressed by the substantial contribution of the target activity have to be included under the enabling activity's description and SC criteria, and aspects regarding the other five objectives under the DNSH criteria. It is preferred that the SC and DNSH criteria address the life cycle effects directly, e.g., by including thresholds, rather than requiring life cycle analysis on the side of the companies performing the enabling activity. For the life cycle effects, the level of ambition should match the one of DNSH criteria of own performance activities in the same sector. If life cycle assessments have to be performed by the companies, reference to appropriate methods and standards should be included in the criteria where relevant.

**Step 5d: Does the activity have an instrumental role in delivering a substantial positive environmental impact in the vast majority of target activities or uses, and does not cause significant harm in the remaining value chain?**

The analysis of step 5a needs to be performed for all identified target activities and yield a positive result for the vast majority of target activities or uses. If scope exclusions are used, excluded target activities can be left out of the analysis if the conditions for scope exclusions outlined under step 3a are fulfilled.

Enabling activities may in some cases bring substantial positive environmental impact to target activities which cause significant harm, e.g., electrical equipment in or adaptation measures for power generation activities that use solid fossil fuels. In these cases, scope exclusion should be applied.

**Step 6a: Does the activity pass the lock-in test?**

See Step 6a under Option 1 above.

**Step 6b: Does the activity pass the lock-in test for the vast majority of target activities or uses?**

See Step 6b under Option 1 above.

## KPI-reporting for Enabling Activities

For enabling activities for which no scope exclusions apply, KPI reporting follows the same rules as for own performance activities.

For enabling activities for which scope exclusions apply,

- turnover should be reported as aligned for the share of sales that results from the uses that are not excluded (enabling uses);
- capex and opex should be reported as aligned based on the share of turnover resulting from enabling uses. If the company can foresee that the share of turnover from enabling uses will drop in future, the share of capex and opex reported as aligned should be adjusted accordingly. An upward adjustment is only possible based on reliable documentation, e.g., long-term contracts with buyers that provide proof of the share of enabling uses/targets related to the relevant Capex increasing.

Example: A company manufactures a product used in two target activities. Only the use in one target activity counts as enabling. If 40% of the sales result from the enabling use, then 40% of the overall turnover from that activity count as aligned. If there is no contradicting long-term perspective for the sales distribution, then also 40% of capex and opex count as aligned. If there is a long-term perspective that indicates a drop of the enabling use to 35%, e.g., from long-term contracts or an overall shift in the demand structure, then only 35% of capex and opex count as aligned.

This approach is in line with what appears to be the market practice for Capex/Opex reporting in cases where the investment is used for both aligned and non-aligned activities. We nevertheless recommend to include a note specific to enabling activities in future revisions of the relevant legal documents (Art. 5,6,8 delegated acts, Green Bond Standard), Commission communications (Q and A), or regulatory technical documents (RTDs).

## Annex 1: Examples of Application of the Framework

The horizontal framework document is intended as guidance for the experts developing the criteria for enabling activities. Hence, the steps summarized in the decision tree – and applied to three different examples below the tree – are to be performed by these experts, not by the companies performing – and reporting on – the (potential) enabling activities.

**<u>Example 1: rotor blades of wind turbines</u>**

Step 1:

- Target energy generation from wind (Climate DA 4.3) → follow Option 1

Step 2a:

- Direct link from rotor blades to turbines, and blades only used in wind turbines → direct link to single target activity → follow Option 1 to step 4a

Step 4a:

- Energy generation from wind turbines makes a substantial contribution by definition → test passed → follow Option 1 to step 5a

Step 5a:

- Blades are one of the components that are instrumental for generating electricity from wind.
- Impact based on LCA has to be tested for remaining value chain (upstream and beyond use in the turbine), criteria defined appropriately → test passed → follow step 6a

Step 6a:

- Wind turbines using rotor blades can be assumed to be part of a carbon neutral energy system → lock-in test passed

**Can be classified as an enabling activity with appropriate SC/DNSH criteria**

**<u>Example 2: triple-glazed windows</u>**

Step 1:

- Target is construction of new buildings and building renovation (Climate DA 7.1 / 7.2) → follow Option 1

Step 2a:

- Direct link from windows to buildings; type of buildings and activities can differ (renovation, construction) → direct link to multiple target activities → follow Option 1 to step 3a

Step 3a:

- Building renovation and construction are in scope of the Taxonomy → only marginal cases may be outside of scope → test passed → follow Option 1 to step 4b

Step 4b:

- Many buildings where TG windows are used will not make a substantial contribution → test not passed → follow Option 2 to step 5d

Step 5d:

- Instrumental role if SC criteria for energy efficiency of buildings with windows (renovation, construction) can practically not be achieved without TG windows.

- Impact based on LCA has to be tested. → test passed if LC condition fulfilled → follow step 6b

Step 6b:

- Buildings with TG windows can be assumed to be part of a carbon neutral building sector, for both renovation and construction → lock-in test passed

**Can be classified as an enabling activity with appropriate SC/DNSH criteria**

**Example 3: Vehicle tyres**

Step 1:

- Target electric vehicles (Climate DA 3.3, 6.5), among others → follow Option 1

Step 2a:

- There is a direct link from tyres to vehicles, but there are different kinds of vehicles → direct link to multiple target activities → follow Option 1 to step 3a

Step 3a:

- Scope exclusions may be applied to limit target activity to in-scope activities, i.e. means of transport included in the DA rather than out of scope activities, e.g. construction vehicles → test passed if scope exclusions are feasible based on commonly available data → follow Option 1 to step 4b

Step 4b:

- If scope exclusions can be applied to limit the target activity to EVs with zero tail-pipe emissions, substantial contribution can be assumed → follow Option 1 step 5a

Step 5b

- The tyres are not instrumental in generating a substantial positive environmental impact in the target activity → test not passed

**Not an enabling activity**

# Recommendations to the Commission

In this last section we include a number of recommendations for the Commission in consideration of future work on taxonomy development gained through the two-year (Oct 2020 - Oct 2022) experience on working on the Taxo 4 objectives.

It is important to restate where this work began and its original purpose. The TWG of the PSF 1.0 had a clear mandate to develop for a first set of prioritized economic activities, the criteria to recognize their substantial contribution to at least one of the environmental objectives defined by the Taxonomy as well as the DNSH for the other five. The specific focus was on the other environmental objectives (3 - 6) beyond those related to climate mitigation and climate adaptation. A substantial contribution is defined by the headline ambition levels developed in the methodological work of the platform and deriving from the Taxonomy Regulation. This is always beyond what is required by the current European legislation and Norms. The goal with these criteria was to be able to identify those activities which are front runners and/or have environmental performance able to drive towards the objectives developed under the EU Green Deal. It is different for the DNSH criteria which have always been developed by including threshold and criteria established by the current norms and legislation at the EU level.

There are some activities for which significant work has been developed in the past two years but has not reached conclusion. This is noted in the earlier section of this report and described in detail. We **recommend that the Commission consider this work as a basis for continuation in the development of the taxonomy** and to build on the work and thinking that has taken place thus far.

The following other recommendations are made:

**<u>On Do No Significant Harm</u>**

For some of the criteria submitted here and in March 2022, there are some missing DNSH requirements for some environmental objectives. It is important to recognise that just because no DNSH criteria have been recommended <u>does not mean that the TWG believes that an activity cannot do significant harm to a particular objective</u> (see e.g. the aviation or agriculture sector). The reason for their absence is partly the lack of time to develop such criteria and the priority to focus on the criteria for Substantial Contribution. In the context of DNSH the following recommendations are made:

- is recommended that the Commission **develop and complete all DNSH criteria for all objectives for all activities**.
- the conceptual development of the taxonomy framework as submitted in the sub-group 3 report on the extended environmental taxonomy[5] has highlighted that the DNSH requirements currently defined for activities are aimed at preventing significant harm, but do not themselves define what significant harm is for those activities and those objectives. **This should be an area of focus in the development of the taxonomy and the recommendations made in the extended environmental taxonomy report taken forwards**.
- The development of technical screening criteria for environmental objectives 3-6 have improved our understanding of these objectives (and the activities that influence them) and highlighted some inconsistencies with the DNSH criteria in the Climate Delegated Act. **Updating the DNSH requirements for existing activities relating to the Taxo 4 objectives should be an area of focus in providing a harmonized taxonomy addressing all objectives of the taxonomy**.

**<u>On the adaptation to climate change objective</u>**

The following recommendations are made:

**Recommendation 1 – provision of guidance on the application of adaptation criteria.**
To urgently provide guidance on the correct interpretation of the adaptation Substantial Contribution and DNSH criteria

As in-scope entities have started their reporting on the eligibility of their economic activities and are also preparing their first alignment reporting, it is evident, that there is an urgent need for further clarifications and guidance on the application of adaptation Substantial Contribution and DNSH criteria. Original TEG recommendations called for a specific guidance to be developed for the application of adaptation criteria. In absence of such official guidance several national and sector entities across Europe are developing their own guidance documents to assist their constituents. As these efforts are not coordinated and interpretations are not confirmed with/supported by the official positions of the European Commission, the situation risks to result in various different guidance documents circulating in the market

[5] https://finance.ec.europa.eu/system/files/2022-03/220329-sustainable-finance-platform-finance-report-environmental-transition-taxonomy_en.pdf

presenting differing interpretations of the criteria and resulting in non-aligned implementation and reporting on adaptation criteria, including differing ambition levels, risk assessment scope and adaptation measures assessment and coverage, and general methodology. It is therefore strongly recommended that European Commission issues official common guidance on the correct interpretation of the adaptation criteria, in the fastest way possible. In the current situation, it may be via the planned FAQs, the Taxonomy User's Guide or alternatively a separate guidance on adaptation as originally recommended by TEG. It may be reasonable to include the most urgent aspects in the FAQs currently being prepared and consider a more comprehensive guidance development in due time. Such guidance should make use in the first instance of the wealth of existing good guidance already publicly available, but which could be pulled together into a single guidance note and could be added to in further iterations. The most important thing is to deliver simple, good guidance as quickly as possible.

**Recommendation 2 – inclusion of further "adapted" activities.** To:

- Include "adapted" activities in the next upcoming DA as a first priority in support of the adaptation objective, capitalizing on existing work for these activities under other objectives.
- Set-up a continuous, repeating process of considering all activities being developed in support of other environmental objectives for inclusion as activities in the adaptation taxonomy annex; allowing for their adaptation expenditure to be recognized as taxonomy-aligned when the activities are adapted in their own operations.

There are three ways EU Taxonomy adaptation activities are contributing to adaptation objective, (as included in the 1st Delegated Act). They can be described as:

**"Adapted" activities** – activities, which become adapted to climate change risks in own operations and substantially increase their own resilience to current and projected climate related disruptions by assessing climate change related risks to their successful operation and by implementing adaptation actions addressing those risks. (see for example, activity "Electricity generation from hydropower" in Annex II, DA1)

**Adaptation "enabling" activities** – activities, which have a significant potential to increase the resilience to climate change of other economic activities, of people, nature and assets. (e.g. activity "Non-life insurance: underwriting of climate-related perils" in Annex II, DA1)

**“Adapted-enabling” activities** - activities, which have a significant enabling potential, but also need to be adapted to climate risks themselves first and foremost to be able to provide the enabling effect to  (e.g. activity “Afforestation” in Annex II DA1)

During its first mandate PSF has primarily focused on developing criteria for the “adapted-enabling” activities (see technical Annex for proposed criteria), however also recognizes the importance of urgent inclusion of “adapted” activities. Broad coverage of economic sectors as “adapted”  activities would a) significantly accelerate private sector effort contributing to the long-term vision of the EU Strategy on adaptation to climate change:“in 2050, the EU will be a climate-resilient society, fully adapted to the unavoidable impacts of climate change” and b) would allow a higher proportion of the private sector to have their adaptation related expenditure recognized as “Taxonomy-aligned” thus improving the fair balance of taxonomy alignment opportunities in between sectors.

Inclusion of “adapted” activities is a comparatively low effort exercise implementable in short period of time, as the process does not require a comprehensive development of new criteria and instead capitalizes on a) standard criteria for “adapted” and “adapted-enabling” activities adopted in DA1 Annex II and b) can apply the already developed DNSH for the activities under other environmental objectives – as was already done for the development of “adapted” activities in Annex II of DA1.

PSF has compiled a list of activities, which can be included as “adapted” in near term, substantially improving the coverage under adaptation objective with low effort required. Out of the activities, which could potentially be added as “adapted” in near term, 22 can be included with no or low effort, further low-effort activities may be added, if the missing DNSH is deemed as “not applicable” by experts.

To facilitate a smooth and continuous inclusion of further “adapted” activities in the EU Taxonomy to facilitate broad economy coverage for adaptation objective (instrumental for achieving overall contribution to Taxonomy adaptation objective) PSF strongly recommends a set-up a repeating process of considering all activities being developed in support of other environmental objectives for inclusion as activities in the adaptation taxonomy annex; allowing for their adaptation expenditure to be recognized as taxonomy-aligned when the activities are adapted in their own operations. As an additional consideration, those activities, which are especially vulnerable to climate change impacts need to be prioritized for inclusion as “adapted” activities to ensure the incentive for the most affected sectors in EU economy to be made resilient. The proposed process for continuous inclusion of further “adapted” activities in the Taxonomy can be based on the technical recommendations handed over to PSF 2.0

and should preferably be co-led and managed by appointed adaptation experts under PSF 2.0 mandate in collaboration with European Commission services.

**Recommendation 3 – development of criteria of further adaptation enabling activities.** To continue the identification of and criteria development for activities with the highest adaptation enabling potential and in alignment with the horizontal framework for enabling activities

Inclusion of adaptation enabling activities is of high importance, as these activities not only support their own resilience, but also that of other economic activities, of people, nature and assets. These activities also typically have the highest potential to contribute to the implementation of EU Strategy on adaptation and national and local adaptation strategies and plans with positive impacts extending beyond the commercial sector. The scoping of adaptation enabling activities and drafting of their criteria have to be aligned with the final horizontal framework on enabling activities.

# Annex 1: Dissenting views on the ‘forestry and logging’ TSC for biodiversity and ecosystems

Platform members, Business Europe (Alexandre Affre) and the Confederation of European Forest Owners - CEPF (Maria Pohjala), are not endorsing the Technical Screening Criteria (TSC) on the ‘forestry and logging’ activity for biodiversity and ecosystems, which is put forward by the Platform on Sustainable Finance in this report. Our main concerns are related to the (a) **arbitrary chosen three forest management categories** which are in contradiction with the current forest management practices, (b) **impossibly implementable thresholds for the biodiversity measures** because of the **insufficient consideration of local circumstances** and (c) **non-consensual scientific evidence.**

Below, our detailed explanations and proposed recommendations.

**Approach**

At the beginning of the Platform’s process, members were instructed to set taxonomy criteria according to an agreed methodology developed by the Commission´s Joint Research Centre and adopted by the Platform. This included seven approaches to the development of criteria, one of which is practice-based. Nevertheless, the TSC in this report are drafted based on a questionable assumption that sustainable forest management in most cases does not deliver substantial contribution to biodiversity.

Furthermore, Art. 19-1-j of the Taxonomy Regulation requires the TSC to cover all relevant activities within a sector while ensuring that these activities are treated equally. However, the scope has shifted from forestry and logging towards nature conservation, thus prioritising only a specific forest ecosystem function and undermining the other expectations of forest management for society.

There is a huge diversity of forest types, forest management practices and associated forest biodiversity patterns in Europe, stressing the need for context-suited integrated forest management. There is no ‘one size fits all’ for an integrated forest biodiversity conservation approach at European or global level. Context-dependent approaches are needed to fit the specific local and regional biodiversity-related challenges.

Therefore, a better example would be to have a practice-based approach which would consist of a mandatory biodiversity benefit analysis (comparable to the climate benefit analyses in the

Delegated Act C(2021)), and specific biodiversity actions depending on different vegetation zones on a local level.

The biodiversity benefit analysis would list some practices as mandatory (with ranges chosen by local authorities) and some as complementary. The substantial contribution to biodiversity would be delivered through a biodiversity benefit analysis that shall be regularly audited to make sure that a forest owners/operators are on a right path for improving biodiversity. This approach allows for greater flexibility for local circumstances.

**Usability and applicability**

The proposed TSC artificially introduce three forest management approaches, which are currently not used in practice (FMA1-FMA3) and are based on a questionable assumption that forest owners/operators could choose any of the approaches they find most relevant. The reality is that multifunctional forest management, as it is today, consists of multiple different practices and measures for biodiversity enhancement which depend on local conditions and cannot be categorized into three approaches.

The proposed TSC do not acknowledge the fact that biodiversity enhancement in forestry ecosystems is primarily addressed at a local level (i.e., best practices for biodiversity enhancement need to be chosen based on the local conditions and characteristics rather than introducing general criteria and threshold for forests globally). They are also in contradiction with previous Platform's publication, e.g., March 2022 Report on 8.2 Restoration of biodiversity and ecosystem.

The proposed TSC are not applicable from a forest owners/operators' point of view. This is because the combination of different thresholds from the mandatory criteria (e.g., size buffer zones, shares of set-asides, amount of deadwood and retention trees) that does not consider the needed timeframes and local peculiarities, like differences in forest cycles, climate, tree species, forest practices, resilience for forest damages etc. Contrary to the Taxonomy Regulation's and Platform's objectives, the text is not easy to use since many concepts, definitions and criteria are not backed by a reasonably practical implementation approach.

If applying same metrics and criteria for all forest holdings (theoretically, most of European forest holdings under multifunctional use would fall under the category FMA2), the approach would focus on the quantity of hectares protected rather than the quality and efficiency of targeted biodiversity measures. Just to mention a few examples, in some southern parts of Europe, the requested amount of deadwood cannot be left on the ground due to a forest fire risk, and in some northern parts of Europe if leaving at least 90 % of the forest soil area unaffected for soil protection, it would critically hamper the development of new tree generation, hence not improving biodiversity.

Instead, the criteria could be developed by introducing biodiversity actions that demonstrate that biodiversity values, generated by the activity over a period of 30 years after the beginning of the activity, are enhanced compared to a baseline (national legislation), associated to the business-as-usual practices that would have occurred on the involved area in the absence of the activity.

The approach would include actions providing biodiversity benefits, like mandatory criteria to be adapted using the knowledge on a local level; additional mandatory criteria; mandatory and additional set-aside areas and complementary biodiversity measures. Complementary actions would be selected according to the vegetation zone for tree species composition, stand structure, other vegetation, and soil. All mandatory thresholds are to set at national or regional level and based on specific characteristics of the vegetation zones.

The first class of mandatory activities would consist of ranges for the amount of deadwood and retention trees as a minimum threshold, but depending on the performance level, there should be an increase associated to the business-as-usual practices which will be reported to the biodiversity benefit analysis. National competent authorities could advise on the performance level required for each activity within the established range reflecting local conditions.

a) Min. amount of deadwood 5-10 $m^3$ /ha, depending on the performance level (the best suitable range accepted by a local authority)

b) Min. amount of retention trees 5-10 trees/ha, depending on the performance level (the best suitable range accepted by a local authority)

Additional mandatory criteria would consist of:

1. Forest regeneration of harvested areas takes place by using either natural or artificial regeneration. Time for establishment of a new stand depends on climate and soil conditions.
2. Primary forest protection.
3. The use of fertilisers is only allowed on a limited size at the treatment site, taking into account needs to improve nutrient balance, including at afforestation and reforestation sites.

4. Improved efficiency of existing drainage on peatlands which is done according to water management and restoration plans.
5. Diversification of the composition, structure and function of the forest stand by favouring locally-suited and climate adapted species when possible taking into account the natural fertility of the soil and climate conditions, which may lead in naturally occurring mono-specific forests.
6. Riparian buffer zones with unmanaged soil ground alongside seas, lakes, rivers and creeks/brooks, in which selective logging is possible. Width of the zones are based on national decision and guidance taking into account vegetation, soil quality and slope.
7. Preservation of the characteristics of valuable habitats representing the vegetation zone based on national nature and forest legislation.
8. The use of pesticides is only permitted in special cases and alternative approaches or techniques, which may include non-chemical alternatives to pesticides, are favoured, in accordance with Directive 2009/128/EC, with exception of occasions where the use of pesticides is needed to control outbreaks of pests and or diseases.
9. Maintenance of soil quality is considered using the most recent geographic, spatially explicit information available including soil structure, sloping, moisture taking into account seasonal variation.
10. Machinery is deployed in a way as to safeguard good soil structure.
11. Soil preparation is done when needed to ensure successful regeneration and to avoid forest loss.

A second class would include obligatory set aside areas, e.g.:

1. Areas protected or set aside for restoration, in which logging activities are prohibited, are identified in accordance with international and national law. If the protection objectives and decisions require/allow for logging activities, it can be done in accordance with the CBD ecosystem approach taking into account the protection objectives and decisions.
2. Natural wetlands, namely land that is covered with or saturated by water permanently or for a significant part of the year in which logging activities threats natural water cycle and water quality.
3. Primary forests as defined by FAO (Global forest Resources Assessment, 2020).

Additional set aside areas with specific biodiversity conservation values would consists of, e.g.:

1. Forests that haven been voluntarily set aside permanently or temporarily in managed forests. Voluntary agreements are done with the national authorities and the sites are selected according to their ecological structure and their value for biodiversity based on the criteria set by the national authorities. These forest areas include both areas the forest owner has sold permanently to the State and those that are still owned by the forest owner.
2. In a country with lots of peatlands: Earlier drained peatlands in actively managed forests voluntarily provided to restoration. Voluntary agreements are done with the national authorities and the sites are selected according to their ecological structure and their value for biodiversity based on the criteria. These areas include both areas the forest owner has sold permanently to the State and those that are still owned by the forest owner.

In addition, we should address complementary biodiversity actions, where the forest owner or operator choses at least three practices, among the below listed, which are relevant to their local conditions.

a. Transition to continuous cover forestry, if suitable for local conditions
b. Restoration of peatlands
c. Afforestation and reforestation
d. Ecological corridors
e. Leaving thickets in forest management to give protection and shelter for fauna
a. Old-growth forest protection
b. Climate-adapted species used in regeneration
c. Habitat trees designation
d. Use of fire for habitat management and/or control burning for silvicultural purposes according to the instructions from the national authorities
e. Increased rotation period

Within two years after the beginning of the activity and every 10 years thereafter, the compliance of the activity the substantial contribution to biodiversity criteria and the DNSH criteria is verified by either of the following at the sourcing area or at forest management unit of the forest owner (if financing is for a single forest owner): the relevant national or regional competent authorities; an independent third-party certifier or at the request and cost of national authorities or the operator of the activity.

In order to reduce costs, audits may be performed together with any forest certification, climate certification or other audit. The independent third-party certifier may not have any conflict of interest with the owner or the funder, and may not be involved in the development or operation of the activity.

The auditors would verify the implementation of the actions and subsequent development towards the biodiversity benefit goal over a period of 30 years by assessing structural features based on thresholds decided at national level within the sourcing area or forest management unit. The long-term biodiversity benefits are considered to be demonstrated by showing that structural features are developing favourably, without compromising others. Assessment of a single species is not included in the audits. Assessment is done by using sample-based monitoring.

The compliance with the criteria for substantial contribution to climate change mitigation and with DNSH criteria may be checked at the level of a forest sourcing area as defined in Article 2, point (30), of Directive (EU) 2018/2001 or at the level of a group of holdings sufficiently homogeneous to evaluate the risk of the sustainability of the forest activity, provided that all those holdings have a durable relationship between them and participate in the activity.

As the First Delegated Act and the DNSH criteria have been in force for a year, there is no need to change their content yet.

**Scientific evidence**

The scientific literature used behind the mandatory TSC thresholds cannot be generalised to deliver substantial contribution across all forest ecosystems. This point was raised during the public consultation but not sufficiently addressed during the TSC finalisation. In addition, four (out of five) additional forest scientists that were involved in the Platform's work as of spring 2022 commented that the draft TSC were based on a one-sided approach on forest management and therefore questioned their scientific relevance. These scientists also stressed that the references were primarily based on a conservation-based selection of literature and were insufficient to capture all types of forest management and related biodiversity measures. Hence, their request was to fundamentally change the Platform's draft TSC.

Ultimately, the final TSC only includes a limited number of changes in response to comments made during the public consultation and by additional scientists.

# Part B: Technical screening criteria

This section includes the following technical screening criteria:

**1. Agriculture, Forestry and Fishing**

1.1 & 1.2 Agricultural production (Option C)

1.4 Forestry and logging

**2. Manufacturing**

2.14 Manufacture of chemicals

2.15 Manufacture of chemical products

2.16 Manufacture of basic pharmaceutical products

2.17 Manufacture of pharmaceutical preparations

2.18 Manufacture of plastic packing goods

2.19 Manufacture of copper

**4. Civil Engineering**

4.3 Use of concrete in civil engineering works

**5. Buildings**

5.3 Demolition of buildings and other structures

**6. Transport**

3.3 Manufacture of low carbon technologies for water transport

6.7. Inland passenger water transport

6.8. Inland freight water transport

6.9. Retrofitting of inland water passenger and freight transport

6.10 Sea and coastal freight water transport, vessels for port operations and auxiliary activities

6.11 Sea and coastal passenger water transport

6.12 Retrofitting of sea and coastal freight and passenger water transport

**8. Restoration, remediation**

8.5 Hotels, holiday, camping grounds and similar accommodation

**9. Water supply**

9.2 Desalination

**E. Enabling activities**

E.1 Marketplace for the trade of second-hand goods for reuse

E.2 Provision of IT/OT data-driven solutions and software that provide a substantial contribution to circular economy

E.3 Provision of IT/OT data-driven solutions that provide a substantial contribution to the use and protection of water and marine resources

E.4 Manufacture and installation of, and associated services for leakage control systems enabling a substantial contribution to sustainable use and protection of water and marine resources

E.5 Manufacture, installation, and servicing of high, medium and low voltage electrical equipment for electrical transmission and distribution that result in or enable substantial contribution to climate change mitigation

# 1. Agriculture, Forestry and Fishing

## 1.1 & 1.2 Agricultural production (Option C)

*Description of the activity*

Animal production

These criteria cover the raising (farming) and breeding of all animals, except aquatic animals. These activities are classified under the following NACE code 1.4 which includes raising of:

- 01.41 - dairy cattle;
- 01.42 - other cattle and buffaloes;
- 01.43 - horses and other equines;
- 01.44 - camels and camelids;
- 01.45 - sheep and goats;
- 01.46 - swine/pigs;
- 01.47 - poultry;

Crop production

These criteria cover the growing of crops in open fields. At this time, they do not cover growing of crops in greenhouses or other indoor settings. These activities are classified under the following NACE codes:

- Growing of non-perennial crops:
    - 01.11 - cereals (except rice), leguminous crops and oil seeds;
    - 01.12 – rice;
    - 01.13 - vegetables and melons, roots and tubers;
    - 01.14 - sugar cane;
    - 01.15 – tobacco;
    - 01.16 - fibre crops;
    - 01.19 - other non-perennial crops
    - 01.28 - spices, aromatic, drug and pharmaceutical crops;
- 1.2 Growing of perennial crops:

- 01.21 - grapes;
- 01.22 - tropical and subtropical fruits;
- 01.23 - citrus fruits;
- 01.24 - pome fruits and stone fruits;
- 01.25 - other tree and bush fruits and nuts;
- 01.26 - oleaginous fruits
- 01.27 - beverage crops;
- 01.28 - spices, aromatic, drug and pharmaceutical crops;
- 01.29 - other perennial crops

**Mixed farming** (NACE code 01.50)

Substantial contribution to the protection and restoration of biodiversity and ecosystems (Proposal 1 Ensuring a farm-gate nitrogen balance respecting regionally specific biodiversity limits)

At the end reducing nutrients such as nitrogen can only be implemented on the holding via balancing nutrient inputs with the outputs of the agricultural system[6]. This proposal guides the farms to use nitrogen efficient, regarding regionally differentiated sensitivities to nitrogen.

This approach is based on farm-gate nitrogen balance limits (N-input – N-output) giving farmers the possibility to choose the necessary and targeted N-reduction measures on their farms. These limits are regionalized and take into account: 1) the capacity of different ecosystems in buffering nitrogen pollution, 2) the differing pollution impact of nitrogen which varies depending on soil, slope and climate, 3) the locally varying N pollution from other sectors which affects the "allowable" N losses from agriculture and 4) different rates of denitrification. Additionally, the approach differentiates balance limits according to type of fertilizer (manure or mineral) , defining balance limits to ensure a sustainable livestock-area-balance. These tailored limits are needed to incentivize the better use of organic manure, after which mineral fertilizer and thus the overall amount of nitrogen entering the nitrogen cycle can be reduced.

The regionalized balance limits consider thresholds for critical ammonia emissions in view of nutrient enrichment of terrestrial ecosystems (biodiversity effects) and b) critical N concentration in surface waters to avoid eutrophication (biodiversity effects). They do not take

[6] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590574123338&uri=CELEX:52020DC0380

into account nitrate/nitrogen leaching to groundwater and related health effects as we are targeting biodiversity. .

A note for further application: This proposal is put forward for substantial contribution to biodiversity and ecosystems but is equally applicable to substantial contribution of sustainable use and protection for water and marine resources and substantial contribution to pollution prevention and control – as balanced nitrogen fertilization tackles the overall reduction of nitrogen emissions.

Overview

The holding must comply with[7]:

1.1 Regional and farm-specific farm-gate nitrogen balance limit; AND

1.2 Maximum farm-gate nitrogen limit; AND

1.3 Minimum nitrogen use efficiency (NUE) AND

1.4 Application limit for organic fertiliser

To give an example, a cropping farm produces solely wheat with 170kg N/ha output using 200 kg N/ha mineral fertilizer. This farm has an NUE of 85% which is well above the Min. NUE of 70%. If the farm-gate nitrogen balance value of 30kg N/ha/yr of the farm is below the regional permissible farm-gate nitrogen balance limit (see chapter 0, right column) the farm complies with the taxonomy criteria for farm-gate nitrogen balance respecting regionally specific biodiversity thresholds.

The values for the first three criteria above will be provided to the farmer by a virtual Web-Application (App). The App re calculates the criteria based on farm-data as well as regional and supra-regional data provided by EU, national and regional authorities. The App will also support the farmer in calculating their own farm-gate nitrogen balance limit and its NUE based on farm-specific data and help the farmer to compare actual farm values with the taxonomy criteria in order prove compliance.

Further details on these four requirements are given below.

**1.1 - Regional and farm specific farm-gate nitrogen balance limit:**

[7] For 1 and 2 the lower value is relevant.

The agricultural holding must show annually that over a rolling average of three years its farm-gate balance does not exceed the permissible regional- and farm specific farm-gate balance limit.

*N.B. The component for the regional specification is explained in the chapter Critical surplus limits respecting regionally specific biodiversity thresholds.*

*The value for the balance limit is also determined by the nitrogen-manure prevalent at the farm. This is necessary in order to give credit to the smaller NUE of manure as fertilizer (see chapter Setting tailored balance limits for different farm types) the farm-gate balance limit increases proportionally to the nitrogen-manure prevalent at the farm (without losses, including im- and exports). The rate at which the limit increases depends on the animals and the according potential efficiency of the manure. At a nitrogen-manure limit of 120 kg N/ha/a no further increase of the permissible farm-gate balance limit is possible (see Figure 1).*

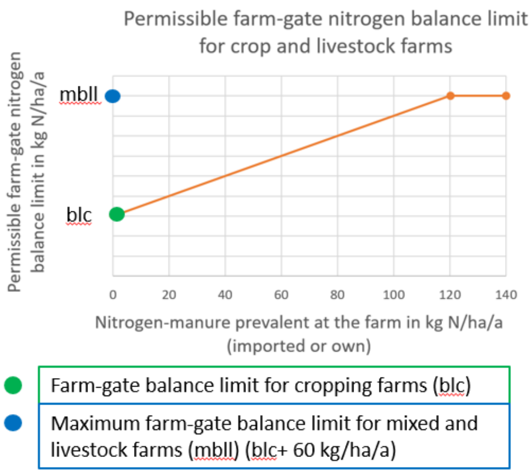



*Figure 1: Defining the permissible farm-gate nitrogen balance limit depending on manure-nitrogen prevalent on the farm (imported or own, excluding exported) and regional critical surpluses/ nitrogen sensitivities of ecosystems measured in kg N/ha/a. The slope of the curve depends on the livestock-type (different NUEs, for different manure)*

***Methodological notes for the development of the regional and farm-specific farm-gate nitrogen balance limit***

*a) Calculating the farm-gate nitrogen balance*

The farm-gate nitrogen balance (equivalent to the farm N surplus defined by EUNEP – see right column) is the difference between nitrogen inputs and nitrogen outputs to and from the farm.[8]. (see Table 1).

*b) Inputs and outputs that must be accounted for in the farm-gate nitrogen balance*

*Table 1: List of in- and outputs in the balance*

| Nitrogen input | Nitrogen output |
| --- | --- |
| – Mineral fertilizers<br>– Imported feed<br>– Biological nitrogen fixation<br>– Seed and planting material<br>– Bedding material (straw, saw dust)<br>– Atmospheric N deposition<br>– Imported animals<br>– Irrigation water<br>– Imported compost and sewage sludge and other organic fertilizer<br>– Imported animal manure [9]<br>– Imported digestates *<br>*For calculation of nitrogen content of imported feed and fertilizers see below* | – Crop products<br>– Exported animals<br>– Animal products<br>– Exported feed<br>– Exported compost and sewage sludge and other organic fertilizer<br>– Exported animal manure<br>– Exported digestates *<br>*For calculation of nitrogen content of exported fertilizers see below* |

*c) Determining the nitrogen content of in- and outputs*

The N-content of the in- and outputs of the nutrient balance are determined by values integrated in the App. In principle there are three ways with different degrees of differentiation: testing the nitrogen content on the farm, using data from regional authorities or using the look-up table provided by the EUNEP-document. The nitrogen content of a representative manure

[8] EU Nitrogen Expert Panel (2016) Nitrogen Use Efficiency (NUE) – Guidance document for assessing NUE at farm level. Wageningen University, Alterra, PO Box 47, NL-6700 Wageningen, Netherlands. http://www.eunep.com/wp-content/uploads/2019/09/NUE-Guidance-Document.pdf

sample of the bulk of the material from which it is taken has to be conducted on a regular basis (see rules on fertilizer plan). In order to encourage growing legumes, it is possible to leave out the biological fixation in the balance.

*d) Calculation of nitrogen content of imported feed*

In the case of livestock production we comprise with the farm-gate balance approach two systems with different boundaries[10]. A farm which imports all or part of its feed has a comparatively lower N-input in the balance than a farm that would produce the same feed completely or partly on its own land[11]. In order to take account of the required N for the production of this feed and not to disadvantage mixed livestock farms over landless livestock farms, nitrogen imported via feed must be multiplied by the inverse nitrogen unit efficiency (NUE) of the feed production if known (preferable) OR with a factor of 2 (this means a conservative NUE of 50%, taking into account potential losses).[12]

*e) Calculation for nitrogen manure im- or exported*

In case that manure is imported to a farm or exported from a farm, the losses that occur during management (storage or housing) of the manure are attributed to the exporting farm and losses that occur during field application are attributed to the importing farm. In case that these losses cannot be calculated the losses are distributed evenly[13] between storage and housing on the one hand and field application on the other.

*f) Calculation of nitrogen content in anaerobic digestates*

Anaerobic digestates are not included in the EUNEP document but can contribute substantially to nitrogen surpluses and need therefore be integrated. Factors of N-content in digestates need to be obtained from the fertilizer plan by taking into account the amount of feedstock and its nitrogen content. If this is not possible, we recommend for calculation for digestates from energy plants a nitrogen content of 0,85% and for digestates from organic manure and energy plants (50/50) a nitrogen content of 0,71%[14]

[10] EU Nitrogen Expert Panel (2016) Nitrogen Use Efficiency (NUE) – Guidance document for assessing NUE at farm level. Wageningen University, Alterra, PO Box 47, NL-6700 Wageningen, Netherlands. http://www.eunep.com/wp-content/uploads/2019/09/NUE-Guidance-Document.pdf

[11] The reason for that is that the production of feed requires additional or virgin N in form of fertilizer (or more rarely as biological fixation).

[12] In this context it is still unclear how the criteria should deal with exported feed. A multiplication with 2 on the output-side be straightforward for a clean balance, but that would advantage feed production over food production.

[13] If better values are available, these should be used.

[14] https://www.ktbl.de/webanwendungen/wirtschaftlichkeitsrechner-biogas

*g) Livestock farms with little utilized agricultural area (UAA)*

If a livestock farm imports feed, to either completely or partly feed its animals and requires therefore additional cropping area for manure application in order to comply with the nitrogen-balance criteria, it must prove that the exported manure is applied according to the rules defined in these criteria. This applies also when the farm exports manure in form of digestates. Ideally this is done in such a way that the importing farm and exporting farm create their nitrogen farm-gate balance together. Treatment of manure is allowed as long as the farm using the treated manure can prove that in the treatment process no N was lost to the environment.

*h) No data available for three consecutive years*

If this is the case, the agricultural holding can also rely on farm-gate nitrogen balance calculations of the last two years, or if not available over the last year. This criterion is only valid for the farm at the beginning of the accounting period. In extreme cases such as droughts or unexpected yield losses, the year can be exempted from the rule.

**1.2 Maximum farm-gate nitrogen balance limit**

In case that the critical surpluses and therefore the region-specific nitrogen farm-gate balance limits are very high, the farms must comply with maximum general farm-gate nitrogen limits.

N.B. These limits can be provided by national authorities. As a starting point, the values provided by the German expert group responsible for developing a suggestion for a material flow ordinance for the German government[15] are proposed. Here the overall limits are differentiated for different fertilizer type (see Table 2) for a nitrogen-manure prevalent at the farm up to 120 kg N/ha/a. The farm specific maximum farm-gate balance limit must be calculated with a weighted average for each farm according to the quantity and fertilizer type applied at the farm

*Table 2: Maximum nitrogen farm-gate balance limit for different fertilizer types and animal categories*

| Animal category | Fertilizer type | Maximum permissible balance limit in N kg/ha/a |
|---|---|---|
| Cattle | Liquid manure | 64 |
| Cattle | Solid manure | 106 |

[15] Löw, P, Osterburg, B. Garming, H. Neuenfeldt, S. et al. Evaluierung der Stoffstrombilanzverordnung, Deutscher Bundestag - 20.Wahlperiode, Drucksache 20/411. https://dserver.bundestag.de/btd/20/004/2000411.pdf.

| | | |
|---|---|---|
| Pigs | Liquid manure | 52 |
| Pigs | Solid manure | 100 |
| Poultry | | 64 |
| Other livestock | | 100 |
| | Biogas digestate | 64 |
| | Mineral fertilizer | 35 |

### 1.3 Minimum Nitrogen Use Efficiency

Each farm holding utilizes nitrogen at least with a minimum NUE (Nitrogen Use Efficiency) where the NUE is farm-specific and calculated according to farm production types.

The following values are proposed (see 14 Defining minimum NUE limits):

- NUE crops: 70%
- NUE mixed crop-livestock systems granivores: 40%
- NUE mixed crop livestock systems ruminants: 30%

Where mixed refers here to farms that produce feed and animal products.

That the farm-specific minimum NUE complies with the actual reference farm-NUE has to be demonstrated with the data collected in the farm-gate balance sheet.

N.B. The calculation of the minimum as well as the reference NUE is described below.

For future versions of this criteria, regional tables for permissible losses for different production types or losses according to best available practice values are proposed.

Methodological notes:

- The reference NUE of the farm is calculated as the ratio of total nitrogen output in products of the farm and total nitrogen inputs: NUE = [Σ(N output) / Σ(N input)] * 100 (see Table 1). This NUE must be higher or equal than the minimum NUE.
- Farms that produce more than one product type must apply a weighted minimum NUE. This weighted minimum NUE is calculated by multiplying the share of the N-output of the according product (crop, ruminant or granivore) with the according NUE and adding up the numbers. (For example: farm produces (outputs) 70 % N in crop products and 30 % in granivore products, its weighted Min-NUE is 0.7*70

+ 0.3*40% = 61 %, livestock farms: 50% ruminant products and 50% granivore products, the resulting weighted NUE would be 35% (0.5*30%+0.5*40%)).

- For livestock farms that have no or only little own UAA and must export most or all of their manure this system cannot be applied. These farms must make a cooperation with a cropping farm and create a virtual farm gate balance. This balance must be submitted together.

### *1.4 Application limit for organic fertilizer*

The agricultural holding must show that the yearly quantity of organic fertilizer applied does not exceed:

- 120 kg N/ha for cropping land
- 140 kg N/ha for grassland land

This application limit applies for each ha and is not averaged over the UAA of the holding.

Substantial contribution to the protection and restoration of biodiversity and ecosystems (Proposal 2 - Low nitrogen pollution and efficient nutrient cycling in integrated farming)

**Intensification of farming and increased nitrogen pollution**

Farming's contribution to the exceedance of the planetary N boundary (a biodiversity problem as well as related to climate change, water pollution, etc), is largely caused by high volumes of "new" reactive nitrogen being fixed for mineral fertiliser and its over-application and inefficient uptake (i.e. low nitrogen efficiency)[16.] "The scale and pace of change are startling and worrisome: in only two generations, humans have become the dominant influence on global nitrogen cycling' (Townsend and Palm, 2009).

85% of Europe exceeds one or more regulatory thresholds for N pollution in dry deposition, run-off and groundwater (Schulte-Uebbing & de Vries, 2021). The European Union's Farm to Fork Strategy seeks a reduction in nutrient losses of at least 50% by 2030, while ensuring no deterioration in soil fertility (EC 2020).

**Integrated farming**

[16] The use of the Haber Bosch process to create mineral fertiliser is the largest cause of "new" reactive N in the world's N cycle (see SCU 2013 for an overview).

Whereas Proposal 1 provides a route to compliance that is data driven and neutral regarding type of farming, this proposal is focussed on reducing "new" reactive nitrogen from the creation of mineral fertilisers, through farming that fixes and efficiently cycles its own nitrogen primarily on site. Farming's contribution to the nitrogen crisis is often attributed to the separation of crop and animal farms which began in some parts of the world post second world war and continues as a trend to this day (although mixed farming remains common in many regions in the "developed" and "developing" worlds)[17]. The separation of arable and crop production resulted in the intensification of both, relying on greater flows of N from mineral fertiliser and severing the efficient nutrient cycling between livestock and crops which may occur in mixed and other integrated farming systems[18], and which self-limits the overall flows of reactive nitrogen due to what is possible within the land's own N cycling capacity.

Mixed, or other "integrated agricultural systems" [19] that combine animals and crops, commonly focus on onsite N fixation (through biological nitrogen fixation) and use animals as onsite nutrient recyclers, converting N taken up by plants (e.g. by legumes, catch crops, pastures) into excretions which can transfer N wherever needed onsite (e.g. to cash crops or hydroponics and aquaculture etc). A great many ways of doing this are possible such as rotations of nitrogen fixing crops, cash crops, pastures and fallow; sophisticated grazing rotations (e.g. combining the niches of different livestock such as cattle, poultry, sheep) on permanent or temporary pasture or catch crops; agroforestry that combines simultaneous crop and animal production (and utilisation of manures from wild animals such as birds)[20]; cleaning up and re-utilisation of nitrogenous manures and slurries through passing them transformation processes such as composting, using effluents to grow an aquaculture crop in

[17] Watson *et al*, 2008… "Changes in agricultural subsidies in Europe and the ready availability of fertilizers have allowed a spatial decoupling of livestock and crop production. This has increased the flow of nutrients that occurs between farms compared to within individual farms. In terms of nutrient cycling, mixed farms provide the opportunity to re-integrate aspects of agricultural production. The degree of integration between crop and livestock production is defined by the reliance on the use of home-produced feed compared to imported feed, and is independent of intensity. Management of inputs and/or internal flows offers the scope to improve nutrient use efficiency (NUE) on mixed farms" (Watson *et al*., 2008). See Halberg *et al*., 1995; Oomen et al 1998; Schroder 2005; Lantinga *et al.* 2004 & 2013; Lin *et al.,* 2016; Chmelíková *et al*., 2021.

[18] Any form of farming can be done well or badly, including mixed farming in which there may be a wide range of nutrient use efficiencies (Watson et al, 2008, Ryschawy *et al.,* 2012) although some researchers point to a generally higher potential for high NUE in integrated farms (see Oomen et al. (1998); Eltun et al. (2002); Lantinga et al., (2004; 2013); Ryschawy *et al.* (2012). However, at farm scale, without considering supply chain complications, higher NUE is often demonstrated by segregated farms due to the predictability of using mineral fertilisers, but "this improvement disappears completely when evaluated at higher levels of integration" (Schroder, 2005).

[19] "integrated agricultural systems have multiple enterprises that interact in space and time, resulting in a synergistic resource transfer" (Hendrickson *et al*., 2008).

[20] See Kay et al, 2019. Lin et al (2016) also show agroforestry can reduce N inputs whilst maintaining protein output.

“multi-trophic farms”, or passing it through a constructed wetland that can itself provides a plant yield; and so on[21].

Integrations of animal and plant production systems can result in nitrogen fixation that is tied to the productivity of the land area being farmed, reduce overall fluxes of N, and encourage tighter loops of nitrogen cycling and therefore require less import of reactive nitrogen and result in less excess as either gaseous or liquid N pollutants.

In addition to crop-animal integrations, these criteria may also be applicable to predominantly livestock systems (e.g. dairy or meat production) where the limits herein on stocking densities, on-site forage production, and manure application rates are met. In such cases, the “integration” between plant and animal (producer and consumer/nutrient cycler) is between herbage growth and livestock. Such holdings may also be eligible for Option A (Grazing is beneficia for biodiversity), but where the holding does not meet the 50% biodiverse pasture requirement of option A (e.g. due to having a dominance of improved pastures), it could either increase its biodiverse pasture to comply with Option A, or achieve substantial contribution through effective N management (this option).

However, improved pastures are less biodiverse than those focussed upon in Option A. Therefore, safeguards are in place in this option to ensure this route to compliance is not used as a means to reduce biodiverse pasture whilst remaning taxonomy compliant. No reductions of biodiverse pastures is permissible in any option, in addition to which, this option does not permit reductions in extent of, or quality of permanent pastures (through further intensification such as increased nutrient loads, alterations to hydrology, etc).

Whilst perhaps less likely, this route to compliance could also be available to farms with no livestock. As counterintuitive as that may seem, an activity solely growing crops but reutilising biologically fixed nitrogen through composts, mulches, alley-cropping, wormeries, etc, could also comply. The nutrient cycling between producers (plants) and consumers (animals) is in fact, in any farm, not just achieved through the interaction of crops and animals such as cows, sheep, horses, goats, poultry, pigs etc, but also by invertebrates and a multitude of microscopic decomposers.

**Co-benefits of integrated farming**

The segregation and intensification of modern agriculture has many implications, including land-take, simplification of agricultural habitats and consequent loss of biodiversity, and the

[21] See Kronberg *et al*. for examples (2021).

risk of adversely altering its own resource base and sustainability, including the structure, organic matter (including carbon) and mineral content of soils (see Hendrickson et al., 2008). In contrast, integrated farms offer many likely benefits beyond a reduced likelihood of nutrification of soils and water bodies.

Nature-based solutions, such as buffer zones, hedges, flower-strips, scattered trees and tree shelter-belts, natural and constructed wetlands, can be effectively used to reduce nitrogen pollution whilst simultaneously providing habitat for wildlife. This win-win for direct biodiversity impacts as well as indirect benefits through N abatement, is encouraged herein.

Mixed farms can be expected to provide more niches for biodiversity than specialised farms due to greater variety in crops, livestock, their spatial structure and interactions and the many niches such interconnectivity generates (see Benton *et al,* 2003; Fahrig *et al*, 2011; Sirami *et al,* 2017). Integrated systems can also have improved resilience to economic and environmental shocks due to reduced dependence on external inputs of N and increased diversity of on-farm production systems and resources (see Hendrickson *et al*, 2008)[22]. General ecosystem services can be expected to be enhanced, for instance, hydrological and climatic regulation due to improved soil organic matter due to an emphasis on organic fertiliser (Price *et al*, 2011, p.28). Mixed farms may be more resilient to pests and diseases and therefore have less need of pesticides. Such benefits are generally relevant worldwide[23].

**This proposal**

This proposal provides a compliance route for low nutrient pollution integrated systems, and an incentive to diversify specialised livestock systems and specialised crop systems into integrated systems adjusted to the local environment (such as its climatic conditions, soils, hydrology and biodiversity). The farming being encouraged operates predominantly within its ecological carrying capacity, in application of the proximity principle, both in terms of input provision and recycling of potential outputs. This option encourages eco-effective agriculture modelled on how ecosystems work, sensitive to place, in contrast to imposing intensive modifications of the land and water system and reliance on import of resources (and the

[22] In the USA, for example, the 20th century saw the average number of commodities produced per farm reduce from 5 to just 1 (Dmitri *et al*, cited by Hendrickson et al, 2008).

[23] In the Caribbean, for instance, "Mixed farming systems (MFS) have demonstrated some success by focusing on the use of integrative and holistic mechanisms, and rationally building on and using the natural and local resource base without exhausting it, while enhancing biodiversity, optimizing complementarities between crops and animal systems and finally increasing opportunities in rural livelihoods" (González-García *et al.,* 2012).

productive space implication thereof) or export of wastes (and the pollution and externalities thereof).

A taxonomy compliance route for mixed farming is not a niche preoccupation, but rather encourages tried and tested sustainable farming techniques with great utility globally. Billen *et al*. (2021) model that European, indeed global, food requirements can be met, whilst drastically cutting (in half) N pollution, and without the need to import livestock feed, through a combination of prioritising biological nitrogen fixation (they exclude the use of mineral fertilisers) and re-integration of crops and animals, in combination with the circular economy aspect of utilising human manures and, on the demand side, dietary adjustments.

According to UNECE (2014, p.18):

*"Nitrogen management can be defined as "a coherent set of activities related to the handling and allocation of N on farms to achieve agronomic and environmental/ecological objectives. The agronomic objectives relate to crop yield and quality, and animal performance in the context of animal welfare. The environmental/ecological objectives relate to minimizing N losses from agriculture. "Taking account of the whole N cycle" emphasizes the need to consider all aspects of N cycling…*

*…Nitrogen management varies greatly across the ECE region, and NH3 emissions will vary accordingly. In general, emissions of N tend to decrease when: (a) All N sources on the farm are fully considered in a coherent whole-farm perspective and a whole N-cycle perspective; (b) All N sources are stored and handled properly; (c) Amounts of N used are strictly according to the needs of growing plants and animals; (d) N sources are used in a timely manner, using the appropriate techniques, in the appropriate amounts and appropriate place; (e) All possible N-loss pathways are considered in a coherent manner.*

*… The N cycle is strongly linked with the carbon cycle and with other nutrient cycles. Hence, managing N may affect the cycling of carbon and the net release of CO2 into the atmosphere and the sequestration of carbon in soils. Generally, a leaky system for N is also a leaky system for carbon, and vice versa. This highlights the importance of considering N management from a whole-farm perspective.*

This option provides a "whole farm perspective", applying coherent principles of nitrogen management at the scale of the holding. These criteria:

- Permit both the use of manures (and other onsite produced organic fertilisers such as slurry, compost, digestates, biosolids) and mineral fertilisers. However, organic fertilisers produced on-site are prioritised in order to limit "new" nitrogen to that which can be largely fixed and cycled within the land area of the activity. By prioritising nitrogen fixation through on-farm plants, and N cycling through manure generated on site, the criteria effectively require the activity to be operating integrated farming. Some flexibility is given to the import of N from mineral or organic sources, albeit at a low level of N pollution risk.

- Total N input limits are set, primarily through a limit on N applied per hectare from organic fertilisers such as manure, ensuring that production is based primarily on farm N cycles rather than excessive N imports. The limits to organic fertiliser application are based on application rates that avoid nutrification due to exceeding the ability of plants to take-up nitrogen efficiently.

- In addition to the organic fertiliser application limits, limits on livestock units per hectare further ensure the intensity of livestock production is restrained by the N processing capacity of the land. There is a relationship between stocking density and leaching from pasture, which this measure limits (Watson *et al*., 2008). An average stocking density makes it impossible to have intensive indoor housing units requiring more imported feed than the land can generate, thus avoiding high N losses associated with such facilities and the supply chain farming required to produce their feed. Livestock are also required to free-range to the extent possible.

- 100% on-site reutilisation of livestock manures is required, to ensure the scale of livestock production is tethered to the capacity of the land to receive and recycle nitrogenous wastes. Prioritising on-farm nutrient cycling helps minimise the need to buy-in manure or mineral fertiliser – which remains an option but within the manure application limits and mineral fertiliser application limits.

- Limits are placed on the amount of mineral fertiliser that can additionally be used, in proportion to manure. Although organic farming does not permit use of mineral fertilisers (but does permit imported manure), these criteria do allow a minority proportion of mineral fertiliser use. This provides some flexibility to the farmer, and insurance against mistakes in the planning of crop/animal integration, and acknowledges the potential usefulness of mineral fertilisers (e.g. both in terms of methods of application and the predictability of their N supply).

- Given the mineral fertiliser limits, it will be in the activity's interest to consider efficient on-site fixation and utilisation of nitrogen (e.g. as appropriate through rotation, green manures, herbal leys, permanent pasture, composting, etc)

- The N cycling efficiency of this integrated farming, and low pollution outputs, are guaranteed not only through limits to the intensity of operation based on the land's capacity to generate and reutilise nitrogen, but also through **best practices** in cropping, livestock production, manure storage and riparian buffer zones. Even mixed farming, with its high capacity for N efficiency, nevertheless has potential points of considerable N losses (e.g. during manure storage, or after "ploughing-in" of temporary pastures - see Watson *et al,* 2008), which need to be minimised through good practices.[24]
- Safeguards are also in place to reduce the risk of nitrogen pollution to nearby sensitive habitats.

**The criteria at a glance**

- Keep within organic / mineral fertiliser totals
- Ensure at least 80% of N fertilisers are organic fertilisers produced on-holding
- Grow at least 75% of any livestock feed on-holding and get the rest locally / from certified sources
- Recycle all livestock excreta on-holding
- Have sufficient vegetated buffer zones of freshwater bodies to remove majority of N from soil run-off and through-flow
- Adopt certain practices on cropping, outdoors livestock, indoors livestock and manure storage, and choose from a menu of others.
- Observe safeguards such as ensuring at least 15% non-productive high biodiversity landscape features, no decline in quantity or biodiversity value of permanent pastures, free-ranging of livestock, and protection of nitrogen sensitive sites.

**How this option differs from organics (Option B)**

These criteria have some similarities to organic certification, but go further in defining robust on-farm N cycle criteria through the application limits of manure; the % of that N that must come from onsite; the necessity to utilise all livestock manures onsite; and the extent of

[24] For instance, on manure: "Undeniably, it is easier to manage mineral fertilizers than manure. However, when proper attention is given to the composition of manure and decisions on rates, timing and placement are made correspondingly, the nitrogen fertiliser value can be enhanced. This should lead to a drastic reduction of mineral fertilizer use, nutrient surpluses and environmental pollution. Under such conditions, `manure', `precision farming' and `environment' can become reconciled again." (Schroder, 2005).

riparian buffer zones to tackle leachate. However, organics does prohibit all imported synthetic N, which these criteria refrain from in the interests of allowing some flexibility. Organics does not, however, prohibit import of organic fertiliser, which itself may be the result of systems using mineral fertiliser[25]. Also, because of the N focus of these criteria, wider aspects of organic certification are not mandated such as using only organics-approved plant protection products. However, these criteria do borrow from free-range stipulations in organics.

***A note on Nitrogen Use Efficiency***

*Consideration was given as to whether or not to stipulate minimum levels of nitrogen use efficiency within Proposal 2. During consultation, the opinion was voiced that the simpler the criteria, the better, and calculating NUE inevitably involves requiring the farmer to deploy data and attempt the calculation, or use a tool, and some farmers will neither wish to do so 'nor to employ someone to do it.*

*The question was also considered as to what method of NUE calculation to use. Should an overall NUE at holding level be stipulated, or should the NUE of particular outputs be calculated (based on those in Proposal 1 for crops, ruminants and monogastrics)? Further, should every N aspect be calculated (including atmospheric deposition, biological N fixation, inputs of seeds, bedding, etc – as is viable in Proposal 1 due to the use of the FAST Tool), or would this be both unrealistic and unnecessary given the overriding logic of on-site N cycling guaranteed by these criteria?*

*Further, the variability in NUE in systems qualifying as "integrated" could be considerable and make a catch-all target less meaningful. For example, taking a simplified approach of NUE as purchased inputs vs sold outputs, Lantinga et al (2004) give an example of a mixed farm purchasing 27 Kg N / Ha as concentrates, with outputs being 65 kg / N / Ha – a positive NUE of 1.75. This positive ratio was possible because the farm utilised considerable flows of atmospheric N deposition as well as on-site biological N fixation. Lantinga et al (2013) achieve 73% NUE (involving considerable bought-in fertiliser) on a model Wageningen University*

[25] "The main difference between organic and non-organic farm nutrient flows was the replacement of mineral fertilizers with organic inputs. However, the magnitude of nutrient flows were generally similar for organic and non-organic farms. Certified organic farms with positive nutrient budgets had a heavy reliance on external inputs. Continued high dependence on an external supply of nutrients, which typically originate from mineral sources, poses a significant challenge to organic farmers' fulfilment of the principles of organic agriculture… The use of fertility building rotations and leys is not practised sufficiently on organic farms investigated" (Oelofse *et al.,* 2010).

*farm, similar to Ryaschawy et al (2012)'s survey of 48 mixed farms in Gascogne which achieved an average of approx. 70% NUE (based on N out/N in, from their Table 5).*

*It was concluded that given the range of different farming systems applicable to this proposal, and the strong on-holding N cycling logic, and the general desire for simple criteria, that requiring a minimum NUE was not necessary. Indeed, a farm could be low input, low output, and low pollution, and its NUE would not be very material to biodiversity.*

**Specific criteria for proposal 2**

**1 Fertiliser N inputs**

**1.1 Total organic fertiliser input**

The yearly quantity of organic N fertilisers applied (i.e. manure/slurry/urine/biosolids[26]/composts) does not exceed:

- **120 kg N/ha** for **cropping land**
- **140 kg N/ha** for **grassland land***

*This total may be exceeded only in the case of grazing pasture when 100% of the feed is from the grazing of pasture and no feed or fertiliser is imported. In such cases, the stocking densities in Table 4 may also be exceeded provided all other criteria are met, and provided manures from any housing units are distributed to land in such a way as to avoid peak loads to particular areas (10% more per Ha than average).

**1.2 Ratio of organic to mineral fertilisers, and on-site to off-site**

**1.2.1 80% of fertiliser needs must be met by on-site produced sources of N**, such as manure, slurry or other sources of N such as compost and mulch. This means a maximum of 20% mineral fertiliser in addition to the totals in 1.1. are permitted (max. 24 kg / Ha on crops, max 28 kg / Ha on improved pastures[27])

Methodological note

[26] Biosolids defined as "organic-based materials from industrial or municipal wastewater sludge or other bio-wastes and their derived products in the form of solids, semi-solids, semi-liquids (pastes), and liquids which have been treated to meet specific standards, guidelines or requirements including the reduction of pathogens, vector attraction and contaminant criteria" (ISO19698, 2020).

[27] However, improved pastures cannot see increases in total N inputs – see safeguards.

The above application limits apply both to the average per Ha over the entire UAA, and to the average per Ha for each field (see field size limits in Table 4). I.e. These limits should not be exceeded either at field or holding scale.

**2. Onsite nitrogen cycling**

**2.1.N output from manure**

All livestock excreta produced onsite must be reutilised onsite OR treated through nature-based solutions (NBS, such as constructed wetlands) such that less than 2.5 mg N / L is emitted (this latter must be supported by theoretical and annual sampling data).

Caveat: Where N outputs cannot efficiently be treated by NBS, such as very concentrated N streams such as digestates (that cannot be applied to land due to exceeding land application limits), other efficient and reliable treatments may be used, and off-site, provided the N is converted into another type of fertiliser/product.

**3. Animal feed (and the N therein)**

**3.1 The following dry matter feed %s are adhered to** (unless extreme circumstances necessitate time-limited emergency measures, e.g., due to local drought):

- At least **75%** of annual feed requirement **is from on-holding –** either grazed or cut from grasslands, or as agroecology outputs such as catch crops, cover crops, forage cut from living trees and shrubs, vegetation from NBS water treatments such as algae, duckweed, etc.
- Max of **25% can come from off-holding**
    - Up to **25%** (of total) can be produced in cooperation with other farms primarily in the same region, or come from CE outputs
    - A maximum of **10%** (of total) feed (dry mass of) can be from other sources (i.e. imported feed, cakes, etc), which must comply with the "all livestock" criteria in Table 3 (already submitted) - i.e. no deforestation/conversion certification, no fish except by-catch)

**4. Practices**

The following practices tables cover:

i. Generally applicable practices (i.e. to crops and livestock)

ii. Cropping practices

iii. Indoor livestock

iv. Outdoor livestock

v. Manure storage & transformations

- The practices marked with double asterisk * * must be deployed, AND
- At least 3 practices must be deployed from each of the following combination of practices tables
  - For cropping activities: At least 3 practices from the Cropping Practices Table and/ or Generally Applicable Practices Table
  - For indoor livestock activities: At least 3 practices from the Indoor Livestock Practices Table and/ or Generally Applicable Practices Table
  - For outdoor livestock activities: At least 3 practices from the Outdoor Livestock Practices Table and/ or Generally Applicable Practices Table
  - For manure storage and transformations: At least 3 practices from the Manure Storage and Transformations Table

(NB. The compulsory practices count towards this requirement for "at least 3 practices"

The SFMP must keep annual records of the practices observed.

The practices here are not exhaustive but give a good overview of some of the commonly deployed measures likely to be compatible with these criteria. The operator can fulfil the requirements of the optional practices by deploying other proven practices listed in these documents provided they are consistent with all other criteria herein:

- Price 2011
- UNECE 2014

**Practices Table i. Generally applicable (i.e. to crops & livestock)**

| | ***Best practices*** |
|---|---|
| ***Fertilisation plan*** | **Use a recognised fertiliser recommendation system** (e.g. RB209, PLANET, Manner NPK, FAST tool), **and / or professional advisor** (e.g. Fertiliser Advisers Certification and Training Scheme) to plan and integrate use of organic and mineral fertilisers, not exceeding recommended rates and only using when "the supply of nutrients from |

| | |
|---|---|
| | all other sources is insufficient to meet crop requirements" (Price et al, 2011, p.43-). |
| ***Application of organic/mineral fertiliser*** | ****Spread fertilisers evenly, or precisely.** When spreading generally, a variability of less than 10% should be aimed for. (Price method, 67)<br><br>****Avoid soil compaction** – such as through use of machinery or over grazing in wet conditions.<br><br>**Cultivate compacted soils** (with annual or perennial plants) (see Price et al, 2011, p.24)<br><br>******Manage liquid run-off from roads and hard surfaces*** *so it is not routed directly to water bodies but is spread and soaked through fields prior to riparian buffer zones / wetlands treatment systems as described in section 5.* |
| ***Use of vegetation & nature based solutions*** | **** ^^ Establish perennial native vegetation** (e.g. along fence lines and also on contour / across slope to intercept run-off):<br><br>• **Native grass buffer strips** (Price, p.30)<br>• **Native hedgerows** (Price, Method 80)<br>• **Native tree and shrub lines**<br>• **Nature tree shelter belts** (Price, Method 83)<br>• **Scattered trees/shrubs**<br>• [****Riparian buffer zones** - see section below]<br><br>**Allow field drainage systems to deteriorate** (Price et al, Method 16)<br><br>**^^Create and restore wetland habitats** to remediate run-off and throughflow. |

**Practices Table ii. Cropping**

| | ***Best practices*** |
|---|---|
| ***Soil management*** | Adopt reduced tillage methods (e.g. no-till – direct drilling / broadcasting, or reduced cultivation using discs or tines) (Price et al, 2011, p.22) |

| | |
|---|---|
| | Maintain consistent soil moisture levels, particularly when applying fertiliser |

**Practices Table iii. Indoors livestock** [28]

| | ***Best practices*** |
|---|---|
| ***Feeding plan*** | **High fibre, low protein feeds** (such as incorporating hay, prioritising wheat silage over maize silage, etc). See Lantinga et al 2013; UNECE 2014 p.23; Price Method 33[29]. . |
| ***Management of manure in indoor facilities*** | **Grooved floor system (dairy and beef cattle housing).** UNECE 2014, p.28.<br><br>**Efficient climatization and thermal regulation**<br>**-** of air: e.g. with roof insulation and/or automatically controlled natural ventilation (ACNV) (UNECE 2014, p28)<br><br>- Of floor of broiler facilities, e.g. via Combideck system (heat exchangers to moderate floor temp) (UNECE 2014, p.39)<br><br>**Manure drying** e.g. of poultry manure to 60%–70% dry matter to minimize the formation of NH3 (UNECE 2014, p.36, Price method 51).<br><br>**- Reducing spillage of water** from the drinking system such as via using a nipple instead of bell drinkers (e.g. broiler hens) (UNECE, p.38).<br><br>**Scrape dairy cow cubicles 3x per day.**<br><br>**Pressure wash dairy cow collecting yards after each milking** (provided all slurry is collected and covered) |

[28] Measures are generally optional as it depends on the type of housing being deployed (such as solid manure = straw-based, can be removed daily; deep litter = where the manure may remain a whole season; or slatted-floor cubicle based), and there can be many considerations affecting the operator's decision including different nitrogen implications at different stages (e.g. housing, storage and application to fields) as well as animal welfare and wider farming considerations. See, for instance, UNECE 2014, p.27, Price methods 55 and 56.

[29] This will in many cases be encouraged herein by the on-holding production of feed (e.g. where pasture is utilised), but many choices will still be available to the operator including in the selection of crops grown as feed, or of the minority % permitted as imported feeds such as concentrates.

| | |
|---|---|
| | **In solid manure cattle systems, additional targeted straw-bedding.** Use of approx. extra 25% straw bedding, targeting wetter/dirtier areas – see Price Method 43.<br><br>**Outwinter cattle on wood chip stand-off pads in preference to concrete.** Wood-chips must be compliant with Forestry & Logging criteria.<br><br>**Floating balls in manure pits** (pigs, UNECE 2014, p32).<br><br>**Remove manures to storage at least twice a week** (pigs & poultry).<br><br>**Change from a slurry to solid manure handling system** (cattle & pigs).<br><br>^^ **(Native) Tree shelter belts around livestock housing and slurry storage facilities,** to reduce ammonia emissions (Price, method 83)<br><br>See also Manure Storage & Transformation practices below. |
| ***Emissions to air*** | **Air-scrubbing systems** (acid or bio-scrubbers) for ammonia abatement.<br><br>^^ **(Native) Tree shelter belts around livestock housing and slurry storage facilities,** to reduce ammonia emissions (Price, method 83)<br><br>**^^ Scattered trees** |

**Practices Table iv. Outdoor livestock**

| | **Best practices** |
|---|---|
| ***Grazing*** | Stock, and grazing density of, must be managed to prevent: a) poaching of the soil b) over-grazing of vegetation[30], through the following means:<br><br>**Extend the grazing season for cattle** (Price Method 36)<br><br>**Graze high:** i.e. increasing the energy/protein ratio in the diet by using “older” grass (higher sward surface height). |

[30] See Soil Association (2021): 3.6.3. Managing Pasture and Ranges

| | |
|---|---|
| | **Reduce field stocking rates / time spent in field when soils are wet**<br><br>**Maximum stocking densities** (see Table 3 (already submitted) and section 1 (Max fertiliser inputs) above). |
| ***Feeding / watering*** | ****Move feeders at regular intervals** sufficient to avoid point source accumulations of manure<br><br>****Construct water troughs with a firm but permeable base or move them frequently.**<br><br>****No feeding stations with 10m of riparian verge** |
| ***Vehicle & livestock routes (tracks, gates etc)*** | **Manage animal and vehicular routes to reduce risk of run-off** such as:<br><br>- **preventing livestock access to riparian buffer zones [see Riparian Buffer Zone section]<br><br>- positioning field gates at low risk locations<br><br>- constructing livestock bridges over water-courses<br><br>- farm track maintenance and erosion minimisation in design |

**Practices Table V. Manure storage & transformations**

| ***Best practices*** |
|---|
| **Minimise surface area of slurry/manure storage and reduce air flow exposure. I**n addition to covers (DNSH), measures can be chosen such as:<br><br>- allowing crust to form<br><br>- increasing depth:surface ratio<br><br>- vacuum assisted drainage of slurry from pits.<br><br>**Decrease slurry source strength** e.g.<br><br>**-** by dilution (e.g. of slurries before field application) (UNECE, 2014)<br><br>- slurry acidification, where approved (see Latacz-Lohmann, 2017).<br><br>**Separation of liquids / solids** |

**Minimise the volume of dirty water & slurry produced** (Price, method 57).

**Hot composting:** thermophilically compost solid manure, according to best practices on C:N ratio, pH, temperature, humidity, turning frequency, potentially using biochar* [31], whilst further minimising gaseous N losses by keeping compost both covered and aerated [32] or deploying acid/bio scrubbers.

* To avoid sourcing biochar unsustainably from habitat conversion, or excessive ecological footprint of growing crops to produce biochar, biochar from trees must be from Forestry-fiche aligned sources, and other sources must be either produced either on-holding or from CE by-products.

^^ **(Native) Tree shelter belts around livestock housing and slurry storage facilities,** to reduce ammonia emissions (Price, method 83)

**Air-scrubbing systems** (acid or bio-scrubbers) for ammonia abatement[33].

**5. Riparian buffer zones of native, perennial, permanent vegetation**

See Table 3 (already submitted), 2.3.4., for definitions of riparian buffer zones

^^Buffer zones count towards npHBLF (see below), but must be in place even if leads to more npHBLF than stipulated in Section 6, Biodiverse Habitats, below

**ONE of the following buffer zones options must be complied with:**

**Option i. 30m buffer zones***

- **30m buffer zones on all water courses[34]**

**Option ii. 30m staggered buffer zones***

- Riparian buffer zones are in place as per Table 3 (already submitted), AND

[31] On biochar and compost, see Zhang et al, 2021. For wider discussion, see for instance: Sika & Hardie, 2013; Borchard et al, 2019; Ayaz et al 2021; Chen et al., 2021.

32 This may sound like an oxymoron but even without considering technological solutions, there are low-tech ways of doing this, even in wind-rows in fields, such as covering with tarpaulin with large plant-pots keeping the tarpaulin from touching the wind-row's top, and placing sticks etc between wind-row and tarpaulin at edges.

[33] This is more often done in animal housing facilities as other cheaper methods tend to be deployed in manure storage facilities (e.g. covers), but, notwithstanding costs the approach is effective and enables re-capture and utilisation of potentially wasted/polluting N.

[34] Although permanent pasture generally shed less nitrate than cropped land, we do not differentiate the buffer zone because a differentiation is made in section 1 on total N inputs to pastures and cropland (with more permissible on pasture).

- **The additional width of buffer zone required to meet a total 30m width (as per option i) is achieved within 223m[35] of the land perpendicular to the water body,** by one or more permanent, perennial, native and continuous vegetation communities (such as grass strip, hedgerow, tree-line, permanent fallow) that are arranged across slope (e.g. on contour) in order to intercept run-off.

***Example**: A 5 Ha field has a medium sized river below it = 15m riparian verge requirement (Table 4). A further 15m is needed to achieve 30m. Various ways of doing this are possible, such as:*

***- Solution a:** A 15m riparian verge is retained, a 5m hedge is added half-way up field, a 10m tree belt at top of field. (Total = 30m).*

***- Solution b:** The riparian buffer zone is extended to 20m, a 5m grass strip is added by it. An additional 5m hedge is added at top of field. (Total = 30m)*

**Option iii. Constructed wetland treatment**

- **Lands with complex ditch system hydrology can use Table 4 buffers if the ditches' outputs are 100% routed through a constructed wetland / equiv. NBS[36]** and output is shown (by calculation and annual sampling results) to be less than 2.5 mg N / L)

* The additional riparian width required here, over and above Table 4's, may be composed of perennial vegetation that is cut/mowed and the vegetation may be removed from the area (e.g. and used for compost making, hay, haylage, silage, bedding, mulch, etc), provided such cutting/mowing is not done during sensitive times of year such as bird-breeding and plant flowering and seed development (as per Table 4, 2.3.3). For instance, the additional buffer width could be permanent grassland, willow coppice, etc. Some flexibility is permitted regarding the definition of npHBLF, therefore, as a willow coppice is primarily for productive reasons, but so long as the willow is a native species (or analogous situation), it can contribute to the npHBLF %. However, livestock are to be excluded from riparian buffer zones.

6. **Biodiverse habitats**

[35] I.e. The maximum field size is 5Ha (see Table 4), of which 223m would represent the length of a square 5 Ha field.

[36] E.g. 2-stage ditches could also potentially play a role in the design of such NBS solutions – see Mancuso et al 2021. N.B. Vegetation in drainage channels – and times of year - Further develop re Mancuso et al 2021's refs. [N.B. drainage must not become MORE efficient – see Table 3]

At least 15% of the holding area is non-productive high biodiversity landscape features (npHBLF)[37].

The practices already listed above and marked with ^^, provided they meet the definition of npHBLF, contribute to the 15% area of npHBLF: i.e. buffer zones, wetland habitats, constructed wetlands, tree shelter belts, tree and shrub lines, scattered trees, hedges, grass strips).

If above criteria require more than 15% npHBLF, the higher amount is met (for instance, if buffer zone criteria exceed the minimum requirement).

**7. Additional safeguards**

7.1 **Quantity and biodiversity quality of pastures**

**7.1.1. No reductions in quantity (i.e. area) of permanent grasslands** (of all types: natural, semi-natural, unimproved and improved). This means permanent grasslands cannot be converted to temporary grassland, arable or other land use.

The area of permanent grasslands **should be maintained or restored** at least to the extent in 2008 (if the amount of pasture was greater then) or if records / verification possibilities do not exist this far back, to the furthest back date possible.

**7.1.2. The biodiversity *quality* of existing permanent grasslands cannot be reduced through intensification measures** such as ploughing or re-seeding*, or increases in applications per unit area of fertilizers or other agrochemicals (such as herbicides, PPPs, veterinary products), increases in drainage efficiency or any other degradation].

[37] npHBLF is defined in Option A's Table 1, section 1 as:

*Non-productive HBLFs are land lying fallow*, hedges, trees and shrubs** (isolated / in line / in groups / wooded strips***), field margins, riparian verges, ponds, traditional stone walls, traditional terrace walls, flower strips). They are features primarily for habitat, biodiversity and ecosystems services: If a yield is taken, it is incidental and a by- product to the management of the habitat (e.g., hay cut from fallows).*

**Fallows may be rotational or non-rotational. In pastures, fallows may include pasture that is uncut or grazed for at least a year (which we add to the list - see next footnote - because the CAP list was designed for arable, and we also need to ensure sward variation in grazed ecosystems (see rationale column). Such longer sward may be in isolation or in combination with (i.e. as a buffer) around other landscape features such as trees.*

*** Deadwood from native trees, should be left in-tact (standing or on the tree) or on the ground under the tree canopy (unless there are compelling reasons to remove, such as disease that could affect living trees).*

****The vegetation component of these all to be native species**** (i.e. dominant components of trees, hedges, riparian verges). This list is based on types of areas and landscape features that qualify for Ecological Focus Areas in the CAP (see Delegated Regulation (EU) 639/2014, Section 4).*

***** A native, or "indigenous" (syn) species, is one "occurring within its natural range (past or present) and dispersal potential (i.e. within the range it occupies naturally or could occupy without direct or indirect introduction or care by humans)" (IUCN 2000. Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species (2000). Approved by the IUCN Council, Feb 2000. Cited on the Convention of Biological Diversity's Glossary: https://www.cbd.int/invasive/terms.shtml visited Januray 2022).*

Farm records should keep data on each of these, sufficient to show no increases.

* This does not include the seeding of native plants in order to improve sward biodiversity

**7.1.3. Pasture access**[38]

1. All herbivore and poultry species are given permanent access to pasture, unless the following circumstances temporarily prevent this: a) the health or welfare of the animal b) the weather conditions and the state of the ground, or c) community or national requirements or restrictions relating to specific animal or human health problems.

2. Breeding bulls over one year old must have access to pasture or an open air run of at least 30 $m^2$ .

3. Pigs must have permanent access to pasture or vegetated range, unless the circumstances listed above prevent this.

**7.2 Sensitive habitats**

7.2.1. No activities (e.g. cropping or pasture) utilising manure or mineral fertilisers (see section 1) can be within **0.5 km** of a Natura 2000 site or Nitrate Vulnerable Zone (or local equivalents if outside the EU)[39] *

7.2.2. No livestock housing or manure storage facilities may be in, or within **1km of a Natura 2000 site** or Nitrate Vulnerable Zone (or local equivalents if outside the EU), unless permissions are acquired*. However, this distance threshold can be reduced if the facility has an acid or bio-scrubber based on a calculation of the efficiency of that abatement technology as verified by annual checks on efficiency.

*unless permission is granted by the competent biodiversity / water regulatory body (depending on the type of site) to the effect that relevant sensitive site/s are not expected to be adversely affected by nitrogen pollution.

**7.3 Other safeguards**

[38] These pasture access criteria are paraphrased from Soil Association (2021) (and is consistent with (EC) 834/2007 on Organic production and labelling of organic products, Art. 14(1)(b)(iii)(d)(iii)).

[39] This means activities solely based on cycling nutrients through re-utilising on-site plant growth such as mulch or compost are not included in this.

**7.3.1. No use of herbicides in field transitions: herbicides cannot be used to kill temporary pasture (ley) or catch crops in transition to arable.** This means other methods are to be deployed, such as ploughing or direct drilling through crop residue.

Do no significant harm ('DNSH') - for both Option C - proposals 1 and 2 are the same as those presented for Options A and B in the PSF TWG report submitted in March 2022 and are not repeated here

Rationale

This rationale is divided into three parts. First a general introductory rationale for the inclusion of option C into the already submitted set of criteria. Then the two rationales for the two proposals provided above.

**Introductory rationale for Option C: Substantial Contribution to Biodiversity and Ecosystems via 'Ensuring a farm-gate nitrogen balance respecting regionally specific biodiversity limits'**

"Nitrogen is essential for plant growth. In crop production, it is often the most limiting nutrient, and therefore must be available in sufficient amount and in a plant-available form in soil to achieve optimum crop yields. (UNECE 2014, pp65-66)

Excessive nitrogen losses caused by agricultural production have significant negative effects on biodiversity and ecosystems. Eutrophication caused by excess nutrients (nitrogen as well as phosphorus) can result in increases in weeds and algae, reduced oxygen levels and subsequent biodiversity loss[40]. Excess reactive nitrogen leads to direct foliar damage of the plants as well as to harmful acidification. Especially problematic is the nitrogen excess to species and communities that are adapted to low nutrient levels or are poorly buffered against acidification. Evidence is strong that ecological communities respond to the accumulated pool of plant-available N in the soil and that because of this biodiversity has been in decline in Europe for many decades. Additionally, the exceedance of critical loads for nutrient nitrogen is

[40] https://www.eea.europa.eu/airs/2018/natural-capital/agricultural-land-nitrogen-balance

linked to reduced plant species richness in a broad range of European ecosystems.[41] Such impacts affect not only local ecosystems in the region where nitrogen is emitted, through air transmitted ammonia and through water-bound nitrogen traveling by rivers into seas nitrogen can lead to eutrophication in distant regions.

Many EU Directives aim to tackle excess nutrients and their consequences. The EU Nitrates Directive (91/676/EEC) aims to reduce water pollution by nitrates from agricultural sources and prevent pollution of ground and surface waters. The EU Water Framework Directive (2000/60/EC) aims at protecting and restoring the quality of all inland and coastal waters across Europe, and the National Emissions Ceilings (NEC) Directive (2016/2284/EC) sets out to reduce emissions through commitments for Member States and for the EU for important air pollutants, including nitrogen oxides ($NO_x$) and ammonia, which are nitrogen compounds.[42]

For the EU-Commission the reduction of nutrients losses is one of the major goals of the EU Biodiversity strategy for 2030 (2020/380/EC). With it, it aims to reduce nutrient losses by at least 50%, while reducing the use of fertilisers by at least 20% by 2030[43].

*N.B. Two proposals are given. PROPOSAL 1 is the preferred option from a scientific perspective, but cannot be readily taken up at scale. (Therefore, alongside this technical proposal is a recommendation that would enable rapid take up – specifically that the EU-Commission promotes and develops FaST as a global tool for farmers to calculate farm specific farm-gate nitrogen balance limits which ensure a substantial contribution to biodiversity.) In the meantime, a complementary PROPOSAL 2 is put forward that could be utilised in the short term. Both of these proposals are intended to be applicable to both animal and crop production systems.*

*N.B. Please see also the already submitted safeguards that would go alongside these criteria, per the two Table 3s (P34 for Animal Production and P92 for Crop Production)*

[41] https://www.researchgate.net/publication/236268651_Nitrogen_deposition_as_a_threat_to_European_Terrestrial_Biodiversity

[42] https://www.eea.europa.eu/airs/2018/natural-capital/agricultural-land-nitrogen-balance

[43] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590574123338&uri=CELEX:52020DC0380

[*Annex to the platform on Sustainable Finance's report with recommendations on technical screening criteria for the four remaining environmental objectives of the EU taxonomy (europa.eu)]

*N.B. And lastly please also see the already submitted DNSH criteria that would go alongside these criteria, per the two DNSH tables (P10 for Animal Production and P62 for Crop Production)*

[*Annex to the platform on Sustainable Finance's report with recommendations on technical screening criteria for the four remaining environmental objectives of the EU taxonomy (europa.eu)]

**Detailed rationale for proposal 1**

*The farm-gate nitrogen balance*

Stipulating a farm-gate nitrogen balance limit[44] as a way to increase nitrogen use efficiency and to protect ecosystems provides the farmer with the flexibility to manage nitrogen within all their farming operations flexibly, to optimize nitrogen use at every point of the usage and use it according to their needs and economic criteria. As all nutrients along the entire production chain are accounted for, it also prevents pollution swapping which occurs when e.g. nutrients are poorly managed at housing and storage and consequentially lost in the organic fertilizer. Applying a farm-gate nitrogen balance limit as incentive for the farmer to increase Nitrogen Use Efficiency will necessarily lead to an enhanced usage of precision farming instruments such as nitrogen sensors.

Several studies consider the farm gate nitrogen balance indicator the most integrative and transparent indicator in nutrient management[45] [46] [47].

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[44] Instead for example of limiting the permitted amount of applicable nitrogen in fertilizers or setting a limit for nitrogen calculated by a soil balance.

[45] Oenema, O.; Kros, H.; de Vries, W. Approaches and uncertainties in nutrient budgets. Implications for nutrient management and environmental policies. Eur. J. Agron. 2003, 20, 3–16. [Google Scholar] [CrossRef]

[46] Bach M and Frede H-G 2005 Assessment of agricultural nitrogen balances for municipalities—example Baden-Wuerttemberg (Germany) Eur. Water Manage. Online 1–15

[47] SRU 2015 Stickstoff: Lösungsstrategien für ein drängendes Umweltproblem: Sondergutachten Sachverstaendigenrat für Umweltfragen (Berlin: Hausdruck)

Additionally, other indicators, such as e.g., the farm nutrient use efficiency (NUE) can be deduced from the farm nitrogen balance[48]. Complying with farm nitrogen balance limits has been made obligatory by Germany[49], Romania and Switzerland as a tool to implement the Nitrate Directive and to reduce nutrient surpluses[50]. The use of farm nutrient budgeting such as the farm gate nitrogen balance as agri-environmental indicator is well established and has been highlighted by OECD and EU[51] [52].

There is also evidence that the farm gate indicator is able to indicate well that high nitrogen surpluses lead very often also to high nitrogen concentrations in groundwater. Hansen et al. (2017)[53] found significant correspondence between developments in N surplus and nitrate concentrations in upper groundwater for four subsequent development periods for Danish agriculture in the period 1946–2012. Dalgaard et al. (2012)[54] calculated gross farm budgets for six European landscapes in Poland, the Netherlands, France, Italy, Scotland and Denmark as an indicator for N losses. The authors found significant correlations of N surplus to both nitrate concentrations in soils and groundwater. Additionally, the indicator is able to catch also ammonia emissions, which are also an important source of eutrophication.

The here proposed criteria for farm gate nitrogen balance are designed in a way that they can be applied by crop farms without animals, mixed farms or animal farms without cropping area when the farms can prove a virtual cooperation with a cropping farm.

*1. Critical surplus limits respecting regionally specific biodiversity limits*

The impact of nitrogen on biodiversity is regionally very specific and depends on:

1) the capacity of different ecosystems in buffering nitrogen pollution,

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[48] Löw P, Karatay Y N and Osterburg B 2020 Nitrogen use efficiency on dairy farms with different grazing systems in northwestern Germany Environ. Res. Commun. 2 105002

[49] Stoffstrombilanz – German legislation on farm budget implementation (https://www.gesetze-im-internet.de/stoffbilv/StoffBilV.pdf

[50] Klages S, Heidecke C, Osterburg B, Bailey J, Calciu I, Casey C, Dalgaard T, Frick H, Glavan M, DHaene K, Hofman G, Amorim Leitão I, Surdyk N, Verloop K, Velthof G (2020) Nitrogen surplus - A unified indicator for water pollution in Europe? Water MDPI 12(4):1197)

[51] Eurostat and OECD (2013): Eurostat Nutrient Budgets—Methodology and Handbook, Version 1.02.

[52] EEA (2005): Agriculture and Environment in EU-15—The IRENA Indicator Report. Agriculture and Environment. p. 128. Available online: https://www.eea.europa.eu/publications/eea_report_2005_6.

[53] Hansen, B.; Thorling, L.; Schullehner, J.; Termansen, M.; Dalgaard, T. Groundwater nitrate response to sustainable nitrogen management. Sci. Rep. 2017, 7, 1–12. [Google Scholar] [CrossRef]

[54] Dalgaard, T.; Bienkowski, J.F.; Bleeker, A.; Dragosit, U.; Drouet, J.L.; Durand, P.; Frumau, A.; Hutchings, N.J.; Kedziora, A.; Magliulo, V.; et al. Farm nitrogen balances in six European landscapes as an indicator for nitrogen losses and basis for improved management. Biogeosciences 2012, 9, 5303–5321. [Google Scholar] [CrossRef]

2) the differing pollution impact of nitrogen which varies depending on soil, slope and climate
3) the locally varying N pollution from other sectors which affects the “allowable” N losses from agriculture and
4) the regionally specific denitrification rates.

Critical surpluses (which can here be interpreted as regional farm-gate surpluses which can be allowed without endangering biodiversity) take these points into account and by integrating environmental thresholds for air and water (either derived from EU-legislation or from values derived from scientific literature) give information on how much of agricultural nitrogen lost to the environment in various N-species can be tolerated by local ecosystems. The compliance with critical surplus limits for farms is therefore an important criterion for substantial contribution to biodiversity.

The regional differentiated critical nitrogen surpluses which are the basis for the farm relevant farm-gate nitrogen balance limits have been published in a recent study by DeVries et al. (2021)[55]. The authors calculated critical N surpluses for ca. 40,000 Nitrogen Calculation Units (NCUs), which are clusters of 1 km × 1 km pixels with identical soil type, slope class and altitude class within a NUTS3 region for the EU[56].

Concretely, the critical nitrogen surpluses are derived from two biodiversity relevant critical thresholds:

*Critical ammonia emissions in view of nutrient enrichment of terrestrial ecosystems:*

Nitrogen deposition onto terrestrial ecosystems causes nutrient enrichment and shifts in plant species composition, resulting in biodiversity decline. Ecosystems differ strongly in their

[55] Wim de Vries, Lena Schulte-Uebbing, Hans Kros, Jan Cees Voogd, Geertrui Louwagie, Spatially explicit boundaries for agricultural nitrogen inputs in the European Union to meet air and water quality targets, Science of The Total Environment, Volume 786, 2021, 147283, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2021.147283.

[56] DeVries et al. (2021) cover only the EU. But a paper with a global data set from the same authors is now under review and will be published soon. A first publication on the global data set can be found here: https://research.wur.nl/en/publications/managing-nitrogen-to-keep-food-production-within-environmental-li.

sensitivity to N deposition. To account for these differences, different threshold values (critical loads) are used.

*Critical N concentration in surface waters to avoid eutrophication:*

Increased N concentrations in surface water lead to eutrophication, characterized by excessive plant and algae growth and oxygen depletion, which negatively affects surface water quality and aquatic biodiversity. Critical concentrations for dissolved total N in surface water indicating eutrophication are determined at 2.5 mg N l−1[57].

The final relevant critical surplus for the calculation of the farm-gate nitrogen balance limit is the minimum of a. and b.

When using the algorithms and data from DeVries et al., it is important to keep in mind that a pragrnatic approach is needed to calculate the critical surpluses. The nitrogen system is very complex and not all aspects can be taken into account. For example the nitrogen immobilization in the soil is not considered. The reason for that is the insufficient scientific literature/data available as well as the relatively small impact of immobilization. The experiments that were made (for example Elrys et al. (2022)[58] were short-term and localized and are therefore not transferable to real farming conditions.

*Setting tailored balance limits for different production types*

The method for defining the farm-gate nitrogen balance limit depending on used fertilizer type has been derived from the currently discussed proposition of German legislation on an improved farm gate balance implementation[59].

[57] The references and the details of the thresholds can be found in DeVries et al., they also must be finally determined when developing and launching the App.

[58] Ahmed S. Elrys, Zhaoxiong Chen, Jing Wang, Yves Uwiragiye, Ayman M. Helmy, El-Sayed M. Desoky, Yi Cheng, Jin-bo Zhang, Zu-cong Cai, Christoph Müller (2022): Global patterns of soil gross immobilization of ammonium and nitrate in terrestrial ecosystems, Global Change Biology, 28 (14), https://doi.org/10.1111/gcb.16202.

[59] Taube, F; Bach, M; Breuer, L; Ewert, F; Fohrer, N; Leinweber, P; Müller, T; Hubert, W (2020): Novellierung der Stoffstrombilanzverordnung: Stickstoff- und Phosphor-Überschüsse nachhaltig begrenzen. Fachliche Stellungnahme zur Novellierung der Stoffstrombilanzverordnung. Texte 200/2020. Umweltbundesamt. Dessau-Roßlau. Download unter: https://www.umweltbundesamt.de/publikationen/novellierung-der-stoffstrombilanzverordnung

The reason for such an approach is the importance of the efficient use of organic fertilizer. Mineral fertilizer has an important role in feeding the global population and it can be used with smaller surpluses than organic fertilizer, but its easy and cheap availability reduces the efficient use of organic fertilizer. In regions with high livestock densities, farmers are often faced with the problem of an oversupply of manure which they have difficulties to apply on farmland according to legislation. Brink et al. 2011[60] have shown that in areas with high livestock densities manure N can even have a negative economic value.

The problem of inefficient use of fertilizers can be seen when comparing nitrogen use efficiencies with surpluses in different regions. In the EU, the efficiency of N-use is less than 50% in countries with an N surplus above 80 kg/ha/yr (the Netherlands, Belgium, Denmark and UK), between 50% and 70% in countries with an N surplus between 50–80 kg/ha/yr and more than 70% in countries with an N surplus below 50 kg/ha/yr, except for Portugal and Spain[61]. Globally, it is estimated that about 57% of anthropogenic nitrogen fixation results from the manufacture of nitrogen containing fertilizers[62]. This large amount must be reduced as it comes as additional input into the nitrogen cycle. An additional problem is the high energy demand of the industrial manufacturing of reactive nitrogen, which uses approximately 2% of world energy[63].

*Combining critical surplus limits in regards to biodiversity with fertilizer-specific farm-gate nitrogen balance limits*

Farms that comply with critical surpluses enable a substantial contribution to regional biodiversity but in order to reduce overall nitrogen as well as local pollution, the differing

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[60] *Brink, C., van Grinsven, H., Jacobsen, B.H., Rabl, A., Gren, I.-M., Holland, M., Klimont, Z., Hicks, K., Brouwer, R., Dickens, R., Willems, J., Termansen, M., Velthof, G., Alkemade, R., van Oorschot, M., Webb, J., 2011. Costs and benefits of nitrogen in the environment, in: Sutton, M.A., Howard, C.M., Erisman, J.W., Billen, G., Bleeker, A., Grennfelt, P., van Grinsven, H., Grizzetti, B. (Eds.), The European Nitrogen Assessment. Cambridge University Press, Cambridge, pp. 513–540. https://doi.org/bh59rj*

[61] OECD (2006). Key Environmental Indicators. OECD Environment Directorate, Paris, France. http://www.oecd.org/dataoecd/32/20/31558547.pdf.

[62] Erisman , J. W. , Domburg , N. , de Vries , W. et al. (2005). The Dutch N-cascade in the European perspective. Science in China, Series C, Life Sciences, 48, 827–842.

[63] Sutton M.A., Bleeker A., Howard C.M., Bekunda M., Grizzetti B., de Vries W., van Grinsven H.J.M., Abrol Y.P., Adhya T.K., Billen G.. Davidson E.A, Datta A., Diaz R., Erisman J.W., Liu X.J., Oenema O., Palm C., Raghuram N., Reis S., Scholz R.W., Sims T., Westhoek H. & Zhang F.S., with contributions from Ayyappan S., Bouwman A.F., Bustamante M., Fowler D., Galloway J.N., Gavito M.E., Garnier J., Greenwood S., Hellums D.T., Holland M., Hoysall C., Jaramillo V.J., Klimont Z., Ometto J.P., Pathak H., Plocq Fichelet V., Powlson D., Ramakrishna K., Roy A., Sanders K., Sharma C., Singh B., Singh U., Yan X.Y. & Zhang Y. (2013) *Our Nutrient World: The challenge to produce more food and energy with less pollution.* Global Overview of Nutrient Management. Centre for Ecology and Hydrology, Edinburgh on behalf of the Global Partnership on Nutrient Management and the International Nitrogen Initiative.

efficiencies of different production as well as fertilizer types need to be considered (see explanation above in *Setting tailored surplus limits*). This means regional specific permissible farm-gate nitrogen balance limits for cropping farms using only mineral fertilizer will be identical across the entire region, but the total nitrogen farm-gate balance limits increasing with the prevalent manure-nitrogen on the farm as described in Figure 1 will differ for different livestock farms depending on livestock type and manure amount. The difference between the permissible farm-gate nitrogen balance limit for mineral fertilizer and the permissible maximum farm-gate nitrogen balance limit for total fertilizer is determined by the slope of the curve which is determined by the livestock-manure-type (depending on potential efficiency-use.)

For local biodiversity not the single farm, but the nitrogen output in the entire region is decisive. In order to determine farm-gate nitrogen balance limits all farms and their nitrogen output in a region must be considered and the final farm-specific farm-gate nitrogen balance limit must be calculated according to this, meaning that at the end the entire region will comply with the critical surplus of the region. The mineral fertilizer and maximum farm-gate nitrogen balance limit can therefore only be calculated when all farms in the region are considered. Consequentially this means that in a region with only cropping farms using only mineral fertilizer, the mineral fertilizer balance limit is identical to the critical surplus in this region, as no manure is used. In a region with only livestock farms and all having the same animals and the same amount of manure per ha, the total maximum balance limit (all fertilizers) is equal to the regional critical surplus, for farms here it will be much harder to comply with their relevant surplus limit. In regions with livestock and cropping farms the mineral fertilizer and total balance limit needs to be calculated based on the agricultural production (weighted average based on nitrogen in agricultural outputs). (see Figure 2 for an exemplary depiction).

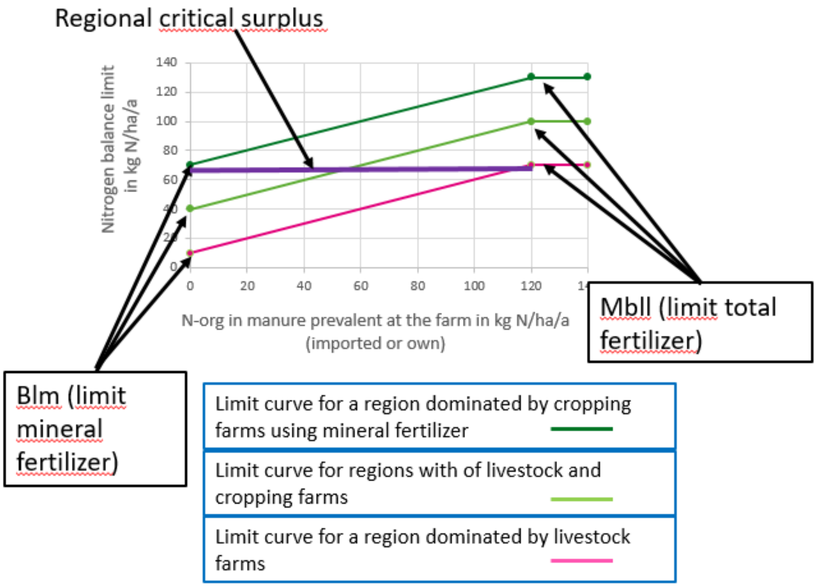


*Figure 2: Showing exemplary for three regions with identical critical surpluses but differing distributions of farming types the resulting farm-gate nitrogen balance limit curves (cropping farm-gate balance limit depicted at x-axis 0, maximum farm-gate balance limit at x-axis 120 kg N/a/ha). The purple line signifies the regional critical surplus value.*

The size of the final region needs to be decided when the App is developed. But a potential region-size could be the NUTS3-region.

*Calculating the regionalized farm-gate nitrogen balance limits*

For the determination of the taxonomy-relevant farm-gate nitrogen balance limit, the critical surplus values from the DeVries data set must be adapted as 1) global/EU-data sets on soil, slope and climate can never reach the accuracy of the data from regional authorities or farmers, 2) farm specific data is necessary to estimate the different nitrogen paths and 3. the final balance limit depends on farms types in the region (see *Combining critical surplus limits in regards to biodiversity with fertilizer-specific NUEs*).

The proposed approach for assessing farm-gate nitrogen balance limits (cropping and livestock farms) is therefore the integration of relevant algorithms and data sets from different sources into the App:

1. Farm-specific data on agricultural production (such as manure, animals, feed) is necessary to determine the nitrogen paths of the farm and comes directly from the

farmer and is in the context of the fertilizer plan and the nutrient balance already available

2. Locally verified data on soil-type, precipitation surplus and slope of the UAA[64] is necessary to determine denitrification rate, runoff etc.and comes either from local authorities or from the farmer

3. The relevant data on regional thresholds on air and water (as described above) as well as a) the deposition of NH3 and NOx determining the existing buffer for additional pollution, b) the share of agricultural land determining how much buffer there is for additional nitrogen pollution, c) N-concentration in run-off towards surface water and N-concentration in leaching towards ground water determining the buffer for additional pollution necessary for determining how much additional nitrogen can be accepted in the region comes from DeVries et al. (2021)

4. Data on the regional farm types needed to determine the final level of the nitrogen farm-gate balance limit curve (see Figure 3 for a schematic depiction) comes from local authorities. .

[64] The information are needed as follows: soil-type for the denitrification rate, precipitation surplus for the run-off, soil and slope for determining surface or subsurface run-off or leaching to the groundwater.

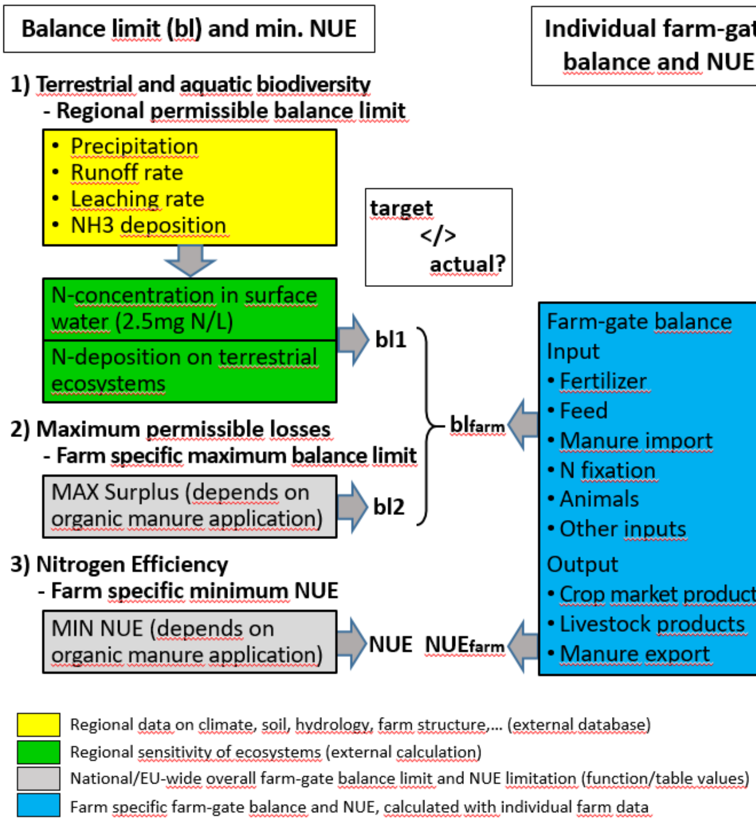


*Figure 3: Scheme showing how different data sources must be combined in the App for calculating regional farm-gate nitrogen balance limits, maximum farm-gate balance limits and minimum NUE and how they are set in relation to farm-gate balance limits and farm-NUEs*

As the data from DeVries et al. (2021) is based on values from 2010, a regular update is necessary. But the authors can show that in the last ten years the nitrogen pollution has not changed, so the critical surpluses are still valid.

<u>Setting a maximum general farm-gate nitrogen limit</u>

In some regions the biodiversity related thresholds for nitrogen are very low and the resulting nitrogen farm-gate limits are high. This happens for example because of high precipitation rates, low existing nitrogen pollution and not very sensitive ecosystems. Even a high amount of nitrogen emitted into the environment does here not lead to problems for local biodiversity. But as nitrogen emitted in the environment will water or air-borne sooner or later arrive at a sensitive ecosystem and also having in mind the goal of reducing overall nitrogen emissions, the farm-gate nitrogen balance limit should be capped farms in these regions.

<u>Defining minimum NUE limits</u>

In order to ensure that all farms considered in this criterion do not only have farm-gate nitrogen balance values respecting biodiversity thresholds, but also a productivity which ensures an efficient use of nitrogen (NUE), minimum levels of nitrogen use efficiency must also be specified. This approach, of combining an N-surplus limit with NUE, has also been proposed by the EU Nitrogen Expert Panel (EUNEP)[65] (See Figure 4) for examining the performance of the farm management.

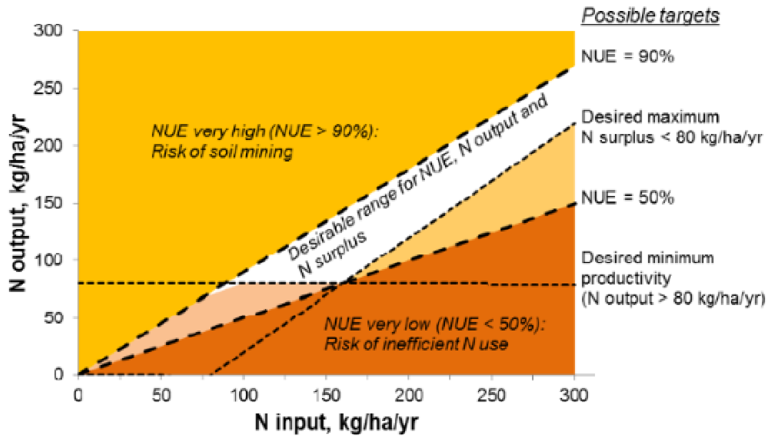


*Figure 4: The NUE-Approach developed by the EUNEP. Lower and upper bounds for NUE values, a minimum N yield level and a limit for N surplus are defined to find the optimal values for N-input and N-output (white area). We are not including the productivity in our approach as the range for N-yield levels is too wide to find a general value. Source: [http://www.eunep.com/reports/](http://www.eunep.com/reports/)*

In order to adapt the EUNEP-methodology to different farm types, minimum NUE-limits for crops, ruminants and granivores were set and farm-gate nitrogen balance limits defined depending on nitrogen-manure prevalent at the farm (see Figure 1). The NUE minimum limits are derived from the lower boundaries of values given by the EUNEP[66] for balanced N-

[65] Nitrogen Use Efficiency (NUE) - an indicator for the utilization of nitrogen in agriculture and food system http://www.eunep.com/reports/

[66] http://www.eunep.com/wp-content/uploads/2017/03/Report-NUE-Indicator-Nitrogen-Expert-Panel-18-12-2015.pdf

fertilization as well as from a recent paper by Hutchings et al (2020)[67] which calculated typical NUEs for different farm types in Northern and Southern Europe.

Minimum productivity levels (as also suggested from EUNEP) as note set as productivity varies enormously between different crops as well as livestock products and therefore too many different productivity levels would need to be defined.

The application limit

Nitrogen from manure cannot taken up by plants well when applied in very large amounts. Starting from an application rate of 120 kg N/ha the efficiency of the nitrogen use decreases over proportionally and the risk of leaching increases [68]. The German Environment Agency proposes therefore a manure application limit of 120 kg N/ha/ from cropland and of 140 kg N/ha/a for grassland[69]. Also, the EU-Commission states that "The definition of fertilizer application standards that ensures balanced fertilisation remains one of the most important and challenging measures"[70].

A digital tool to estimate farm-gate nitrogen balance limits, Min NUE as well as actual NUE and farm-gate balances

At the national or regional level many digital tools exist which either can already estimate farm gate nitrogen balances or collect the necessary data in order to do so with small changes to the software. These are for example the cool farm tool[71], Ferticalc[72], AGROasesor[73], AZOFERT[74], Landsupport project h2020 Dynamic Armosa[75], (PIANO DI CONCIMAZIONE

[67] Nicholas J. Hutchings, Peter Sørensen, Cláudia M.d.S. Cordovil, Adrian Leip, Barbara Amon, Measures to increase the nitrogen use efficiency of European agricultural production, Global Food Security, Volume 26, 2020, 100381,ISSN 2211-9124, https://doi.org/10.1016/j.gfs.2020.100381. (https://www.sciencedirect.com/science/article/pii/S2211912420300353)

[68] Gutser, R; Ebertseder, T; Schraml, M; von Tucher, S; Schmidhalter, U (2010): Stickstoffeffiziente und umweltschonende organische Düngung. In: KTBL-Schrift 483. KTBL-/vTI-Tagung 8-10. Dezember 2010. Emissionen landwirtschaftlich genutzter Böden. Darmstadt, S 31–50

[69] Umweltbundesamt 2021, Perspektiven für eine umweltverträgliche Nutztierhaltung in Deutschland, UBA-TEXTE 33/2021

[70] REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2012–2015

[71] https://coolfarmtool.org/

[72] http://www.uco.es/fitotecnia/fertilicalc.html.

[73] https://www.agrogestor.es/plataformas/plataforma-agroasesor/

[74] http://www.rmt-fertilisationetenvironnement.org/moodle/course/view.php?id=6

[75] https://www.landsupport.eu

AZIENDALE - ON-FARM FERTILIZATION PLAN) Regione Campania (Italy)[76] or the tool N-Expert[77].

In the original proposal[78] of the EU-COM for the new CAP, the EU-COM proposed that "*Member States shall establish a system for providing the Farm Sustainability Tool for Nutrients […] to beneficiaries, who shall use the Tool*." Although it is not part of the current CAP, the FaST tool[79] is still under development in DG Agri and is used by regions in Spain and Italy, as well as Estonia[80]. Although the primary purpose of the tool is to support fertilizer planning, it can easily be adopted to the purpose of generating farm gate nitrogen balance. *A farm-gate balance module could be integrated into the FaST as a quick and easily to use digital tool*.[81] FaST would be a good starting point for an App calculating farm specific nitrogen balance limits based on regional critical surpluses as described above as well as the minimum NUEs.

It is therefore recommended that the EU-Commission promotes and develops FaST as a global tool for farmers to calculate farm specific farm-gate nitrogen balance limits which ensure a substantial contribution to biodiversity.

If such a tool is implemented all algorithms and all data used should be fully documented and published on official websites.  A control panel or expert group must monitor the development of the App on a regular basis.

**Detailed rationale for proposal 2**

Fertiliser N inputs

Nitrogen from **manure** cannot be taken up by plants when applied in very large amounts. Starting from an application rate of 120 kg N/ha the efficiency of the nitrogen use decreases disproportionately and the risk of leaching increases (Gutser *et al*, 2010).

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[76] http://www.agricoltura.regione.campania.it/concimazione/PRCFA_intro.html
[77] https://www.igzev.de/projekt_type/n-expert-duengung-im-freilandgemuesebau/?lang=en
[78] Regulation on the new CAP post-2020 COM(2018) 392 Recital 22, Article 12.3 and ANNEX III
[79] https://ec.europa.eu/info/news/new-tool-increase-sustainable-use-nutrients-across-eu-2019-feb-19_en
[80] https://fastplatform.eu/about
[81] Policy recommendations from the EU-project SuMaNu - Sustainable Manure and Nutrient Management for reduction of nutrient loss in the Baltic Sea Region (*https://balticsumanu.eu/userassets/uploads/2021/04/Sumanu_policy-recommendation-2_FINAL.pdf*)

The German Environment Agency therefore proposes a manure application limit of 120 kg N/ha/ from cropland and of 140 kg N/ha for grassland (Umweltbundesamt (2021). Grassland has a higher limit compared to exposed soils, likely due to factors ensuring higher N interception and uptake such as the well-established root network, soil structure and microbiology, and quick growth response of sward.

80% fertilisers from onsite is the metric we choose, to allow some  flexibility and the convenience of precision use of mineral fertilisers, albeit a minority proportion of.

The farmer's decision-making should also take into account local volumes of atmospherically deposited N as well as opportunities for biological nitrogen fixation through: green manures (e.g. alfalfa, clover, sainfoin) as cover-crops or in permanent pastures and impermanent pastures (leys); fallows; nitrogen fixing tree forage; algae in aquaculture; etc.

Whilst these input limits are notably less than the EU Nitrates Directive's 170 kg manure per Ha (which, to our knowledge, was not an empirically derived figure), it is nonetheless considerably more than in various examples in the literature.  Price et al (20011, p3) cite UK mixed farms as using an average 92 kg N / Ha (all types of fertiliser).  A Wageningen University model farm deployed 110 kg N/ha/yr, and only used slurry on pastures (Lantinga *et al*., 2013). Halberg et al (1995) describe Danish organic mixed farms as importing no fertiliser.

However, the natural N fixation and processing capability of pasture in highly productive areas can in some cases exceed these figures purely by the nutrient cycling function of the livestock manuring whilst in pasture (e.g. in Ireland, where rainfall is high).  Therefore, special dispensation is allowed for exceeding these total inputs, and also the stocking densities in Table 4, but only in cases where the livestock are fed 100% from the holding's pasture and all other criteria herein are met.

<u>Onsite nitrogen cycling</u>

N outputs to be reutilised onsite.  Through these needing to be within the N input limits, this additionally ties the N budget to the N processing capability of the land.

Denmark has "harmonisation areas; meaning that the livestock farm needs to include or have access to field areas of the necessary size for application of the produced manure in compliance with maximum nitrogen input on the field" (Hertel et al., 2009). Herein, this is achieved at activity/holding scale.

Excreta can be applied to the land (see Practices on ways to do so efficiently) but other options exist such as utilising the N in aquaculture and aquaponics.

2.5 mg N / L is from de Wries *et al* (2021). They suggest 1 – 2.5 mg N / L is sufficient to avoid exceeding N thresholds in most situations, and themselves prefer to aim for 2.5 mg N / L in the interests of pragmatism. This is also the figure used in Proposal 1.

See Mancuso et al 2021 for an overview of Nature Based Solutions for treating water, though not exhaustive.

<u>Animal feed (and the N therein)</u>

“To ensure full connection with cropping systems, livestock must be fed locally, without import of feed from distant origin, and its excreta returned to cropland and grassland” (Billen et al., 2021).

“One of the constraints of current livestock production in The Netherlands (as well as in some other regions and countries in the EU and the world) is the fact that a large fraction of the animal feed is imported from elsewhere, while the manure with most of the nutrients produced from the intake of this animal feed is not returned to the sites where the animal feed was produced. As a consequence, the intensive livestock production systems contribute to nutrient depletion in areas where the animal feed is produced and to nutrient enrichment and gaseous nitrogen emissions in areas where the animal feed is consumed for animal production.”

… “The Ministry of Economic Affairs, Agriculture and Innovation, The Netherlands (EL&I) is now exploring… coupling of feed production and animal production at regional scale.”, e.g. through “the replacement of soya cakes imported from Brazil and US by protein-rich feed stuff produced in northwest Europe”. (Groenestein *et al*, 2011)

These criteria address this at the scale of the activity / holding. Compared with the feed restrictions in cross-cutting Table 4, the criteria opposite, are:

- **More strict regarding % of onsite production** because the entire onus of this option is on-site nutrient cycles.
- **But less strict** in terms of proportion derived onsite from pasture vs crops. Option A prioritised extensive pastures for biodiversity, but in this option, it’s for mixed farm to

dedcide their preference in terms of N as pasture or crops/green manures etc, provided there is no loss of quality or quantity of biodiverse permanent pasture.

- **Flexibility for off-site feed when needed** - Unlike in Table 4, we have expanded the amount that could be local or CE, which, if met to the full, would cannibalise the 10% of “other imported” that is allowed. This allows flexibility whilst keeping a link to regional N boundaries (see EEA/FOEN 2020; Chang 2021), so this proposal first prioritises on-holding N cycles, and then local/regional N budgets.

- **10% other** (e.g. concentrate) – e.g. allows any specific nutritional needs to be met.

Predominantly on-holding feed production also addresses biodiversity impacts that accrue through the various footprints involved in global feed supply chains – from land-take from converting habitats to agricultural lands, to water use, to carbon emissions of transportation logistics and fertiliser manufacture (etc) to the nitrogen pollution implications that are hard to track during the up-stream farming of animal feed (e.g. mineral fertiliser use) and its transportation (fossil fuels emit nitrogen pollution), etc. See the previously submitted criteria for agriculture for more detail.

Practices

Further practices could potentially be added, for instance by further reviewing the documents utilised in selecting the DNSH measures, for practices likely compatible with proposal 2, i.e:

- TFRN’s Guidance document on integrated sustainable nitrogen management[82]
- HELCOM’s Revised Palette of measures for reducing phosphorus and nitrogen losses[83]

JRC (2017) B Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry or Pigs[84].

General practices

[82] http://www.clrtap-tfrn.org/
[83] Baltic Marine Environment Protection Commission (2013): Revised Palette of measures for reducing phosphorus and nitrogen losses from agriculture, https://helcom.fi/media/documents/Revised-palette-of-agri-environment-measures.pdf
[84] JRC (2017): https://eippcb.jrc.ec.europa.eu/reference/intensive-rearing-poultry-or-pigs-0

**On the use of a fertiliser recommendation system**, this has been estimated to potentially reduce NO3 (plus ammonium and nitrite) leaching losses by up to 5% as well as associated direct and indirect N2O and NH3 emissions (Price et al, 2011). The British Survey of Fertiliser Practice indicates that farmers do not always make full allowance for the nutrients supplied by organic manures when calculating fertiliser application rates. (see Price et al, 2011, pp.43-46).

**On periods for fertiliser application.** For example, Denmark has the restriction that "application has to take place when plants have the maximum nitrogen uptake. This is during growth and in practice this means that most application takes place during a short time-period in spring." (Hertel *et al.,* 2009).

**On no fertiliser application close to water bodies** see Price et al, 2011, p.49, "do not apply fertiliser to high risk areas"…"The risk of N and P pollution is reduced by not applying fertiliser at any time to areas where it could easily be transferred to a watercourse… Avoiding fertiliser spreading to hydrologically well connected areas helps prevent the transfer of pollutants to water".

**Spread fertilisers evenly, or precisely.** (Adapted from Price method 67 – "manure spreader calibration"). Even spreading can avoid areas of accumulation and therefore poor uptake by plants and losses. E.g. "fertiliser spreaders should be checked at least annually and, ideally, whenever the fertiliser type is changed" A variability of less than 10% should be aimed for (p.42). Similarly, fertiliser placement methods can be deployed to "place nutrients close to germinating or established crops to increase fertiliser N and/or P recovery" (p.51).

**Establishing perennial native vegetation.** For instance, generally increasing hedge coverage will reduce liquid and gaseous N losses. "Plant new hedges along fence lines and use them to break-up the hydrological connectivity of the landscape." (Price, p.118). According to Laura et al (2017): "hedgerows and grass strips intercepted nitrogen from the surface (69% and 67%, respectively) and subsurface (34% and 32%, respectively) flow and phosphorus (67% and 73%, respectively) and soil sediment (91% and 90%, respectively) from the surface flow".

It can be particularly advantageous to place perennial native vegetation on contour (across slope) to intercept run-off and erosion. For this reason, in many old fields one sees soil build up above the slope of a hedge – whether the hedge remain there or has subsequently (unfortunately) been removed. (Whitefield, 2014).

[This relates to the option of a staggered buffer zone, see later]

**Create and restore wetland habitats** that intercept run-off and throughflow (adapted from Price, method 81). "Wetlands act by intercepting pollutant delivery through providing a 'buffer zone' and can potentially clean up polluted water. They can be natural or artificial, permanent or temporary, with water that is static or slow flowing. Constructed wetlands can be either surface (overland) flow or subsurface (percolation) flow systems. A surface flow wetland is akin to a natural wetland; in the form of a reed bed, bog, wet grassland, wet woodland, sedimentation pond or lake. A subsurface flow wetland is generally a highly engineered, confined system of graded gravels and reeds. A range of biological, physical and chemical processes occur in the wetland environment, which can reduce nutrient and sediment concentrations in water that passes through the wetland. Wetlands can potentially be applied to all farming systems on medium/heavy soils with moderate to poor drainage. Provided only native vegetation is used, and no other biodiverse habitat is lost in their creation, they would contribute to npHBLF requirements (see Table 4).

**On the option of allowing field drainage systems to deteriorate** (Price et al, 2011, Method 16, p.34). **"**Drainage systems can accelerate the delivery of pollutants from land to a watercourse, by acting as a preferential (by-pass) flow route. Allowing drainage systems to deteriorate therefore reduces hydrological connectivity and the potential transfer of pollutants to watercourses, although surface runoff would be increased. When drains have deteriorated, water is forced to percolate through the soil at a slower rate, which increases the opportunity for the retention (or transformation) of potential pollutants through physical filtration and biological activity in the soil. Allowing drains to deteriorate will result in a higher water table being maintained, thereby reducing N mineralisation from soil organic matter and NO3 leaching… NO3 leaching loss reductions would typically be in the range of 10-50%...Ammonium and nitrite losses would also be reduced, and indirect N2O losses as a result of lower NO3 leaching losses. However, direct N2O emissions would be increased as a result of greater soil wetness and associated denitrification losses."

**On native tree shelter belts (Price, Method 83).** Tree shelter belts are similar to tree lines, but likely to be wider. "Planting tree shelter belts upwind and downwind of livestock housing or slurry storage facilities will reduce NH3 emissions in two ways. Firstly, the shelter belt will result in a lower wind speed directly above and around the building or slurry store, and thereby will increase the time taken for emitted NH3 to be transported away in the air stream. Secondly, the trees will re-capture a proportion of the emitted NH3 both directly though cuticular uptake and also indirectly by increased deposition[85]. The effectiveness of the method in reducing NH3 emissions will depend on the height and canopy density of the shelter belt, and the prevailing environmental conditions." A 10% reduction in ammonia is predicted for a 30m width of shelter belt, but the principle of wind-breaks with native trees, contributing to npHBLF, can be applied more flexibly.

As well as lining sources of emissions (e.g. mainly intensive housing or storage, to a lesser extent fields where manure is spread), another useful option is to line natural / semi-natural ecosystems with buffer zones of tree shelter belts. This is because small patches of such habitat within agricultural environs can be particularly vulnerable to ammonia deposition and shelter belts can intercept significant quantities of N instead of it depositing within the area being protected (Dragosits et al, 2002; Sutton et al, 2004). Their design needs to ensure wind does not pass through a left-open understory (i.e. without contacting foliage) (Sutton et al, 2004)

**Scattered trees** are another alternative (i.e. reducing wind effect and thus N export, and increasing adsorption surfaces of leaves, soil structure, etc, and may be associated with premium products such as "pannage pork" or high nature value Iberian black pig. Parkland and savannah landscapes (e.g. cork oak dehesa) frequently have 30% or more scattered trees for shade reasons as well as conferring N benefits. "Where stock is kept under trees, overlaying vegetation is expected to recapture a substantial amount of any emitted ammonia" (Sutton, 2004).

**Note on biochar.** Biochar is not listed herein as a practice due to not being in the Price or UNECE documents, perhaps as research continues. However, advocates suggest its incorporation into soils for various reasons from carbon sequestration to providing high surface area for soil microbiology, and it appears to be capable of immense reductions in ammonium and nitrate concentrations in soil water as well as to reduced volatisation of NH3 and reduced N2O emissions, according to some whilst enhancing crop N uptake and stabilising soil N retention (see Borchard et al, 2019; Ayaz et al 2021; Chen et al., 2021).

85 A fraction of ammonia may also be forced higher, over the trees, equivalent to having a higher stack/chimney (Groenestein et al, 2011, p.7).

The suitability of biochar for the particular soil and activity, and the type and provenance of, should of course be considered. Care needs to be taken not to reduce the availability of N too much, nor overly alter soil pH (see Sika & Hardie, 2013).

As stipulated regarding its use in composting (below), to avoid sourcing biochar unsustainably from habitat conversion, or excessive ecological footprint of growing crops to produce biochar, biochar from trees must be from Forestry-fiche aligned sources, and other sources must be either produced on-holding or from CE by products.

Biochar likely has potential also as an additive to manures (similar to expanded clay, below), but has not been considered for inclusion herein).

<u>Practices specific to cropping</u>

**Reduced tillage** (Price, Method 7). Direct drilling or broadcasting of seed (i.e. no-till), or reduced cultivations (e.g. using discs or tines to cultivate the soil surface layers only in seedbed preparation), can retain soil surface organic matter and preserve good soil structure (and improved soil biodiversity), improving water infiltration rates and reducing loss of soil, N and P. “NO3 (plus ammonium and nitrite) leaching loss reductions can be up to 20%; reductions are likely to be at the higher end where manures are applied”.

**Maintain consistent soil moisture levels.** Consistent soil moisture levels reduce the likelihood of denitrification. For instance, the use of organic matter containing manures and composts, as encouraged herein, as well as mulches, polycultures, etc, can help maintain hydration. Of course, (efficient) irrigation can as well, but care is needed to avoid adverse impacts on biodiversity (e.g. from over extraction from fresh water ecosystems), or overwatering and thus leaching..

…“Irrigation with at least 5 mm water immediately following fertilizer application has been shown to reduce NH3 emissions by up to 70%. Water should not be applied to wet soils beyond field capacity. This is only considered a category 1 technique *where there is a water need for irrigation*, as the method may otherwise increase the risk of nitrate leaching” (UNECE 2014, p.58). Application prior to (light) rains is another approach (ibid), though can backfire if rains are heavier than expected and leaching thus increased.

**Plough land for crop preparation in spring rather than autumn (Price, Method 6).** This method may need adapting in different climates. “Autumn cultivation of land stimulates the mineralisation of N from organic matter reserves at a time when there is little N uptake by the crop, which will increase the potential for over-winter NO3 leaching losses. By cultivating in spring, there will be less opportunity for mineralised N to be leached and the N will be available for uptake by the established spring crops, and there will be less risk of particulate P losses in surface runoff… NO3 leaching losses would typically be reduced by 20-50%; on arable land with manure the reduction is likely to be at the higher end of the range. Indirect N2O emissions would be reduced by a small amount."

Practices specific to indoor livestock

**On feed considerations** (Price Method 33). "Farm animals are often fed diets with higher than recommended contents of N and P, as a safeguard against a loss of production arising from a deficit of these nutrients. However, surplus N and P will not be utilised by the animal and will be excreted. Restricting diets to recommended levels of N and P will limit the amounts excreted" (Price, 2011).

"Low-protein animal feeding is one of the most cost-effective and strategic ways of reducing NH3 emissions. For each per cent (absolute value) decrease in protein content of the animal feed, NH3 emissions from animal housing, manure storage and the application of animal manure to land are decreased by 5%–15%, depending also on the pH of the urine and dung. Low-protein animal feeding also decreases N2O emissions, and increases the efficiency of N use in animal production. Moreover, there are no animal health and animal welfare implications as long as the requirements for all amino acids are met" (UNECE, 2014):

"Nutrient excretion can also be reduced by changing the composition of the diet to increase the proportion of dietary N and P utilised by the animal; for example, by optimising the balance of N to carbohydrate in ruminant diets or by reducing the proportion of rumen-degradable protein. Additionally, in non-ruminants, N excretion can be reduced by increasing the digestibility of the ration. In both ruminants and non-ruminants, feeding a ration that supplies amino acids in the ideal proportions required for protein synthesis will reduce the quantities of 'surplus' amino acids that remain un-utilised and contribute to N excretion." (ibid)

**On climatization and thermal regulation.** For example, "optimal barn climatization with roof insulation (RI) and/or automatically controlled natural ventilation (ACNV) can achieve a moderate emission reduction (20%) [eg in dairy and beef housing] due to the decreased temperature (especially in summer) and reduced air velocitie"s (UNECE 2014, p.28).

Ventilation can also be deployed on belt removal systems (e.g. poultry) although free-range and therefore deep litter when indoors, is possibly more likely for poultry in this proposal.

“The Combideck consists of heat exchangers in the concrete floor (e.g. broiler facilities). In the beginning of the fattening period the floor is heated to dry the litter and later in the fattening period the floor is cooled to reduce microbial activity, which reduces breakdown of uric acid… The effectiveness of this technique depends on local conditions.” (Ibid, p.39).

**Scrape dairy cow cubicles 3x per day** (Price, method 42). “More frequent removal of urine and faeces from cubicle passage floor (i.e. 3 times per day rather than 2) reduces the amount of time that NH3 emissions (from a given quantity of excreta) will occur, thereby reducing the overall potential for NH3 emissions… Also, a build-up of dung on the floor can impede the natural drainage of urine, so more frequent removal will also increase the volume of urine reaching the slurry store by natural drainage and thereby further reduce emissions… The method is applicable to cattle housing with scraped passages, but is best suited to those with a gently sloping floor to assist the rapid drainage of urine. Some modern houses are already fitted with automatic scraper belts.”

**Additional straw bedding** (Price, method 43). “Straw bedding reduces NH3 emissions from cattle housing by providing a physical barrier between urine (which has infiltrated into the bedding) and the air above the bedding, and by encouraging microbial immobilisation of NH4 (readily available) N. Adding 25% additional straw above standard practice enhances these effects, particularly when the additional straw is specifically targeted to the ‘wettest/dirtiest’ areas of the house (e.g. around water or feeding troughs). Further reductions may be achieved by using even more additional bedding, but there is a risk that too much bedding could cause the litter temperature to rise (due to greater aeration and associated oxygen supply) and actually lead to an increase in NH3 emissions.”

**Pressure wash dairy cow collecting yards after each milking (Price, method 44).** “Scraping has been estimated to remove 60% of the excreta from the yard surface, but still leaves a film remaining from which emissions can occur. The removal of excreta by pressure washing or by hosing and brushing, immediately following each milking event, will remove a greater proportion of excreta from the yard surface (>90%) prior to urea hydrolysis.”

**Outwintering of cattle on wood-chip stand-off pads** (Price, method 45, see also Groenestein et al, 2011). “An alternative to concrete floors are woodchip pads (including an impermeable liner and drainage collection system), with a feeding area. The rapid infiltration of urine into the woodchip medium will increase the physical barrier to NH3 volatilisation in a similar way to straw bedding in livestock housing and the soil when cattle are at grazing. There may also be some direct adsorption of NH4 by the woodchip medium and microbial immobilisation by the bacterial community within the woodchip pad. Additionally, drainage from the stand-off pad is likely to be lower in volume (because of evaporation losses), N content and dry matter (compared with slurry from cattle housing), and so the potential for NH3 emissions following land application is likely to be lower, because of more rapid infiltration of the lower dry matter slurry into the soil. Additionally, the (solid) woodchips need periodically to be recycled to land, but present a low runoff risk. This method is potentially applicable where beef and dairy cattle are housed (or kept on concrete yards) for at least part of the year."

**"Floating balls in manure pits** may reduce emissions by 25% by partially covering the emitting surface. Manure dropping on the balls causes them to turn, and because of their non-stick surface, the clean side of the ball rotates upward. This technique can be used in existing houses" (UNECE 2014, p.32).

**Remove manures at least twice a week.** The longer manures are in-situ, the more able they are to hydrolyse into ammonia. Whilst various ways are possible to remove manures to storage more promptly than stipulated (daily cleaning, belt removal systems, etc), in both pig and poultry systems twice weekly complete manure removals avoid the worst peaks in ammonia production (e.g. in poultry, ammonia is released usually from the second day so daily cleaning is best, but peaks occur on days 5-7 [i.e. in a cool temperate climate]. Twice weekly removals may enable 25% less ammonia from slatted pig operations, for instance (Price, p.73). Twice weekly is, we consider, a minimum of good practice that is generally applicable to different systems and not technologically specific. See also UNECE 2014, p.30).

**Change from a slurry to solid manure handling system** (cattle & pigs). (Price, method 65). "Solid manures are more easily stored than slurries and present less risk of pollutant loss during and following land spreading. Straw use also encourages bacterial immobilisation of readily available nitrogen, resulting in a lower potential for NH3 emissions during housing, storage and following land spreading."

**Air scrubbing and biotrickling systems.** These are widely deployed in pig farming. "In the Netherlands it is estimated that currently about 5000 farm-scale scrubbers are in operation at animal houses of which about 60% are acid scrubbers and 40% bioscrubbers, the latter also referred to as biotrickling filters." (de Wries, 2017) Air scrubbers and biotrickling both produce nitrogenous outputs that can be used as crop fertiliser. Air scrubbers perform better on a sustainability life-cycle assessment and are thus preferred (ibid). Air scrubbers can be expected to reduce ammonia emissions from 70% (biological scrubbers), or 70% to 90% (acid-scrubbers) Price et al, 2011; UNECE 2014, p.36; Melse & Mol, 2015; de Wries & Melse, 2017).

See General Practices re native tree-shelter belts and scattered trees.

**On use of additives.** We do not list these in practices as UNECE does not list them as Category 1 and also with reference to precautionary principle (e.g. the use of aluminium sulphate and the fate of that aluminium in ecosystems). However, "use of additives [to indoor manure in housing facilities] (aluminium sulphate, micro-organisms) may reduce NH3 emissions, lead to a higher dry matter content of the manure and reduce mortalities, but results are either inconsistent, or tested in one country only (e.g. aluminium sulphate)". N.B. "Light expanded clay aggregates (LECA) balls…can be easily applied to non-crusting pig manure or digestate from anaerobic digesters" (category 1). (UNECE 2014, p.39 & p.41)

Practices specific to outdoor livestock

**grazing season (Price, method 36).** Where soil conditions allow, an option is to extend the grazing season (e.g. either earlier in the spring or later in the autumn). Urine deposition by cattle at grazing rapidly infiltrates into the soil and is therefore associated with lower NH3 emissions, compared with higher emissions from urine deposition on impermeable concrete floors within cattle housing (and associated emissions during storage and following manure spreading). (Price, method 36). Sutton *et al.* (2004, see also UNECE 2014 pp.24-25): "ammonia emissions per kg N excreted are smaller for animals kept outdoors than for housed animals" – another reason for linking livestock density to carrying capacity of land. See also UNECE, p.25.

Graze-high. Farmers in North America have an adage to "graze high", and this can be achieved through rotation management. One reason for the adage appears to be the favourable (and lower N emitting) carb:protein ratio of older grass (see UNECE 2014, p.25).

**Reducing field stocking rates / time spent in field, when soils are wet (Price, Method 37).** When soils are wet, the number of livestock per unit area and/or the time stock spend in the field can be reduced to avoid (severe) poaching and compaction of the soil and the potential for mobilisation and transport of pollutants to watercourses in runoff. Implementation will be easier on farms with access to freely draining soils that can provide alternative grazing ground during 'wet' periods, and where there is alternative housing available.

**Move feeders at frequent intervals to avoid point source accumulations of manure** (Price, method 38). "Animal movements in fields concentrate around feeding points that result in large inputs of excreta deposited on these areas, which can be a source of high levels of nutrient losses to water. As a result of frequent treading, soils around these positions also get heavily poached, which further increases the risk of surface runoff and diffuse pollution losses. Also, damage to the grass sward has the secondary effect of reducing plant uptake that would otherwise reduce NO3 losses. Moving feeders frequently prevents the accumulation of elevated nutrients in localised areas, and reduces the severity of poaching."

**Construct water troughs with a firm but permeable base or move them frequently (adapted from Price, method 39). "**Animal activity is also concentrated around drinking points…Water troughs, with a firm yet permeable base, reduce poaching and allow the rapid infiltration of urine, reducing the risks of surface runoff and transfer of pollutants to watercourses."

**Excluding livestock from riparian buffer zones** (Price method 76) (e.g. with hedging or fencing) provides an extra level of protection to the functionality of the buffer zone and reduction in N inputs to water courses.

**Bridges** enabling livestock to cross water-bodies can completely remove the issue of N directly inputting to water bodies, and erosion of river banks.

**Positioning field gates** (Price, method 78): "A gateway at the bottom of a slope provides a break in the field boundary which might otherwise retain surface runoff within the field. In addition to the poaching and compaction that occurs around gateways, ruts from tractor wheelings and animal tracks tend to converge on these points and channel surface runoff to these positions. Re-siting gateways away from the lower boundary of fields lessens the risk of surface runoff transporting sediment, associated nutrients and faecal-indicator-organism out of sloping fields and directly into watercourses or onto roads etc. This method is applicable to all farming systems on sloping land, with gateways in high runoff risks, areas and is relatively easy to implement. Farmers may be reluctant to re-locate gateways, but if it improves opportunities for access, then it may be seen as advantageous, particularly in wet years." The method supports the efficacy of the riparian buffer zones.

**Farm track management** (Price, method 79): "Tracks can quickly become waterlogged in wet conditions. On sloping land, surface runoff can be generated mobilising sediment and manure-borne pollutants. Constructing tracks from appropriate materials can improve drainage and reduce runoff volumes. Cross drains and soakaways reduce the energy of overland flow, reduce pollutant mobilisation and increase the opportunity for the retention of mobilised pollutants. The location and route of tracks is also important; following contours and avoiding steep slopes can minimise concentrated flows and reduce the risk of track and adjacent field erosion… Also, waterlogged tracks can cause problems to livestock, including foot, mastitis and teat and udder damage."

<u>Manure storage and transformations</u>

**Minimising surface area** is about reducing oxidation (see UNECE 2014, p.10).

See Price Method 55 re allowing slurry to develop natural crust. "Abatement with natural crust is an option only for farms that do not have to frequently mix the manure for frequent spreading, and do have slurries that produce crusts" (UNECE 2014, p.41).

"Ammonia emission can be reduced by 25% by reduction of emitting surface area through frequent and complete vacuum-assisted drainage of slurry from the floor of the pit. Where this is possible to do, this technique has no cost." (UNECE 2014, p.31).

**Minimise the volume of dirty water & slurry produced** (Price, Method 57). "On some farms, dirty water is collected separately and spread on fields, whereas on others it is added to the main slurry store. Keeping the fouled yard area as small as possible minimises the volume of water required to wash it down and hence the volume of dirty water (or slurry) produced. Roofing such yards would avoid additional inputs from rainwater. Poorly designed or badly maintained drains and gutters can allow rainwater from non-fouled yards and roofs to mix with dirty water (or slurry) and further increase the volume. This clean water should be managed separately e.g. to a soak-away. Avoiding unnecessary inputs of water reduces the volume of dirty water (or slurry) produced and increases the number of days of storage capacity. This helps to avoid the need to apply dirty water (or slurry) when soils are 'wet' and reduces the likelihood of surface runoff and drainflow losses of nutrients and FIOs/BOD to (surface) water systems. Also, covering dirty water and slurry stores prevents rainfall from adding to the volume to be stored. This method is mainly applicable to farms with cattle, particularly dairy farms; although most livestock farms produce dirty water. Preventing unnecessary inputs of rainwater will be most beneficial in high rainfall areas."

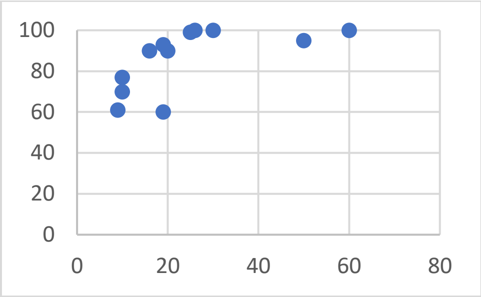
**Decreasing the source strength of the emitting surface**, such as through lowering pH and NH4 concentration through dilution, urease inhibitors, or use of acids, can result in substantial reductions in NH4 emissions, e.g. 30% for dilution of slurry before application (UNECE, 2014, p12).

**Hot composting** (see Price, Method 59, Compost Solid Manure). Hot composting (or "active composting") manures uses thermophilic bacterial action to reduce the readily available N (converting it into more stable forms with very little loss) and thus N losses, whilst generating an easy to apply compost to apply to land that is largely weed and faecal-indicator-organism free (due to high temperatures). Attention should be paid to correct carbon:nitrogen ratio to ensure N is stabilised and organic matter retained. "The readily available N content of FYM is typically reduced from 20-25% (in 'fresh' FYM) to 10-15% of total N (in composted FYM). The whole process should be monitoring to ensure that temperatures increase to above 55'c for three days after each turn. Turning of the heap ensures that all parts are treated (i.e. composted)." Best practices are necessary as poor composting can result in significant N losses. For further guidance see Zhang et al 2021, who found N losses during compost making can be reduced 27.5% principally by taking care over the C/N ratio and moisture. See also UNECE, 2014.

**A note on anaerobic digestion.** Whilst anaerobic digestion can help treat high nutrient manures whilst generating methane for energy production and produce outputs that can be safely emitted to the environment or utilised on-field, because it results in increased nitrate, nitrite and ammonium losses, it is not listed as a N abatement practice herein (see Price, p.56).

<u>Riparian buffer zones of native, perennial, permanent vegetation</u>

Perennially vegetated riparian buffer zones are effective ways to reduce nitrogen run-off and other pollutants, whilst also providing habitat. "The effects of buffer zones on N retention were consistent across continents and in different climates." (Valkama *et al.,* 2019). Depending on factors such as soil, slope, concentration of pollutant in run-off, etc, "buffer strips have been observed to be capable of removing N from 5 up to 130 kg N $ha^{-1}$ $year^{-1}$ (Zak et al, 2018). This variability mainly depends on the width (which can be even more than 200m) of the system. Many studies analyse the % efficacy of pollutant removal according to width, Zhang (2010) modelling 30m buffer zones as usually 100% effective on N removal, which correlates broadly with results reported by Fennessy & Cronk (1997, see figure below).




**% total N removal efficiency (y axis) at different m widths of woody buffer zone (x axis). Data sourced from (Fennessy and Cronk, 1997).**

Outliers do of course occur in which greater buffer zones may be needed, but this is considered far less likely to farms operating under these criteria with restrictions on stocking densities, imported feed, mineral fertiliser, etc.

However, rather than just designating a simple buffer zone of 30m, we offer options for greater flexibility.  A 30m buffer may be simple in a lowland farm bordering one river, but in a more complex situations it may be more attractive to have other options available.

Riparian buffer zones also offer wider benefits – from habitat to potential increased crop yields thanks to attracting pollinators, natural predators, wind reduction etc (see Prosser et al 2020, and Table 4 for more).

The concept presented herein, of ***staggered buffered zones*** combines the logic of riparian buffers with analogous effects of perennial vegetation that may not be directly adjacent to water bodies.  See Price et al 2011, p.30, on the use of "in field grass buffer strips", which are "most effective when combined with additional riparian buffer strips". Such perennial grass strips can be mown periodically (in accordance to Table 4 management of npHBLF, e.g. outside of nesting season), if the farmer does not want scrub/tree-line to develop.  For more, see Practices Table 1.

It is permissible to remove the vegetation from the buffer zones in excess of the widths required in Table 4, albeit outside sensitive times of year for biodiversity, partly to increase the utility of the land for the farmer but also as whilst riparian buffer zones remove nitrogen in run-off through various mechanisms (ammonification, nitrification-denitrification, ammonia adsorption and sedimentation), plant uptake is one of them (Manusco *et al*, 2021), so by removing the plant material and recycling it into the farming system, a win-win is achieved.

Note: Allowing further flexibility by permitting activities to calculate the extent of buffer zone above Table 4 requirements they would need on site to get run-off total N below 2.5 mg N / L was also considered. However, given this proposal is intended to be simple, this has not been prioritised as it would require farmer expertise and auditing checks (or a tool). It would essentially require the activity to calculate the total runoff (i.e. N inputs * runoff conversion factors de Wries et al use), calculate the volume entering each relevant stretch of water body (i.e. using contour mapping, with run-off perpendicular to contours), and then the width of buffer required to mitigate the run-off in each riparian buffer (using efficacy data from Zhang, 2010).

Biodiverse habitats

See option A's Table 1, section 1 / footnote opposite for definition of npHBLF. (in the March 2022 text)

This % is less than the npHBLF required under Crops criteria Option A (i.e. 20% - *large areas of the holding are under high-biodiversity landscape features or are otherwise biodiversity rich*), because the emphasis of this option is N management, albeit with co-benefits.

However, 15% is more than required in Table 4 safeguards (e.g. the 10% applicable to Crops Option B (organics) or Animals Option B (e.g. rare breeds), or indeed the NUE efficiency options Ci in both fiches. This is because the co-benefits sought in this option include the use of nature based solutions to reduce nitrogen pollution (e.g. larger buffer zones than in Table 4, increased use of tree shelter belts / scattered trees / hedgerows / grass strips / constructed wetlands, etc) – all of which are npHBLF when based on native species. By stipulating more than 10%, we are incentivising the adoption of the nature based solutions practices in section 5, and consider it anyway likely that 15% or more will be reached by integrated farms pursuing this option.

Also – ammonia adsorbing vegetation is to some extent **sacrificial** – its value to wildlife is often reduced (e.g. the understorey biodiversity in a shelterbelt woodland will be compromised by nutrification, or the grassland sward under an ammonia adsorbing tree in parkland). So a little more npHBLF compensates for this.

A traditional example would be the dehesa / montado system, in which tree cover (often cork oaks, sometimes with or other species) is typically 30% or more. This is analogous to parklands in northern Europe with standard trees (e.g. oak) that are grazed underneath; also orchards with fruit or nut trees that are grazed underneath.

E.g. If half an integrated farm were parkland-pasture with 30% scattered native trees, this would already exceed 15% npHBLF (16.5%). 15% would likely be met with much less parkland-pasture due to also having buffer zones, hedges, shelter belts, etc.

Additional safeguards

To avoid canabilising Option A - Table 4 currently has safeguards avoiding the loss of natural (1.5) and semi-natural grasslands (1.6). But we widen this here to include avoiding loss of any permanent grassland including improved (which, under the input limits herein, should make additional (though lesser) contribution to biodiversity.

To avoid canablising Option A - The biodiversity value of all permanent grassland should not deteriorate. Improvement measures of grassland not only affect biodiversity, but also increase N losses, e.g. reseeding, drainage (Lantinga *et al* 2013).

Outdoor livestock on permanent pasture emit less nitrogen pollution than animals kept indoors, for a number of reasons such as a high fibre diet (e.g. roughage of pasture), the immediate infiltration of urine to soil and thus less ammonia emissions, and the greater uptake of nitrogen in the soil by perennial plants in permanent pasture and the microbiology of the soil. (See Price 2011, UNECE 2014). Thus, whilst achieving co-benefits of animal welfare and nutritional value to consumers (pasture fed animals have healthier fat profiles – O'Keefe & Cordain, 2004), the more time animals spend outdoors, the less indoors manure has to be managed to mitigate N losses and the less need for expensive mitigation such as acid and bio scrubbers.

"Decreasing the amount of animal excrement in animal housing systems through increased grazing is an effective measure to decrease NH3 emissions. Though emissions from grazing will increase when animals are kept outside, NH3 emissions from animal housing systems will decrease much more, provided surfaces in the house are clean while the animals are grazing outside. Total annual emissions (from housing, storage and spreading) from dairy systems may decrease by up to 50% with nearly all-day grazing, as compared with animals that are fully confined… Grazing is category 1 if the animals are grazed all day or if very little floor area is contaminated with manure each day. Less than 18 grazing hours per day must be considered as category 2 because of the uncertainty in quantifying emissions" (UNECE, 2014, p.28).

However, in order to avoid overstocking pastures particularly in wet periods where soil poaching can occur and thus higher nitrogen run-off, whilst rotational grazing/free-ranging can be part of the solution, indoor periods will nonetheless be part of farming.

This proposal lends itself to more extensive farming systems with a a high proportion of pasture-based foraging time, but if the holding (or group application holding) is large enough, congregations of animals could still be sizeable, and thus notable point sources of ammonia emissions, potentially making worthwhile abatement measures such as acid or bio-scrubbers (see Practices tables).

<u>Sensitive habitats</u>

Natura 2000 areas are designated according to the EU's Birds and Habitats Directives in order to protect particular habitats and species. A variety of these habitats and species are particularly sensitive to deposition of nitrogen caused by ammonia emissions. Livestock farming is the primary source of this pollution…over 90% of ammonia emissions in the EU originate from agriculture, [so] the key to their reduction lies in livestock farms”[86] (Jacbosen et al., 2019)

60% of sites protected by the EU Habitats Directive could exceed critical loads for nitrogen pollution, leading to suggestions for local air quality limits for Natura 2000 sites, in conjunction with national limits (see SCU 2013).

Although ammonia can be a long-distance (trans-boundary) pollutant[87], it follows a pattern of deposition similar to other air pollutants, with depositions exponentially decreasing over distance (depending on factors such as wind, local vegetation, etc). This makes it essential for these criteria not only to minimise overall ammonia emissions but also to consider local ammonia impacts: “ammonia emissions from larger point sources (livestock facilities, manure storage and field application of manure) can dominate local deposition rate within a given

[86] Some reduction has occurred in Europe due to the National Emissions Ceilings directives, but progress has recently slowed. Hitherto reductions “within the agricultural sector has primarily been due to a reduction in livestock numbers (especially cattle) since 1990, changes in the handling and management of organic manures, improved feeding techniques and decreased use of nitrogenous fertilisers… The target for NH3emissions in the Clean Air Policy Package for theEU28 is 94% by 2020 and 73% by 2030 compared to the 2005 level” (Jacobsen et al, 2019).
” (EEA, 2017a, cited by Jacobsen et al, 2019).

[87] “Typically, most of the nitrogen deposition at a given location originates from emissions far from the locality and often from othercountries. Only 23% of the deposition to Danish land area is caused by Danish ammonia emissions, while the corresponding figures for Germany and the Netherlands are 49% and 28%, respectively” (Jacobsen et al, 2019).

radius around the source…therefore to protect nitrogen sensitive nature both local and international initiatives to reduce ammonia emissions are necessary" (Jacobsen et al, 2019).

Activities aligned with these criteria are, generally, less likely than others in the sector to have intensive scale animal housing and manure storage facilities. However, this could still occur in cases where the holding is very large, or a group-holding is making the application, in which case even though the majority of feed is grown on-holding, it could be concentrated into point source pollution sites (housing facilities or manure storage areas). This is also less likely due to the requirements herein on free-ranging – but even so, cattle will often over-winter indoors, free-range units can also accumulate large quantities of manure, etc.

Ammonia critical levels (i.e. concentrations of, not deposition rates, beyond which adverse effects are known to affect ecosystems) for sensitive ecosystems are generally 1-2 micrograms / $m^3$ [88]. Vogt et al (2013, see figure below) collate 3 studies modelling the ammonia deposition from point sources. The more intensive units were still significantly exceeding critical loads at 900m, less intensive units were getting within critical loads from approx. 300 or more meters. However, many studies show problematic deposition from point sources in exceedance of these distances. Sutton *et al* (2004) consider "the worst problems occur where a large intensive livestock farm is located close (e.g., < 2 km) to an area of nature conservation value", and themselves map significant deposition affecting ecosystems 2.5km downwind.

[88] See Vogt et al (2013): 1 microgram / m3 in the most sensitive ecosystems where bryophytes and lichens are present, 3 micrograms +/- 1 (i.e. therefore 2 for our purposes) for higher plants in other semi-natural ecosystems.

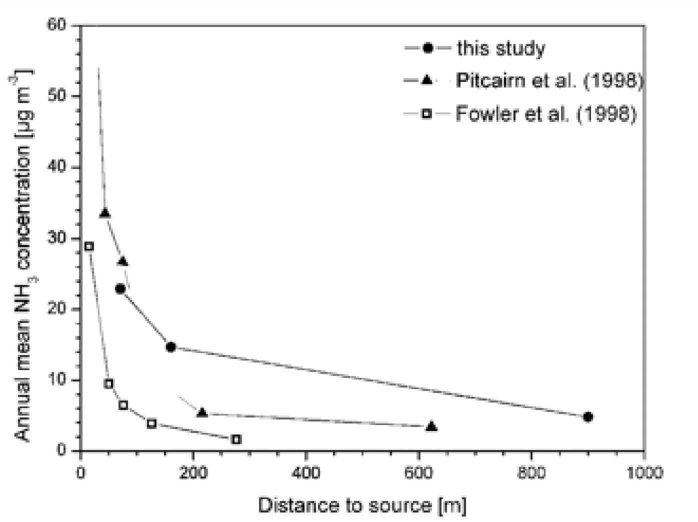



**Fig. 4.** Ammonia concentration decrease with distance from the source of this study (sites 31, 30, 23) compared with results of Pitcairn et al. (1998) and Fowler et al. (1998).

**Source: Vogt *et al*., 2013**

Requiring competent body permissions within a reasonable zone of risk, is consistent with the EU Habitats Directive, which requires any plan or project that might have an impact on the quality of a Natura 2000 site to be subject to an assessment of its implications, and the member state is obliged to take appropriate steps to avoid the deterioration of natural habitats (see Article 6) (EC 1992). In the case of these criteria, the caveat is useful also as the animal / manure facility may be small.

Allowing adjustment of distances in instances where point sources are tackled by abatement technologies (acid or bio-scrubbers) is valuable as an incentive to deploy these mitigation measures and capitalise on the opportunity to capture and re-use the N in the ammonia at point sources.  Whilst not in the Industrial Emissions Directive's Best Available Techniques due to cost implications, scrubbing technology is widely deployed – half of Netherlands' pig facilities (Jacbosen et al, 2019), for instance, and Filter Decrees make scrubbing technology compulsory for large pig units in German regions of Schleswig-Holstein, Lower Saxony, and North Rhine-Westphalia (see Lactacz-Lohmann, 2017).  Acid scrubbers tend to be 70-90% effective in ammonia abatement (see Practices tables).

"In and near sensitive nature areas, atmospheric nitrogen deposition should be reduced. Farms that are situated at short distances from nature areas should carefully evaluate the impact of expanding their farm on the environment even when the maximum emission reducing techniques are being applied. In the near future it may be possible to take into account closing farms in the neighborhood to calculate the net effect of all planned sources and the resulting

N load and its impact on the specific nature values (plant species and their critical loads) that should be protected. Models to calculate these loads should be validated and improved and user friendly versions should be made available for farm planning purposes[89]." (Groenestein et al, 2011).

In the Netherlands, "within a zone of 250m around nature areas that have been labelled as vulnerable ecosystems, new livestock farms are not allowed and existing livestock farms may only expand if housing systems are applied with a very high reduction of ammonia emission" (see Melse et al, 2009).

Note: Setting a livestock unit / ammonia emission threshold at which to mandate scrubbers was consided, but no data was found for it.

Note: Being more precise with such restrictions based on emissions from different land-uses, particularly from livestock housing and manure storage units, was considered. E.g. were the per m3 data on the x axis below to be converted to total ammonia emissions or to the equivalent livestock units (of different livestock), distance thresholds could be based on the total animals per housing facility. E.g. based on the graph above, it could be that the equivalent of 30 micrograms / m3 or above data have a distance threshold of 400m from Natura 2000 site), and more than 30 micrograms / m3 (e.g. 1km from Natura 2000 site). However, time did not allow answering this conversion question, so a simpler formula was presented.

References used in these criteria and rationale

Aguiar Jr., T. R., Rasera, K., Parron, L. M., Brito, A. G., & Ferreira, M. T. (2015). Nutrient removal effectiveness by riparian buffer zones in rural temperate watersheds: The impact of no-till crops practices. Agricultural Water Management, 149, 74–80. https://doi.org/10.1016/j.agwat.2014.10.03

[89] For instance, "ammonia concentrations and depositions can be calculated by several models (New National Model, Depac, AAgrostacks, ISL 3A, preliminary PAS tool ammonia)" (Groenestein et al, 2011, p.35).

Ayaz, M., Feizienė, D., Tilvikienė, V., Akhtar, K., Stulpinaitė, U., & Iqbal, R. (2021). Biochar Role in the Sustainability of Agriculture and Environment. Sustainability, 13(3), 1330. https://doi.org/10.3390/su13031330

Benton, T. G., Vickery, J. A., & Wilson, J. D. (2003). Farmland biodiversity: Is habitat heterogeneity the key? Trends in Ecology and Evolution (Vol. 18, Issue 4, pp. 182–188). https://doi.org/10.1016/S0169-5347(03)00011-9

Billen, G., Aguilera, E., Einarsson, R., Garnier, J., Gingrich, S., Grizzetti, B., Lassaletta, L., le Noë, J., & Sanz-Cobena, A. (2021). Reshaping the European agro-food system and closing its nitrogen cycle: The potential of combining dietary change, agroecology, and circularity. One Earth, 4(6), 839–850. https://doi.org/10.1016/j.oneear.2021.05.008

Borchard, N., Schirrmann, M., Cayuela, M. L., Kammann, C., Wrage-Mönnig, N., Estavillo, J. M., Fuertes-Mendizábal, T., Sigua, G., Spokas, K., Ippolito, J. A., & Novak, J. (2019). Biochar, soil and land-use interactions that reduce nitrate leaching and N2O emissions: A meta-analysis. Science of The Total Environment, 651, 2354–2364. https://doi.org/10.1016/j.scitotenv.2018.10.060

Chang, J., Havlík, P., Leclère, D., de Vries, W., Valin, H., Deppermann, A., Hasegawa, T., & Obersteiner, M. (2021). Reconciling regional nitrogen boundaries with global food security. Nature Food, 2(9), 700–711. https://doi.org/10.1038/s43016-021-00366-x

Chen, X., Yang, S.-H., Jiang, Z.-W., Ding, J., & Sun, X. (2021). Biochar as a tool to reduce environmental impacts of nitrogen loss in water-saving irrigation paddy field. Journal of Cleaner Production, 290, 125811. https://doi.org/10.1016/j.jclepro.2021.125811

Chmelíková, L., Schmid, H., Anke, S., & Hülsbergen, K.-J. (2021). Nitrogen-use efficiency of organic and conventional arable and dairy farming systems in Germany. Nutrient Cycling in Agroecosystems, 119(3), 337–354. https://doi.org/10.1007/s10705-021-10126-9

de Vries, J. W., & Melse, R. W. (2017). Comparing environmental impact of air scrubbers for ammonia abatement at pig houses: A life cycle assessment. Biosystems Engineering, 161, 53–61. https://doi.org/10.1016/j.biosystemseng.2017.06.010

de Vries, W., Schulte-Uebbing, L., Kros, H., Voogd, J. C., & Louwagie, G. (2021). Spatially explicit boundaries for agricultural nitrogen inputs in the European Union to meet air and water quality targets. Science of the Total Environment, 786. https://doi.org/10.1016/j.scitotenv.2021.147283

Dragosits, U., Theobald, M. R., Place, C. J., Lord, E., Webb, J., Hill, J., ApSimon, H. M., & Sutton, M. A. (2002). Ammonia emission, deposition and impact assessment at the field scale: a case study of sub-grid spatial variability. Environmental Pollution, 117(1), 147–158. https://doi.org/10.1016/S0269-7491(01)00147-6

EC (1992). COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities.

EC (2020). Farm to Fork Strategy.

EEA, & FOEN. (2020). Is Europe living within the limits of our planet?

Eltun, R., Korsaeth, A., & Nordheim, O. (2002). A comparison of environmental, soil fertility, yield, and economical effects in six cropping systems based on an 8-year experiment in Norway. In Agriculture, Ecosystems and Environment (Vol. 90).

Fahrig, L., Baudry, J., Brotons, L., Burel, F. G., Crist, T. O., Fuller, R. J., Sirami, C., Siriwardena, G. M., & Martin, J.-L. (2011). Functional landscape heterogeneity and animal biodiversity in agricultural landscapes. Ecology Letters, 14(2), 101–112. https://doi.org/10.1111/j.1461-0248.2010.01559.x

Fennessy, M. S., & Cronk, J. K. (1997). The effectiveness and restoration potential of riparian ecotones for the management of nonpoint source pollution, particularly nitrate. In *Critical Reviews in Environmental Science and Technology* (Vol. 27, Issue 4, pp. 285–317). Taylor and Francis Inc. https://doi.org/10.1080/10643389709388502

González-García, E., Gourdine, J. L., Alexandre, G., Archimède, H., & Vaarst, M. (2012). The complex nature of mixed farming systems requires multidimensional actions supported by integrative research and development efforts. Animal, 6(5), 763–777. https://doi.org/10.1017/S1751731111001923

Groenestein, C. M., Smits, M. C. J., Huijsmans, J. F. M., & Oenema, O. (2011). Report 488: Measures to reduce ammonia emissions from livestock manures; now, soon and later. Wageningen UR Livestock Research. http://www.livestockresearch.wur.nl

Gutser, R; Ebertseder, T; Schraml, M; von Tucher, S; Schmidhalter, U (2010): Stickstoffeffiziente und umweltschonende organische Düngung. In: KTBL-Schrift 483. KTBL-/vTI-Tagung 8-10. Dezember 2010. Emissionen landwirtschaftlich genutzter Böden. Darmstadt, S 31–50

Halberg, N., Steen Kristensen, E., & Sillebak Kristensen, I. (1995). Nitrogen Turnover on Organic and Conventional Mixed Farms. In Journal of Agricultural and Environmental Ethics (Vol. 8, Issue 1). http://orgprints.org/13010

Hendrickson, J. R., Hanson, J. D., Tanaka, D. L., & Sassenrath, G. (2008). Principles of integrated agricultural systems: Introduction to processes and definition. In *Renewable Agriculture and Food Systems* (Vol. 23, Issue 4, pp. 265–271). https://doi.org/10.1017/S1742170507001718

Hertel, O., Theobald, M., Hill, R., van Pul, A., Cellier, P., Skjøth, C. A., & Frohn, L. M. (2009). Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000-Topic 4. Background Document for the 'Nitrogen Deposition and Natura 2000: Science & practice in determining environmental impacts' Workshop at the Bedford Hotel and Conference Centre, Brussels, 18th - 20th May, 2009

Hutchings, N. J., Sørensen, P., Cordovil, C. M. d. S., Leip, A., & Amon, B. (2020). Measures to increase the nitrogen use efficiency of European agricultural production. Global Food Security, 26, 100381. https://doi.org/10.1016/j.gfs.2020.100381

ISO 19698:2020. Sludge recovery, recycling, treatment and disposal — Beneficial use of biosolids — Land application. https://www.iso.org/standard/74262.html

Jacobsen, B. H., Latacz-Lohmann, U., Luesink, H., Michels, R., & Ståhl, L. (2019). Costs of regulating ammonia emissions from livestock farms near Natura 2000 areas - analyses of case farms from Germany, Netherlands and Denmark. Journal of Environmental Management, 246, 897–908. https://doi.org/10.1016/j.jenvman.2019.05.106

Kay, S., Graves, A., Palma, J. H. N., Moreno, G., Roces-Díaz, J. v., Aviron, S., Chouvardas, D., Crous-Duran, J., Ferreiro-Domínguez, N., García de Jalón, S., Măcicăşan, V., Mosquera-Losada, M. R., Pantera, A., Santiago-Freijanes, J. J., Szerencsits, E., Torralba, M., Burgess, P. J., & Herzog, F. (2019). Agroforestry is paying off – Economic evaluation of ecosystem services in European landscapes with and without agroforestry systems. Ecosystem Services, 36, 100896. https://doi.org/10.1016/j.ecoser.2019.100896

Kronberg, S. L., Provenza, F. D., van Vliet, S., & Young, S. N. (2021). Review: Closing nutrient cycles for animal production – Current and future agroecological and socio-economic issues. *Animal*, *15*, 100285. https://doi.org/10.1016/J.ANIMAL.2021.100285

Lantinga, E. A., Oomen, G. J. M., & Schiere, J. B. (2004). Nitrogen efficiency (NUE) in mixed farming systems. *Journal of Crop Improvement*, *12*(1–2), 437–455. https://doi.org/10.1300/J411v12n01_07

Lantinga, E. A., Boele, E., & Rabbinge, R. (2013). Maximizing the nitrogen efficiency of a prototype mixed crop-livestock farm in the Netherlands. NJAS - Wageningen Journal of Life Sciences, 66, 15–22. https://doi.org/10.1016/j.njas.2013.07.001

Latacz-Lohmann, U. (2017). Economic analysis of ammonia regulation in Germany (Schleswig-Holstein) in relation to the Habitat Directive Final report. https://www.umweltbundesamt.de/daten/luftbelastung/luftschadstoff-emissionen-in-deutschland/ammoniak-

Laura, V. V., Bert, R., Steven, B., Pieter, D. F., Victoria, N., Paul, P., & Kris, V. (2017). Ecosystem service delivery of agri-environment measures: A synthesis for hedgerows and grass strips on arable land. Agriculture, Ecosystems & Environment, 244, 32–51. https://doi.org/10.1016/j.agee.2017.04.015

Lin, H.-C., Huber, J. A., Gerl, G., & Hülsbergen, K.-J. (2016). Nitrogen balances and nitrogen-use efficiency of different organic and conventional farming systems. Nutrient Cycling in Agroecosystems, 105(1), 1–23. https://doi.org/10.1007/s10705-016-9770-5

Mancuso et al (2021). Diffuse water pollution from agriculture: a review of nature-based solutions for nitrogen removal and recovery. Water, 13.

Melse, R. W., & Mol, G. (2004). Odour and ammonia removal from pig house exhaust air using a biotrickling filter. Water Science and Technology, 50(4), 275–282. https://doi.org/10.2166/wst.2004.0283

Melse, R. W., Ogink, N. W. M., & Rulkens, W. H. (2009). Overview of European and Netherlands' regulations on airborne emissions from intensive livestock production with a focus on the application of air scrubbers. Biosystems Engineering, 104(3), 289–298. https://doi.org/10.1016/j.biosystemseng.2009.07.009

Oelofse, M., Høgh-Jensen, H., Abreu, L. S., Almeida, G. F., El-Araby, A., Hui, Q. Y., & de Neergaard, A. (2010). A comparative study of farm nutrient budgets and nutrient flows of certified organic and non-organic farms in China, Brazil and Egypt. Nutrient Cycling in Agroecosystems, 87(3), 455–470. https://doi.org/10.1007/s10705-010-9351-y

Oomen, G. J. M., Lantinga, E. A., Goewie, E. A., & van der Hoek, K. W. (1998). Mixed farming systems as a way towards a more efficient use of nitrogen in European Union agriculture. *Environmental Pollution*, *102*(1), 697–704. https://doi.org/10.1016/S0269-7491(98)80101-

O'keefe, J. H., & Cordain, L. (2004). Becoming a 21st-Century Hunter-Gatherer 101. Mayo Clin Proc, 79, 101–108.

Price, N., Harris, J. P., Taylor, M., Williams, J. R., Anthony, S. G., Duethmann, D., Gooday, R. D., Lord, E. I., Chambers, B. J., Chadwick, D. R., & Misselbrook, T. H. (2011). An inventory of mitigation methods and guide to their effects on diffuse water pollution, greenhouse gas emissions and ammonia emissions from agriculture. Prepared as part of DEFRA project WQ0106 by North Wyke Research & ADAS.

Prosser, R. S., Hoekstra, P. F., Gene, S., Truman, C., White, M., & Hanson, M. L. (2020). A review of the effectiveness of vegetated buffers to mitigate pesticide and nutrient transport into surface waters from agricultural areas. Journal of Environmental Management, 261. https://doi.org/10.1016/j.jenvman.2020.110210

[3] REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2012–2015

Ryschawy, J., Choisis, N., Choisis, J. P., Joannon, A., & Gibon, A. (2012). Mixed crop-livestock systems: an economic and environmental-friendly way of farming? *Animal*, *6*(10), 1722–1730. https://doi.org/10.1017/S1751731112000675

SCU (2013). Nitrogen Pollution and the European Environment Implications for Air Quality Policy Science for Environment Policy Environment. , Science Communication Unit (SCU), University of the West of England. http://ec.europa.eu/science-environment-policy

Schröder, J. (2005). Revisiting the agronomic benefits of manure: a correct assessment and exploitation of its fertilizer value spares the environment. Bioresource Technology, 96(2), 253–261. https://doi.org/10.1016/j.biortech.2004.05.015

Schulte-Uebbing, L., & de Vries, W. (2021). Reconciling food production and environmental boundaries for nitrogen in the European Union. Science of the Total Environment, 786. https://doi.org/10.1016/j.scitotenv.2021.147427

Sika, M. P., & Hardie, A. G. (2014). Effect of pine wood biochar on ammonium nitrate leaching and availability in a South African sandy soil. European Journal of Soil Science, 65(1), 113–119. https://doi.org/10.1111/ejss.12082

Sirami, C., Gross, N., Baillod, A. B., Bertrand, C., Carrié, R., Hass, A., Henckel, L., Miguet, P., Vuillot, C., Alignier, A., Girard, J., Batáry, P., Clough, Y., Violle, C., Giralt, D., Bota, G., Badenhausser, I., Lefebvre, G., Gauffre, B., … Fahrig, L. (2019). Increasing crop heterogeneity enhances multitrophic diversity across agricultural regions. Proceedings of the National Academy of Sciences of the United States of America, 116(33), 16442–16447. https://doi.org/10.1073/pnas.1906419116

Smit, H. P. J., Reinsch, T., Kluß, C., Loges, R., & Taube, F. (2021). Very Low Nitrogen Leaching in Grazed Ley-Arable-Systems in Northwest Europe. Agronomy, 11(11), 2155. https://doi.org/10.3390/agronomy11112155

Soil Association. (2021). Soil Association Standards Farming and growing. Version 18.7.1

Sutton, M. A., Dragosits, U., Theobald, M. R., Mcdonald, A. G., Nemitz, E., Blyth, J. F., Sneath, R., Williams, A., Hall, J., Bealey, W. J., Smith, R. I., & Fowler, D. (2004). The role of trees in landscape planning to reduce the impacts of atmospheric ammonia deposition. www.apis.ceh.ac.uk. *Conference paper: Landscape ecology of trees and forests. Proceedings of the twelfth annual IALE (UK) conference, Cirencester, UK, 21-24 June 2004 pp.143-150 ref.13*

Taube, F., Pötsch, E. M., Taube, F., & Pötsch, E. M. (2001). *On-farm nutrient balance assessment to improve nutrient management on organic dairy farms Grazing View project Impact of future climate conditions on productivity and biogeochemistry of grassland ecosystems View project Organic Grassland Farming On-farm nutrient balance assessment to improve nutrient management on organic dairy farms*. https://www.researchgate.net/publication/313422807

Townsend, A.R. and Palm, C.A. (2009). The nitrogen challenge. BioScience. 59 (10): 822-823.

Umweltbundesamt (2021), Perspektiven für eine umweltverträgliche Nutztierhaltung in Deutschland, UBA-TEXTE 33/2021

UNECE. (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. United Nations Economic Commission for Europe, Executive Body for the Convention on Long-Range Transboundary Pollution.

Valkama, E., Usva, K., Saarinen, M., & Uusi-Kämppä, J. (2019). A Meta-Analysis on Nitrogen Retention by Buffer Zones. Journal of Environmental Quality, 48(2), 270–279. https://doi.org/10.2134/jeq2018.03.0120

Vogt, E., Dragosits, U., Braban, C. F., Theobald, M. R., Dore, A. J., van Dijk, N., Tang, Y. S., McDonald, C., Murray, S., Rees, R. M., & Sutton, M. A. (2013). Heterogeneity of atmospheric ammonia at the landscape scale and consequences for environmental impact assessment. Environmental Pollution, 179, 120–131. https://doi.org/10.1016/j.envpol.2013.04.014

Watson, C. A., Öborn, I., Eriksen, J., & Edwards, A. C. (2008). Perspectives on nutrient management in mixed farming systems. *Soil Use and Management*, *21*(1), 132–140. https://doi.org/10.1111/j.1475-2743.2005.tb00117.x

Whitefield, P. (2014). How to read the landscape. Permanent Publications.

Wilkinson. (2011). Herbal Leys. *Cattle Breeder*, *Spring*.

Zak, D.; Kronvang, B.; Carstensen, M.V.; Hoffmann, C.C.; Kjeldgaard, A.; Larsen, S.E.; Audet, J.; Egemose, S.; Jorgensen, C.A.; Feuerbach, P.; et al. Nitrogen and phosphorus removal from agricultural runoff in integrated buffer zones. Environ. Sci. Technol. 2018, 52, 6508–6517

Zhang, X., Liu, X., Zhang, M., Dahlgren, R. A., & Eitzel, M. (2010). A Review of Vegetated Buffers and a Meta-analysis of Their Mitigation Efficacy in Reducing Nonpoint Source Pollution. Journal of Environmental Quality, 39(1), 76–84. https://doi.org/10.2134/jeq2008.0496

Zhang, Z., Liu, D., Qiao, Y., Li, S., Chen, Y., & Hu, C. (2021). Mitigation of carbon and nitrogen losses during pig manure composting: A meta-analysis. Science of The Total Environment, 783, 147103. https://doi.org/10.1016/j.scitotenv.2021.1

## 1.4 Forestry and logging

### *Description of the activity*

These criteria cover the production of timber and related forestry operations.

In accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006, these activities are classified under NACE codes 2.1 and 2.2:

A.02.1 - Silviculture and other forestry activities:

*Includes*: growing of standing timber (planting, replanting, transplanting, thinning and conserving of forests and timber tracts), growing of coppice, pulpwood and firewood, operation of forest tree nurseries. These activities can be carried out in natural or planted forests.

*Excludes*: growing of Christmas trees, operation of tree nurseries (except for forest trees), collection of wild mushrooms, other non-wood forest products, production of wood chips and particles

A.02.2 – Logging:

*Includes* production of roundwood for forest-based manufacturing industries or used in an unprocessed form such as pit-props, fence posts and utility poles, gathering and production of wood for energy, gathering and production of forest harvesting residues for energy, production of charcoal in the forest (using traditional methods). The output of this activity can take the form of logs or firewood.

*Excludes*: growing of Christmas trees, production of wood chips and particles, production of charcoal through distillation of wood.

NACE codes A.02.30 (Gathering of wild growing non-wood products) and A.02.40 (Support services to forestry) are *not* covered by these criteria.

These criteria apply to lands classified as forests and 'other wooded land' (OWL) (see below). They do not apply to small scale tree management in urban landscapes and agricultural lands.

The FAO ([90]2020) defines forest as "*Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.*"

[90] i8661en.pdf (fao.org)

*"Other wooded land" (OWL) is defined as "of more than 0.5 hectares with a canopy cover of 5-10 % of trees able to reach a height of 5 metres in situ; or a canopy cover of more than 10 % when smaller trees, shrubs and bushes are included.*

***Explanatory notes***

1. *Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters in situ.*
2. *Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of 5-10 percent and tree height of 5 meters (see above forest definitions). It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice, natural disasters or other human induced disturbance and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used.*
3. *Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest.*
4. *Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters.*
5. *Includes abandoned shifting cultivation land with a regeneration of trees that have, or are expected to reach, a canopy cover of 10 percent and tree height of 5 meters.*
6. *Includes areas with mangroves in tidal zones, regardless of whether this area is classified as land area or not.*
7. *Includes rubber-wood and cork oak plantations, cork forest, and cork oak savannah (dehesa & montado) and other agroforestry systems where crops are grown or livestock reared under tree cover. Some agroforestry systems such as the "Taungya" system where crops are grown only during the first years of the forest rotation should be classified as forest.*
8. *Includes areas with bamboo and palms if land use, height and canopy cover criteria are met.*
9. *Includes areas outside the legally designated forest land which meet the definition of "forest".*
10. *Excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations, olive orchards and Christmas trees.*

These criteria are applicable to forestry and logging activities with integrated conservation and restoration. A forestry or logging operator can alternatively use the criteria under 'Conservation of Habitats and Ecosystems' and / or 'Restoration of Habitats and Ecosystems' to assess conservation or restoration activity that can be separately distinguished from any timber production activity.

| Substantial contribution to the protection and restoration of biodiversity and ecosystems |
|---|
| If the activity and associated Forest Management Unit (FMU) is being newly established (i.e., afforestation), the area on which the activity will take place is covered by an afforestation plan (AP) or equivalent of a duration of at least five years, or the minimum period prescribed in national law, developed prior to the start of the activity and continuously updated, until this area matches the definition of forest as given above.[91]<br><br>After that time, or for forests not newly established, the area on which the activity takes place is covered by a forest management plan (FMP) or equivalent of a duration of at least ten years[92], or the minimum period prescribed in national law, and is updated continuously.<br><br>The AP / FMP provides detailed spatial and temporal information to describe how the criteria described in Table 2 are met. Noting that some of these criteria are mandatory and some selective (as summarised in Table 1 and explained in the key for Tables 1 & 2.) Table 3 provides additional guidance and safeguards around the interpretation of the criteria in Table 2 where operators are converting between Forest Management Approaches (FMAs) – which is further explained below.<br><br>The AP / FMP will also provide for monitoring that ensures the correctness of the information contained in those plans.<br><br>Within two years after the beginning of the activity and every 10 years thereafter, the compliance of the activity with these practices are verified by either the relevant national competent authorities or an independent third-party certifier.[93]<br><br>Compliance with the essential practices may be checked: |

[91] This follows the wording of the TSC for Climate Change Mitigation per ANNEX 1 to the Commission Delegated Regulation (EU) .../...

[92] This requirement is consistent with the Forestry TSC for Climate Change Mitigation in ANNEX 1 to the Commission Delegated Regulation (EU) .../...

[93] Wording taken from the Forestry TSC for SC to Climate Change Mitigation in ANNEX 1 to the Commission Delegated Regulation (EU) .../...

(a) at the level of the forest sourcing area[94]

(b) at the level of a group of holdings sufficiently homogeneous to evaluate the risk of the sustainability of the forest activity, provided that all those holdings have a durable relationship between them and participate in the activity and the group of those holdings remains the same for all subsequent audits.

Key:

| | |
|---|---|
| Purple | **MANDATORY Criteria:** Criteria need to be applied and met in all cases unless otherwise specified in the criteria. Noting that mandatory criteria may vary between FMA type. Mandatory criteria are necessary for the achievement of substantial contribution to biodiversity in all locations. |
| Blue | **SELECTIVE Criteria:** Noting that selective criteria may vary between FMA type. This is intended to allow a degree of variation in applicability in a given location depending on the biodiversity need. Half - 50% of the selective criteria must be met to align with the taxonomy criteria. |
| N/A | Not applicable - no criteria for an FMA |
| (F) | Criteria with flexible thresholds introduced<br>- Variable thresholds are introduced into the criteria to account for the variation in biodiversity potential across implementation areas<br>- A standard variable threshold of ~/- 20% of the threshold value is used, allowing a reduction in performance standard of up to 20%. Performance thresholds can of course be higher, allowing even greater contribution to the objective.<br>- Such variation is only permitted to enable flexibility in contexts where there is a convincing rationale that this criterion is not critical to biodiversity in that location, or a reduction in the levels from the benchmark to the flexed threshold will not be critical to biodiversity in that location. N.B. Simply not being able to achieve that level cannot be a viable reason to flex the threshold in a particular location - it must address the biodiversity need.<br>- Use of this variation in any particular instance needs to be independently verified by an approved, expert entity such as a certified auditor/assessor.[95] This could also take the form of an assessment of the implementation area to determine which of the selective practices are most relevant to the biodiversity in a given context. |

[94] "Sourcing area" as it is defined in Article 2, point (30), of Directive (EU) 2018/2001; 'Sourcing area' means the geographically defined area from which the forest biomass feedstock is sourced, from which reliable and independent information is available and where conditions are sufficiently homogeneous to evaluate the risk of the sustainability and legality characteristics of the forest biomass.

[95] Precedence for this is established in the operation of voluntary schemes under Directive 2018/2001/EU and Directive 2009/28/EC.

*Table 1: Overview of criteria.* ***For full criteria see Table 2***

| Criteria | FMA1 | FMA2 | FMA3 |
|---|---|---|---|
| **1. Provision of high biodiversity forest areas** | | | |
| 1.1.1 The activity has not (since 2008 or anytime thereafter) involved the conversion or fragmentation of, or logging or other commercial forestry activities | (F) | | |
| 1.1.2 Land conversion to forestry of any areas not included in criterion 1.1.1 was (or will be) carried out in accordance with the conclusions of an EIA addressing specifically biodiversity and necessary mitigation measures are implemented. | | | |
| 1.2 Set-aside (unlogged) areas are created or maintained | (F) | | |
| 1.3 Management of high-biodiversity forest areas | | | |
| 1.3.1 There is no commercial extraction of wood from set-aside areas | | | |
| 1.3.2. FMP includes habitat restoration and management measures that ensure native vegetation and natural ecosystem processes can occur or resume | | | |
| 1.3.3. High-biodiversity forest areas are monitored using forest quality tools | | | |
| 1.4 Permanence of high-biodiversity forest areas | | | |
| 1.5 There is alignment with national and local conservation priorities*, and safeguarding of any priority habitats and species present in the FMU. | | | |
| **2. Forest structure, function, and composition^ - I.e., within-stand operational safeguards** | | | |
| 2.1.1. Uneven age structure | | N/A | N/A |
| 2.1.2. Retention trees | (F) | (F) | N/A |
| 2.2.1. Max clear cuts/ coupe | (F) | (F) | N/A |
| 2.2.2. Unharvested area between coupes | (F) | | N/A |
| 2.3.1 No extraction of deadwood of any kind (trees, snags, stumps, logs, or fine woody debris) | | N/A | N/A |
| 2.3.2. General Management guarantees accumulation of deadwood | (F) | | N/A |
| 2.4.1. Natural tree and shrub layer | | (F) | N/A |
| 2.4.2. Use of native species and local genotype | | N/A | N/A |
| 2.5.1. No use of known invasive, alien species | | | |
| 2.5.2. Risk assessment of potential impacts of non-native species, | | | |
| 2.5.3. FMP explains measures to prevent introduction of invasives / naturalising species | | | |
| 2.5.4. FMP includes active management of spontaneous invasives | | | |
| 2.6.1. Natural regeneration | | N/A | N/A |
| 2.7.1. Forest areas should ensure functional connectivity needs for priority species, | | | |
| 2.8. No degradation / simplification of the composition, structure & function | | | N/A |
| **3. Fire prevention and control^** | | | |
| 3.1. If in a region prone to forest fire, a fire risk management plan is part of the Forest Management Plan. | | | |
| 3.2. No use of fire | | | |
| **4. Chemical use^** | | | |
| 4.1. Use of herbicides, pesticides, fungicides etc. | | (F) | (F) |
| 4.2. Use of fertiliser | | (F) | (F) |
| **5. Water management^** | | | |
| 5.1 No new drainage or improved efficiency (e.g., deepening) of existing drainage | | | |
| 5.2. Restoration of natural hydrological regime | | | |
| 5.3. Compliance with water abstraction licenses | | | |
| 5.4. No irrigation of forestry operations | | | |
| 5.5. No alteration of water bodies (diverting / canalising / damming of rivers, streams, etc) | | | |

| | |
|---|---|
| **6. Soil protection and use of machinery^** | |
| **6.1 Machinery is deployed in such a way as to safeguard good soil structure without deterioration** | |
| **6.2 Logging restrictions on sloping terrain** | |
| **6.2.1. Measures are taken sufficient to ensure soil erosion is prevented on sloping soils.** | **(F)** |
| **6.3. Harvest methods on wet soils** | |
| **7. Forest access and security^** | |
| **7.1 Planning** | |
| **7.2 No expansion of roads into roadless areas** | |
| **7.3 The FMP sets out how forest will be safeguarded to prevent access from adverse external influences** | |
| **8. No direct harm to wildlife^** | |
| **8.1. No intentional capture or killing of vertebrate wild animals** | |
| **8.2. No intentional killing of species (any taxa) classified by national or international IUCN red lists as 'near threatened' or more severe categories (e.g., vulnerable, endangered, critically endangered, etc)** | |
| **8.3. Limiting barriers to wildlife movement** | |

*Table 2: Criteria for reduced logging impacts on biodiversity, and improved biodiversity of managed forests*

| Criteria |
|---|
| **1. Provision of high biodiversity forest areas** |
| **1.1 Conservation of existing high-biodiversity forest areas^**<br><br>**1.1.1 The activity has not (since 2008 or anytime thereafter) involved the conversion or fragmentation of, or logging or other commercial forestry activities within:**<br><br>• Areas protected or set aside for restoration, in which logging activities are prohibited, in accordance with international and national law<br>• Primary, old-growth forests, and forests undisturbed by man, within and beyond protected areas<br>• High Conservation Value forests[96] i) containing globally, regionally or nationally outstanding or critical significant biodiversity values (endemism, rare, threatened or endangered species, |

[96] As defined in FSC-STD-01-001 V5-2. These criteria require HCVs 1-4 to be protected from conversion, fragmentation, logging or other commercial forestry activities

habitats, refugia, or ecosystems); or ii) large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance; or iii) forest areas that provide basic services of nature in critical situations (e.g., watershed protection, erosion control)

- Long untouched forest (60 years plus without commercial logging)[97]
- Wetlands and aquatic habitats, as listed under The Ramsar Convention on Wetlands, encompassing peatlands, floodplains, riparian zones (see below), aquatic (rivers, ponds, springs, etc) and coastal habitats.
- Riparian Buffer Zones of native vegetation community (allowed to succeed to climax state) at least 30m either side of a linear water course **[~/- 20% of this threshold value]** (i.e., 60m total, or higher if required by national legislation) and continuous along water bodies and covering all stream orders including ephemeral streams and first order streams.
- High biodiversity farming areas[98] – that support either a high species and habitat diversity and/or the presence of species of national and/or regional conservation concern. These will be recognised by

HCV 1 – Concentrations of biological diversity including endemic species and rare threatened or endangered species that are significant at global, regional or local levels.

HCV 2 - Landscape level ecosystems and mosaics. Intact forest landscapes and large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance

HCV3 – Ecosystems and habitats. Rare, threatened, or endangered ecosystems, habitats or refugia

HCV4 – Critical ecosystem services – Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes.

HCV 5 & 6 are primarily about social aspects, which although not the focus of these criteria, ought to be respected alongside, as part of the rationale of how to conserve the biodiversity sites covered in HCVs1-4.

HCV 5 – Community needs (though arguably beyond main focus of these criteria, it includes 'sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (etc) - and such relationships with land can be important for effective custodianship of biodiversity, so should also be included.

HCV 6 – Cultural values – again, arguably not principal scope of these criteria but does include sites of ecological/sacred importance – which again can be important aspect of ecological custodianship, so should be included.

Further work will be undertaken to determine the equivalence of similar definitions in PEFC (PEFC ST 1003:2018) in particular relating to 'ecologically important forest areas' (EIFAs). In which case reference to those will also be included here.

[97] If a forest has had some non-commercial firewood felling, for instance, or if a 50-ha continuous forest patch has one small felled clearing in the middle of it as an anomaly, the areas should be considered untouched.

[98] This terminology is based on High Nature Value farming principles in Europe, slightly altered to make more globally applicable and relevant to taxonomy. "The High Nature Value (HNV) farmland concept has been widely adopted across Europe in agricultural policy. High Nature Value farmland comprises those areas in Europe where agriculture is a major (usually dominant) land use and where that agriculture supports or is associated with either a high species and habitat diversity, or the presence of species of European, and/or national, and/or regional conservation concern or both. Within this definition three types of HNV farmland are identified: • Type 1: Farmland with a high proportion of semi-natural vegetation • Type 2: Farmland with a mosaic of low intensity agriculture

| |
|---|
| national authorities as of conservation importance - e.g., in Europe, through High Nature Value farming typology[99] and/or farms included in Natura 2000 network[100]. Examples include agroecosystems with extensive native vegetation such as biodiverse permanent grassland or agroforestry with native tree species.<br>• Corridors (intentional or de-facto) of natural or semi-natural[101] vegetation that connect HCVF areas. |
| **1.1.2 Land conversion to forestry of any areas not included in criterion 1.1.1 was (or will be) carried out in accordance with the conclusions of an EIA addressing specifically biodiversity and necessary mitigation measures are implemented.** |
| *Rationale for criterion 1.1:*<br><br>*To avoid significant harm, existing high biodiversity landscape areas need to be safeguarded whether or not they are under legal protection.* |

and natural and structural elements, such as field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers etc. Type 3: Farmland supporting rare species or a high proportion of European or world populations. (EC 2018. Farming for Natura 2000 Guidance on how to support Natura 2000 farming systems to achieve conservation objectives, based on Member States good practice experiences. Management practices likely to be relevant are covered pp.42-46.)

[99] Halad *et al.,* 2011. Which Habitats of European Importance Depend on Agricultural Practices? Biodiversity and Conservation.

[100] EC 2018. Farming for Natura 2000 Guidance on how to support Natura 2000 farming systems to achieve conservation objectives, based on Member States good practice experiences.

[101] These criteria consider the spectrum of semi-natural to natural forest as defined by Buchwald's N2-N10 categories which are all "predominantly composed of self-sown native trees". This broadly equates to FAO's 2020 Global Forest Resources Assessment category of "naturally regenerating forest", except herein we do *not* include exotic species. We also exclude Buchwald's N1 category of "plantation-like natural forest" where "self sown native trees with high intensity forest management, so that the forest structure has become plantation-like by being even-aged, having relatively low tree ages, fairly regular tree spacing and only one or two tree species in the canopy layer." It is necessary to be clear that herein "semi-natural" and "natural forests" are considered to have a naturally occurring species mix without a plantation structure. This is necessary to clarify, because Forest Europe reporting (Forest Europe, 2020, p118) suggests that almost all of Europe's forest is semi-natural (94%), including most of Europe's clear-cut, even-aged, species-adjusted forest, even though "the planted component of semi-natural forest, with similar establishment patterns and intensive silvicultural treatments, is not materially different from forest plantations" (Forest Europe, 2015). From an ecological perspective this is a heavily modified system. Chiarucci & Piovesan (2019) call for more nuanced mapping and reporting: "we believe a global map of forest naturalness that accounts for the bio-ecological integrity of forest ecosystems, for example, intact forests, old-growth forest patches, rewilding forests (exploited forest landscapes undergoing long-term natural succession), and managed forests is needed for global forest assessment" (see also Schulze et al, 2019).

*Wood extraction is sometimes permitted within areas of high conservation value – such as in some IBAs and KBAs which may not have legal protections. In Natura 2000 sites, forests may or may not be permitted extractive activity. Where not permitted, this must be adhered to.*

*On safeguarding valuable unprotected areas*

*It is not enough solely to avoid logging in protected areas, not only because of limitations to protected areas discussed below (section 1.2), but because "despite high conservation value, some forest stands with primeval forest attributes are still threatened today because their importance has gone unrecognized, because adequate conservation management measures are lacking or because of competing interests, such as economically motivated salvage logging in the unique lowland forests of Bialowieza (see Eckert et al 2018). For instance, Virkkala et al (2022) found many valuable habitats for red-listed or declining forest indicator birds outside protected areas, but "many of these sites are increasingly threatened by logging because of increased pressures for using forests"*[102]*. HCV forests are often unprotected and indispensable for conservation (see Mikusinski et al., 2021).*

*On long untouched forest:*

*Long-untouched forest has had "decades without forestry operations", is often in marginal growing areas hence abandonment and represents conservation opportunity as naturalness features recover. If slow-growing species are being managed, there will have been maintenance forestry operations over the decades between harvest – e.g., thinning, maintenance of access, etc.*

*Buchwald defines 'long untouched" as for 60-80 years. "Newly untouched" he defines as where forestry operations have been abandoned for less time, which would also be a valuable opportunity for biodiversity as often forests begin shifting noticeably to uneven age structure, more deadwood etc, within a few decades (see section 1.2). However, a landing zone in the middle (60 years) is proposed based on expert input received.*

*Mikusinski et al (2021) consider long-untouched forest (they call "proxy continuum forest") an indispensable part, along with HCV (protected or unprotected), of Sweden's collective "primary forests" where "ecological processes are not significantly disturbed" so as to contribute to the goal of "intact forest landscapes" with sufficient habitat to "retain forest biodiversity". However, they note there is not enough of these areas to safeguard demanding forest species without restoration (see section 1.2. on set asides).*

*On floodplain forests:*

[102] The study was in Finland, and refers to the increasing extraction pressures from the bioeconomy

*There are few floodplain forests left in Europe due to many land-use pressures, watercourse alterations, etc.*

*<u>On riparian buffer zones:</u>*

*Contiguous riparian zones are important habitats in themselves, contribute to habitat continuity, and are essential for maintaining river biodiversity and ecosystem services (Cole et al., 2020; Riis et al, 2020, Hilary et al, 2021, etc). Rivers are arguably the most threatened of all ecosystems, and riparian zones are essential in safeguarding river quality (Samways & Pryke, 2016).*

*Riparian vegetation is important for reducing bank erosion and sedimentation, as well as providing shade to moderate fluctuations in water temperature which affect multiple taxa. Studies on salmonids show riparian woodland as important for keeping water colder in daytime and warmer at night, the importance of which will only be increased as climate change stresses current distributions of cold water fish species. Spanjer et al (2022) focus on tree height and shade - showing 1.7'c water increase by 2080, mitigated to 0.9'c by 100m wide buffer zones. In Australia's Blue Mountains, Justice et al (2017) similarly assume 100m buffer width and find it, in combination with restoring natural river width, can reduce peak summer temperature increases from climate change by up to 3.5'c. Depending on the type of habitat, soil, surrounding slopes, and political priorities, different widths for sufficient riparian buffers are presented in the literature, often 30m or more.*

*The 30m stipulation is at the low end of the desirable width of riparian zones from a biodiversity and ecosystem services (B&ES) point of view.*

*Numerous studies show species of birds, also including forest-interior species, being excluded from riparian zones of greater size than the 30m stipulation herein. Many birds are riparian obligates – they specifically require quality riparian habitat (such as, in the USA, the southwestern willow flycatcher, swallow-tailed kite and Bell's virio). Studies show exclusions of species at various buffer widths from 40m even as wide as 175m (which one study found sufficient to retain 95% of bird species) (See Fischer, 2000). However, at the lower end of the range, below 25-30m there can be a notable drop-off in functional bird diversity (see Hagvar et al 2004; Hagvar, S., & Baekken, B. T. (2005)).*

*Hansen et al (2010) reviewed buffer zone studies and derived medians in the literature at 30m for water quality, 37m for shading role, and 100m for terrestrial fauna and general connectivity (p.101), determining their recommendations for the Australian state of Victoria as between 40m (low intensity land use) to 100m (for high intensity land use) regarding general biodiversity. Examples in the literature include Aguiar (2015) proclaiming the higher efficiency of woody vegetation zones of 36m to 60 m widths, Samways & Pryke (2016, also Nilsson, 2021) recommend 30m. Wenger (2018) cites various countries' forestry codes ranging from less than 30m on higher order streams to as much as 500m on rivers wider than 600m. The Brazil Forest Code is subject of much controversy due to deforestation having occurred in riparian zones and only partial restoration being mandated* *(see Biggs et al, 2019), however until revisions, the code ranged from 30m buffer zones (less than 10m streams) to 500m (rivers of more than 200m).*

*Consistent with Hansen et al (2010), 30m buffer zones also show significant benefits in removing sediment, nitrogen, phosphorus and pesticide pollutants – pesticide removal, for instance, being predicted on average 93% efficaceous (see Zhang et al., 2010).*

*At least 30m riparian verge also serves to ensure felled trees are unlikely to fall into the water course. These are crucial aspects to consider as water quality depends on avoiding fluxes of turbidity that forestry operations can cause from bank erosion, felled trees falling into rivers, vehicular movements, etc. Further, 30m can be a reasonable diameter for a single tree - if that tree occurs 15m away from the riverbank, a buffer of 30m may be pragmatic for a single tree and its understory.*

**1.2 Set-aside (unlogged) areas are created or maintained** in line with the following thresholds:

| FMA 1: Close to nature: The higher of: | FMA 2: Intensive, even-aged mixed native species: The higher of: | FMA 3: Intensive even-aged monocultures: The higher of: |
|---|---|---|
| a. 10% of the FMU **[~/- 20% of this threshold value]**<br>b. any % threshold set in national legislation<br>c. existing high biodiversity landscape areas in the FMU per 1.1.1 | a. 20% of the FMU **[~/- 20% of this threshold value]**<br>b. any % threshold set in national legislation<br>c. existing high biodiversity landscape areas in the FMU per 1.1.1. | a. 30% of the FMU – provided an additional 20% of the FMU is ~~put~~ under FMA1 (CTN) or FMA2 (mixed even-aged). If this is not the case, then 50% the FMU must be set-aside.<br>b. any % threshold set in national legislation<br>c. existing high biodiversity landscape areas in the FMU per 1.1.1 |

*Methodological notes:*

*Areas of habitat listed in 1.1. contribute to set aside.*

*Set aside can include blocks or corridors of native forest. De-facto set asides (areas not being exploited within the FMU) should be retained and not reduced in extent*

*Flexibility is given to the operator to decide in their FMP the spatial allocation which is most effective for biodiversity whilst practical for operations.*

*Design of set-aside areas can be multifunctional and beneficial to productivity - e.g., reducing wind, soil loss from steep slopes and riparian verges, conserving water resources and providing habitat for species which can help control pests (e.g., insectivorous birds regarding pine processionary moth).*

*The IUCN provides guidelines on the implementation within FMUs of 'ecological networks' - the designed-landscape of set aside areas that include corridors and buffers) (IUCN 2020). Various resources exist to guide optimal design (see also Lindenmayer et al, 2006; Samways & Pryke, 2016; Arroyo-Rodriguez 202; Himes et al., 2022.)*

*Rationale for criterion 1.2:*

*These criteria ensure all types of forestry can make a contribution to quality habitat through the conservation necessity of integrating unlogged areas of set-aside at differential extents. Even-aged systems retain the ability to operate intensively in portions of the land[103], provided they also allocate land to set aside, and potentially also to more biodiverse forms of forestry. This gives the operator flexibility to choose their approach: either intensive operations with land sparing (set-aside); a Triad Forest Management approach with intensive, extensive and set-aside; or less intensive and more biodiverse forestry approaches (FMA1 and FMA 2) with lower amounts of set-aside.*

*For the most intensive operations, a choice is given as to whether to pursue the least biodiverse management approach and compensate with 50% set-aside (so that half the land is providing biodiversity functions), or put 20% of the land into more biodiverse management approaches and 30% in set-aside – again, so that half of the land is providing either high or medium levels of biodiversity functionality.*

*Unlogged areas (set aside) are necessary as biodiversity loss (both in species richness and abundance within populations) correlates with intensity of logging (see Section 2 below): "some species are highly sensitive to management of any sort, so retaining locations of sufficient size and appropriate composition to maintain viable populations of these species is essential" (Himes et al., 2022).*

*For example, the rare boreal beetle (Pytho kolwensis) "occurs only in natural forest sites without logging and with [correspondingly high] deadwood volumes"; similarly, the fungus, Antrodiella citronella, "is not able to survive in areas with logging management". The accumulation of deadwood levels beyond those of logged forests is one reason for the importance of areas where no trees are removed and deadwood levels therefore accumulate. Even whilst observing deadwood thresholds such as those in Section 2.1, many sensitive species will go locally extinct above those thresholds (see Müller & Bütler, 2010), making set-aside crucial.*

*Within stand measures can make a difference to biodiversity in productive areas – through retention trees, ensuring at least some deadwood, etc, but will still be missing a lot of biodiversity that is only retained in completely unlogged patches left untouched permanently. Leaving retention trees in logged stands is nowhere*

[103] where quality natural/semi-natural forests have not been present since 2008, a safeguard which applies to all three FMAs

*near sufficient to retain many forest species (see Müller & Bütler, 2010; Fedrowitz et al., 2014). Set-aside is essential as no other single management approach can retain all biodiversity (Peura et al, 2018). This is why attempts to find an optimal balance between logging and biodiversity (Guburek et al, 2010) are flawed from a biodiversity perspective – they inherently involve loss of some species. Unlogged forest is essential.*

*Priority set-asides are old-growth primary forests, or long-untouched forests (see Section 1.1). However, set-asides of secondary forest gradually recover invaluable old-growth characteristics (see Svensson & Juglum, 2001; Paillet et al., 2010; VandeKerkhove et al., 2011). It cannot be left to protected areas alone to provide unlogged forest – they are often too small and too fragmented (see Carvalho et al., 2021), and often themselves logged (Ellis 2019) and often designated in marginal areas with the least biodiverse forest types[104]. For instance, the total area of old-growth forest within protected areas in southern Finland has been estimated to be 0.1% of the total forest area (Sittonen, 2000) and there is very limited potential to expand such nationally protected areas (Tikkanen & Kouki, 2006). Even were all currently unprotected HCV and long-untouched forests to be conserved in Sweden, there would still be a need for more restoration (e.g. set-aside) to improve the viability of demanding forest species which struggle to move through a fragmented landscape and require large areas of habitat (Mikusinski et al, 2021)[105]*

*Not all species conveniently stay within protected areas (Mazziotta et al., 2017) – Finland's goshawks, for instance, are sensitive to logging but are mostly occur outside protected areas (see Björkunda et al. 2020). Many endangered species require mature old-growth conditions (half of Finland's red list species, for instance – see Tikkanen & Kouki, 2006), so the only way to stop many species from being lost, and to put ecosystems on the path to recovery, is for productive forestry to halt and reverse the pressure it exerts on old-growth species by increasing areas of set-aside.*

*Unlogged areas increase the total amount of quality forest habitat, essential for old-growth specialists but also essential for providing the large amounts of habitat required by species with large ranges or metapopulations (Roberge & Angelstam, 2004; Potapov et al., 2017). Encouraging set-aside to be dispersed throughout productive landscapes also reduces fragmentation and viability of existing forest remnants (see Pardini et al. 2010: Hanski 2011; Hua et al. 2018; Garibaldi et al. 2021). Retaining set-asides within productive landscapes can provide essential refuges during forestry harvesting (for example, enabling orangutans to survive surrounding forestry*

[104] "The predilection of national governments is to protect areas that are "wild", that is, typically remote, cold, or arid. Unfortunately, those areas often hold relatively few species". There is a "bias in establishing large protected areas in wild places". However, "numerous small protected areas are in biodiverse places" (Pimm *et al*, 2018).

[105] Mikusinski et al (2021) analysed detailed Swedish land databases of protected areas, HCV areas and proxy continuity forests (long-untouched – since mid 1900s), finding them all, and more, required for forest species conservation.

*operations - see Ancrenaz et al., 2010). Whilst large tracts of forest are desirable, even small set asides can make a useful contribution to B&Es. Reserves less than 100 Ha commonly hold 50% of species, and "must be included in conservation planning", though the needs of specialist and area-sensitive species mean the larger, the better (Volonec & Dobson, 2020, also Pardini et al, 2010).*

*Because intensive plantations of exotic species are low in biodiversity (see earlier rationale table), and are likely to contribute to habitat fragmentation rather than connectivity (see below), their % of set aside should be highest, but with less imposition of in-stand practices. Native plantations should have intermediate level of both set aside and in-stand practices. Close-to-nature forestry, utilizing the full suite of native species in uneven age structures with accumulating levels of deadwood, should require the least set-aside. These adjustments reflect not only the different biodiversity of these approaches to forestry, but also recognize and promote moves from from monoculture to more diverse forestry.*

*Area of set-aside*

*Set aside is essential, but how much is enough? This is a complex topic. Conservationists increasingly call for "half-Earth" – strictly protecting half of the world's terrestrial land to safeguard the majority (85%) of terrestrial species (Wilson, 2016; Dinerstein et al, 2017). Ellis (2019) considers it possible, were enough high quality areas to be set-aside, to protect the majority of terrestrial species with "half-Earth" but points out productive landscapes must contribute because ¾ of the planet is now "anthrome" – a mix of conurbations, farming, forestry and remnant ecosystems, often in areas where biodiversity has its highest potential. Both quantity and quality are important (see also Pimm, 2018).*

*Leclère et al. (2020) analysed policy scenarios to "bend the curve" of deteriorating terrestrial biodiversity. Habitat loss and degradation were the single biggest factor and the most important to reverse (i.e. more impactful than changes in diet, agricultural output, etc). But even with 40% protected areas in key biodiversity areas[106], important aspects of biodiversity declines would continue, only returning to current levels (e.g. of abundance, notwithstanding species gone extinct) at the end of the century if protected areas and restoration were accompanied by dietary change, better food distribution and sustainable increases in agricultural output)[107].*

*40% total set-aside was not enough to arrest deteriorations throughout the century, meaning more would be required to do so. However, 40%, in combination with all other measures, was sufficient to bend the curve, for*

[106] "Our IAP scenario involved the restauration of 4.3–14.6 million km2 of land by 2050, which requires the Bonn Challenge target (3.5 million km2 by 2030) to be followed by higher targets for 2050"

[107] See Figure 2 in their paper. "These actions may be technically possible, economically feasible and consistent with broader sustainability goals, but designing and implementing policies that enable such efforts will be challenging and will demand concerted leadership"

*instance on population densities (i.e. higher in quality habitats) and number of species committed to extinction, by 2050.*

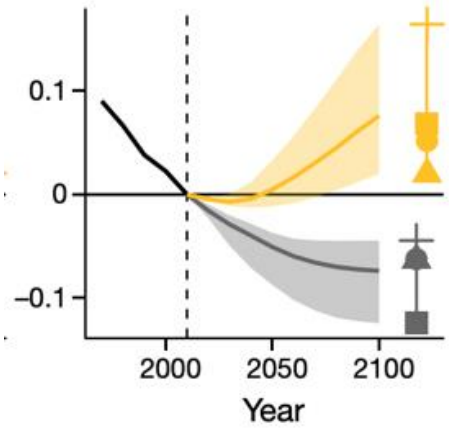



***Figure.*** *Number of species not committed to extinction, if 40% global set-aside and concerted action on other land-use pressures (Leclère et al., 2020). Black line is historical and BAU projection, yellow is scnarios of 40% + all other levers.*

*The Convention on Biological Diversity has a draft target of protecting 30% of terrestrial land area and restoring a further 20% (UNEP 2021). The EU Biodiversity Strategy for 2030 targets 30% of protected land and sea (EC 2021b). The balance between what can realistically be nationally protected area, and what should be integrated into productive lands, depends on context, but in the vast majority of situations there is not enough protected area*[108] *and sometimes difficult limitations to expanding it (see above re Finland). To put our forest ecosystems on the road to recovery, we cannot have vast expanses of productive forestry operations with little or no set-aside. Recovery requires increases in quality and quantity of habitat.*

*Taking into account the landscape level need for nationally protected areas (more of which would come at the expense of productive areas in order to be representative of ecosystems, so would likely be more of an imposition on operators than these criteria), at the barest minimum, forestry operations should avoid the critical thresholds at which a final collapse of forest species may occur. This generally means providing between 30% and 60% of unlogged habitat*[109]*. Some extinction debt occurs at these levels. The thresholds presented herein, therefore,*

[108] About 10% of the terrestrial world is, on paper at least, protected. But many of these are "paper parks" where the legal denomination is there but practical protections are not in operation (see Ellis, 2019). "Even if rigorously conserved, this amount is not enough to save more than a modest fraction of wild species" (Wilson, 2002, p.163).

[109] Thorn et al. (2020), studying a range of forests around the world, estimate that 50% of forest area should be unlogged to retain 73% of forest specialist species (and 75% should be unlogged in order to retain 90% of species). A review by Price et

*whilst representing substantial contribution in terms of reducing the baseline pressures forestry operations are exerting on forest ecosystems, are nonetheless on the low end of the thresholds from a conservation biology perspective. Indeed, given the likely extinction debt above these levels, a strong case could be made for more set-aside than prescribed herein.*

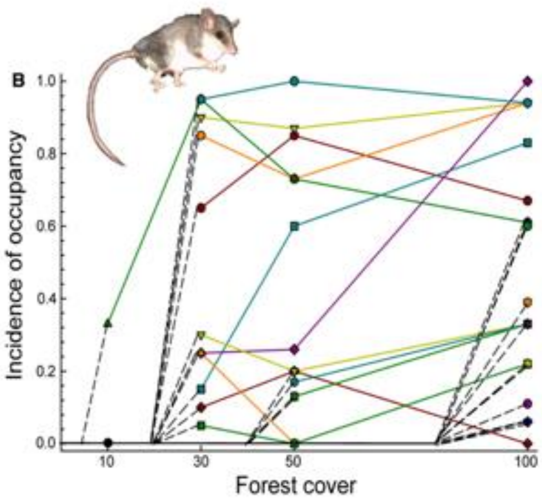



***Figure**. An example of forest loss thresholds: responses of small mammals to forest lost in Brazilian Atlantic forest. Any forest loss results in absences with a clear early threshold of local extinctions at high %s, and a last critical abundance threshold is crossed at 30%. (Source: Hanski, 2011).*

*Hanski (2011), for example, proposes a "cost effective and realistic approach" of putting a third of total land area under "multi-use conservation landscapes within which one-third of the area is protected". This, he estimates, averages out at 10% of the total landscape, but would be "in addition to existing national parks and other protected areas". These criteria are broadly in line with this, however, requiring less set-aside of higher*

al. (2007) similarly cite local extinctions at 75% and 70% habitat, and a common threshold at 60% below which losses increased linearly as habitat continued to decrease, with two thirds of species having crossed thresholds by the time their habitat was reduced to 30%. Arroyo-Rodriguez et al (2020) cited numerous studies in tropical forest landscapes defining local extinction thresholds between 25% and 50% and conclude "at least 40%" should be set-aside provided the surrounding landscape is also a "high quality" matrix (which is not a safe assumption). Atlantic Forest studies show critical thresholds of "approximately 30% of native [forest] habitat is needed to preserve the integrity of *vertebrate* communities within each landscape" (Banks-Leite et al, 2014). Even forest birds, less vulnerable than many taxa because they can fly between patches of viable habitat, can be impacted early – Farwell *et al* (2020) reporting an abrupt decrease in forest interior species in the Appalachians at only 17% habitat loss (i.e. 83% habitat intact).

*biodiversity forest management approaches[110]. This is a conservative level of ambition, given Hanski's proposal was based on trying to reach the Aichi CBD target of only 17% protected area, an ambition the CBD is moving beyond towards something closer to half-Earth (see above).*

*Kok et al (2018 – see their Fig 8) modelled 3 pathways for global forestry and its impacts on mean species abundance taking into account goals of meeting demand for a growing global population. Such global strategizing between policy goals is beyond the scope of this fiche, and clearly aspects of all 3 pathways need to be deployed (such as preventing conversion of quality habitats and safeguarding intact forest landscapes, reducing consumption/demand levels, efficient methods in areas of higher intensity, etc). However, the only pathway in which mean species abundance (MSA) loss was halted by 2050 (showing a possible 0.4% increase) was the decentralised pathway in which 30% of productive landscape was set-aside (i.e. part of the network of protected areas).*

*Furthermore, climate change places increased pressures on fragmented habitats, requiring more set-aside to allow species to move through a changing landscape (see Carvalho et al, 2010). Mair et al (2018) modelled the effects of climate change on suitable habitat availability in Sweden for 6 red-listed old-growth fungi at different levels of set-aside, finding 3.6% set-aside insufficient to avoid declines in habitat suitability for all species due to climate change's impacts; 16% set-aside stabilised the impact of climate change and 32% set-aside saw half the species increase suitable habitat. Climate change multiplies the importance of set-aside and shows the levels proposed here are far from excessive.*

*In the least intensive forestry operations, only 10% set-aside is stipulated as the dynamic between high quality set-aside and good quality forestry operation is to be encouraged. The intermediate intensity FMA 2, requires 20% set aside. The most intensive operations (FMA 3) require at least 30% set-aside and up to 20% put under more biodiverse FMAs (FMA 1 and 2) (or if not, 50% as pure set-aside). In this way, even the most intensive operations (FMA 3) can contribute through the land area being under more biodiverse management approaches or set-aside. Retaining diverse habitat as well as broader connectivity functions in half of such operations is important as the most intensive management, often even-aged monocultures, can decrease functional connectivity and increase fragmentation of forest habitat (Hua et al., 2018; Liu et al., 2019). FMA 3's set-aside requirement may seem ambitious but is in fact far less demanding than most triad forest management scenarios which typically concentrate intensive production in highly productive but relatively small areas, with "the largest area managed under the principles of ecological forestry" (CTN) (Himes et al., 2022 – see below).*

[110] Garibaldi et al. (2020) similarly suggest a minimum of 20% of productive landscapes (in some cases up to 50%) should always be set-aside based on the logic of conserving other ecosystem services important to people without economic loss (pointing out yields, such as agricultural, often improve).

*"We can summarise the essence of what needs to be done in four words: more, bigger, better and joined" (Lawton et al, 2010).*

*Feasibility*

*There are many examples of companies implementing these approaches on large scale:*

- *South Africa allocates one third of its plantation forestry area (half a million Ha) to set-aside (Samways et al., 2009).*
- *"New Generation Plantations" partnership (WWF and major forest companies) allocate approx. one third as set aside (WWF 2017), the rest as intensive plantation.*
- *Mata Atlantica Forestry Pact – 50% is set aside – 1 million Ha - by companies including Fibria, Suzano and Veracel in Atlantic Forest area, Brazil).*
- *Triad forest management commonly provides comparable land allocations. For instance, "triad scenarios with 74% extensive (i.e., CTN), 12% set aside, and only 14% plantation, outperformed the status quo both in terms of the area of forest with old characteristics (a biodiversity proxy) and wood supply."[111] The government of Nova Scotia, Canada, for instance, allocates 51% of all forest to CTN, 33% to set-aside and 16% to intensive (Himes et al., 2022). The Mauricie Triad Project in Quebec, allocated 70% to CTN, 10% to set-aside (representative of all forest types) and 20% intensive (in which bracket they included mixed plantations). Having proved a success, the government of Quebec has now adopted triad forest management as the basis of forest management (Tittler et al., 2016; Himes et al., 2022).*

*It should not necessarily be assumed that set-aside de-facto reduces the productivity of the entire forest operation, as the improved ecosystem services such as reduced edge effects (such as wind), protection from soil erosion, improved hydrology, more diverse predators of insect pests, etc, could have knock-on benefits to productive stands if judiciously planned. Set-aside may also have notable ecosystem services values (Himes et al., 2022).*

**1.3 Management of high-biodiversity forest areas**

**1.3.1 There is no commercial extraction of wood from set-aside areas,** including no salvage logging.

**1.3.2. FMP includes habitat restoration and management measures that ensure native vegetation and natural ecosystem processes can occur or resume**, requiring (where applicable) but not limited to:

- removal of exotic and invasive species
- ensuring former plantation trees do not block natural regeneration
- restoration of natural hydrology (such as on peat soils – see 5.2)
- ensuring representative native plant species are present of local genotype
- restoration of natural disturbance regimes as applicable to the local ecosystem and size of set-aside if natural processes are impeded (e.g., by management of surrounding forestry stands)*.

[111] Betts et al. 2021, citing Coté et al 2010.

These measures adhere to safeguards elsewhere in this proposal (e.g., chemicals, drainage, etc).

** It should not be necessary to mimic tree fall from storms, or mortality from pests, as these can be left to natural processes. If the ecosystem has a natural periodicity of fire disturbance, however, that can be adhered to according to section 3.2. However, if in doubt, it will often be better not to apply disturbance to a set-aside. For example, if the set-aside is not large, it may not be possible to apply a disturbance event at the appropriate patchwork scale, and old-stands could be sacrificed inappropriately. However, discretion is given to the operator (provided no commercial extraction of wood occurs from the set aside as per 1.3.1).*

**1.3.3. High-biodiversity forest areas are monitored using forest quality tools**, where possible as approved by national conservation authorities. Naturalness of forest structure and function must demonstrate ongoing improvement (or no regression if pristine quality)[112]. When a natural disturbance event (e.g., storm damage, pest outbreak, fire) alters the structure of the set-aside, this is not considered as contrary to the progress of naturalness structure but re-sets the stage of succession to be monitored.

*Methodological note: Examples of forest quality tools include:*

- *Geburek et al (2010) - Austrian Forest Biodiversity Index*
- *Whitman & Hagen (2007) - a boreal forest index*
- *See also Pukkala (2021b)*

*Rationale for criterion 1.3:*

On no wood extraction

*Set-aside areas should be left to naturally accumulate deadwood (see section 2.3.1 on salvage logging), as Thorn et al. (2020) explain: "Salvage logging is conducted in all forest types, and is common even in areas that are otherwise excluded from logging, such as national parks. By extracting timber and other tree biomass from large areas, salvage logging can impair ecosystem services and affect the biodiversity of deadwood-dependent species. Salvage logging can have more profound effects on biodiversity than natural disturbance or logging alone due to the additive and interacting effects of the two disturbances. This has been exemplified by studies on changes in communities of birds and vascular plants. Currently, unlogged early-successional forests following stand-*

[112] Such tools should be able to track evolution of naturalness structure according to local reference biome. Where information is lacking, a competent body approved participatory approach between foresters and ecologists can be undertaken to define "forest development types, which describe the long-term forest composition and structure appropriate for a specific site and climate, and then outline the silvicultural actions required to guide actual forest stands in the desired direction", as undertaken for Danish forests overseen by the Danish Forest and Nature Agency"(see Larsen and Nielsen, 2007; quote from Mason *et al.,* 2022).

*replacing natural disturbances are among the most uncommon habitats in many regions of the world". Therefore, natural disturbances within set-aside should not be responded to with salvage-logging.*

*Habitat restoration processes*

*In many cases it will suffice simply to allocate set-aside areas and allow natural regeneration to occur. In some cases, however, the land may struggle to recover natural structure and function without some intervention. Some examples include:*

- *if dominant tree cover of a previous plantation species (exotic or native) will persist and impede natural regeneration*
- *if an invasive species has proliferated and similarly blocks natural regeneration and needs removal*
- *if there is an absence of representative native plant species (e.g. lack of viable soil seed bank or nearby sources of propagules) for the re-establishment of a native plant community, in which case seeding or enrichment planting of native species may be required*
- *If natural hydrology or soil condition of the area has become so degraded those measures are required to re-establish viable conditions.*
- *If there is a lack of deadwood, the recovery of which could be speeded up through deadwood creation (see Vahna-Majamaa, I. et al., 2007; Pohjanmies et al, 2019; Siitonen 2000).*
- *Other measures specific to the locality – such as careful use of controlled burning where fire is a necessary dynamic of the ecosystem (Vanha-Majamaa et al., 2007), see section 3 below.*

*If soils are so damaged as to require rehabilitation (e.g. through facilitating a natural succession of pioneer species, introducing local soils as microbial sources, etc)*

**1.4 Permanence of high-biodiversity forest areas**

The following are mapped in the FMP and are to remain permanently in place:

- High biodiversity areas not to be exploited (see 1.1)
- High biodiversity areas created (see 1.2)
- Close to Nature forestry areas

– unless a convincing conservation rationale is presented for altering the spatial lay-out with demonstrable biodiversity net benefits.

*Rationale for criterion 1.4:*

*Biodiversity value of forests increases over time, for instance as deadwood accumulates.*

**1.5 There is alignment with national and local conservation priorities*, and safeguarding of any priority habitats and species present in the FMU**.

* For the avoidance of doubt, this does not permit practices that are contrary to, or at a lower level of performance than, the criteria herein.

| 2. Forest structure, function, and composition^[113]<br><br>I.e., within-stand operational safeguards | | |
|---|---|---|
| **2.1.1. Uneven age structure:** | | |
| FMA 1: Close to nature:<br><br>Within specific harvest plots, presence of all age classes from sapling to mature, senescent and dead trees.*<br><br>** A coppicing system that is part of a competent body approved biodiversity conservation scheme, for either the habitat itself or species therein, may adhere to FMA 1 if meeting the rest of the FMA 1 criteria - i.e., the coppicing areas are maximum 0.2 Ha, retention trees are left at different age-classes and viable populations, etc. However, a coppice system tends towards a largely even-aged structure in the coppiced trees - albeit with retention (i.e., coppice + standard) trees required herein, and therefore some flexibility is permitted for conservation scheme coppices with regards interpretation of uneven aged structure.* | FMA 2: Intensive, even-aged mixed native species:<br><br>No criterion | FMA 3: Intensive even-aged monocultures:<br><br>No criterion |
| **2.1.2. Retention trees:** | | |
| FMA 1: Close to nature:<br><br>30 mature trees per Ha or 10% standing wood volume – whichever is larger **[~/- 20% of this threshold value]**; AND<br><br>The largest trees are left as retention trees, and the same trees remain in future harvest cycles | FMA 2: Intensive, even-aged mixed native species:<br><br>30 mature trees per Ha or 10% standing wood volume – whichever is larger **[~/- 20% of this threshold value]**; AND | FMA 3: Intensive even-aged monocultures:<br><br>No Criterion |

[113] Note: Fewer stipulations are given for monocultural plantations than for mixed native plantations and CTN. The biodiversity contribution of monocultural plantations is mainly through set-aside due to the impossibility of their hosting a naturally occurring tree cover of uneven age structure that supports all taxa of biodiversity. Mixed native plantations have intermediate level of stipulations, with intermediate level of set aside. CTN stipulations ensure the higher biodiversity structure of close to nature operations, with least required set-aside.

| | | |
|---|---|---|
| | The largest trees are left as retention trees, and the same trees remain in future harvest cycles.<br><br>In the case of coppice with standards, the retention criteria are replaced by criteria on standard trees. There must be at least 50 standards per Ha, AND at least 3 per Ha **[~/- 20% of this threshold value]** left-unharvested as permanent retention trees (the largest). | |

*Rationale for criteria 2.1.1 and 2.1.2:*

*On retention trees and age-structure*

*The more wood is removed from a forest, the greater the impact on biodiversity as studies across taxa show (Watson et al., 2018). Mammals and amphibians suffer a halving of species richness between logging intensities of 38 m (3) ha (-1) and 63 m (3) ha (-1), and the more logged an area, the more forest bird species are replaced by generalists (Burivalova et al 2014).*

*Retention forestry is a within-stand approach to maintain elements of mature forest - the more trees are retained at harvest, the better the biodiversity outcomes. Different metrics are used - % trees left standing (which can vary from 1% in part of Finnish forestry to more than 40% in parts of Canada), to number of trees, to standing volume (Gustaffson et al, 2012). Metrics are used to ensure minimum levels of wood retention – to preclude retaining only a great many immature trees. Latvian forest regulation stipulates the biggest trees should remain as retention trees.*

*Forest certification schemes often stipulate levels of retention, but at levels inadequate to provide meaningful biodiversity benefits, and often these measures are not adhered to[114]). Retention, at reasonable levels, provides*

[114] Kuuluvainen et al (2019) conclude that levels of retention in Finland as stipulated by forest certifications “lack ecological credibility”… “a major ecological problem is that few individual retention trees [5-10 small sized trees per Ha, an average of 1.2% stand volume], “which has been the most common practice in Fennoscandinavia”]…simply do not provide the habitat quality and continuity needed… much higher retention levels than currently applied in Finland would be needed for obtaining tangible ecological benefits such as a halt in the decline of many rare and red listed species depending on large and old living trees and coarse woody debris… One can ask if low retention is used as a “band-aid fix” with minor ecological benefits, but which allows the underlying status quo of ecologically unsustainable clearcutting system to be continued… the current

*superior habitat features to clear-cut, but is not sufficient to avoid losses of forest interior species (Vanha-Maajamaa & Jalonen, 2010; Fedrowitz et al, 2014). Retention practices vary widely, "between a few % and about 30%" (Fedrowitz et al., 2014). 30 retention trees per Ha is more than many operators currently leave but commonly used as a scenario of improved but feasible levels[115].*

*On coppice with standards (FMA 2)*

*The general retention guidelines for FMA 2 need some adapting for coppice with standard. Often FMA 2 will involve even-aged mixed plantations of at least 3 species, but coppice with standard will be even-aged underwood with an overwood strata. In this system the standards are harvested and not left as retention trees to provide biodiversity functions of senescing trees. Instead a minimum of such trees is prescribed similar to the quotient of mature trees for harvest. Guidance on European coppices suggests 50-100 standard trees per Ha (though it can be considerably more depending on location) (Unrau et al, 2018). Assuming four age classes, each with half the number of trees to the preceding younger class (ibid), at 50 standard trees, approx. 3 stage class IV standards will be present. Another 3 are required herein to be retained permanently as retention trees. When underwood trees are replaced, the stools are to be left in place as they "contain many microhabitats and rare epiphytes" (ibid) as well as contributing stored carbon, soil structure and functions, etc.*

**2.2.1. Max clear cuts/ coupe**:

| FMA 1: Close to nature: | FMA 2: Intensive, even-aged mixed native species: | FMA 3: Intensive even-aged monocultures: |
|---|---|---|
| Maximum 0.2Ha harvest areas **[~/- 20% of this threshold value]** * with unharvested area as per 2.2.2<br><br>* Often in CTN forestry the gaps are limited to those created by selectively felling single trees. However, in the case of small group selection, a maximum area needs to be ascribed. | 1 ha in broadleaf or mixed forest, 3 ha in conifer forest **[~/- 20% of this threshold value]** [116] with unharvested area as per 2.2.2 | No Criterion |

**2.2.2. Unharvested area between coupes**

retention practice in Fennoscandinavia cannot be regarded as an alternative to clearcutting, but rather as one form of it". Further, in Finnish monitoring, "removal of retention trees was observed in almost every third of the cutting areas inspected".

[115] 30 retention trees are used as a scenario, for instance, in Mazziotta *et al*., 2017 and Trivino *et al*., 2015, after Vanha-Majamaa & Jalonen, 2010. 30 trees is far from excessive – even 50 may, depending on tree type, constitute only 7% stand volume (Vanha-Majamaa & Jalonen, 2010).

[116] Belgium FSC

<table>
<tr><td>FMA 1: Close to nature:</td><td>FMA 2: Intensive, even-aged mixed native species:</td><td>FMA 3: Intensive even-aged monocultures:</td></tr>
<tr><td colspan="2">At least 100m of forest [~/- 20% of this threshold value] is retained between harvest area as measured from the peripheries of the harvest area, and this retained forest area must not be felled for at least a further 40 years.<br><br>* not applicable to coppice with standards in FMA 2</td><td>No Criterion</td></tr>
<tr><td colspan="3"><u>Rationale for criterion 2.2.1 and 2.2.2:</u><br><br><u>On harvest area and unharvested area between harvest area</u><br><br>Where exceeding natural gap dynamics, clear cuts represent habitat destruction.[117]. The scale of clear-cut sizes in Northern Europe vastly exceeds natural disturbances (in 80% of studies - see Berglund & Kuuluvainen, 2021[118]. This situation is not peculiar to Europe. In Canada, “the current forestry regime involves clear cuts of up to 150 Ha.“ (Côté, et al 2010, see also Betts et al, 2022).<br><br><u>On the size of harvest gaps</u><br><br>The extent of forest openings created during harvesting is another important factor, as is the area of forest retained between those gaps, and the duration of time it is retained for. Common restrictions range from maximum clear-cut sizes in RFM and plantations (herein not applied to FMA 3, whose contribution is via set-aside), and maximum gap size in CTN. For CTN, clear cut is not practiced but small group fellings might be, in imitation of the natural gap dynamics of small disturbance events, so suitable gaps vary.<br><br>These criteria take into account concerns that CTN gaps as low as 0.1 Ha, as appropriate in some cases, may in others limit the regeneration of light-demanding species where commercial trees may require high or medium light in regeneration niche (e.g. Great Britain). 0.2 Ha is twice as large this threshold of concern (see Mason et</td></tr>
</table>

[117] “At an extreme end of the management intensity range is clear-cutting, which results in temporary deforestation of a previously forested area” (Paillet *et al.*, 2010). However, this may not be considered ’deforestation’ according to the FAO definition if 10% is left unlogged and the land use classification is left unchanged.

[118] The argument is sometimes given that clear-cut mimics natural disturbance mechanisms. However, in an update on this theory, Berglund & Kuuluvainen (2021) consider that “in northern Europe, the boreal forest…has for most parts been strongly transformed due to a long history of intensive utilisation and modern forestry based on even aged management and clear-cut harvesting…the proportion of old forests have decreased and been replaced by young, post-harvest forests”. They review natural disturbance regimes and conclude “the simplified view of stand-replacing, even-aged forest dynamics as the natural norm…cannot be justified in light of the current understanding”, concluding that smaller disturbances are reported in 80% of studies. They recommend “even-aged dynamics” in a maximum of a third of the landscape.

*al*, 2022). Setting a limit to canopy openings also makes it clear that the criteria do not call for ubiquitously closed canopy in all cases (except for selective felling of individual trees) - there may be small openings appropriate to the situation (see Schütz, 2001).

Despite continuous cover forestry not using clear-cuts, and often only single tree felling, nonetheless maximum harvest areas and minimum unharvested gaps between them must be kept in FMA 1 as well as in FMA 2. There needs to be a limit to small-group fellings in FMA 1. And the unmanaged area between such, needs to be ensured, to guard against either of these FMAs being used disingenuously to take advantage of their smaller set-aside than FMA 3. For example, an operator should not be able to declare what is essentially a large clear cut (e.g. 20 Ha) as simply 10 smaller harvest areas of 0.2 Ha separated by a nominal amount of retention trees.

<u>On size of unharvested gaps between harvest areas</u>

The area retained between harvest gaps needs to be sufficient to retain meaningful biodiversity functions. The Siberian Jay requires 70% tree cover of 15m height (Lillandt, B. G., 2000), and is adversely impacted by fragmented spruce landscapes that leave only narrow strips of forest - its Finnish population declined by two-thirds in the second half of the 20th century (Uimaniemi et al 2000; Muukkonen et al, 2012). 100m gaps between harvest areas, and the remainder as continuous cover forestry, likely results in 70% tree cover and ongoing local viability*. 90% of Finland's locally endangered siberian jay occur outside legally protected areas (Muukkonen et al, 2012), further underlining the value of set-aside.

However, whereas 100m unharvested gaps may be sufficient to retain the presence (if not the same population) of siberian jay, it will not be sufficient to retain all priority species. Clear-cutting within 150m of flying squirrels reduces the ecological functionality of their habitat, reducing their likelihood of continuing to occupy nests and breeding successfully (Jokinen, M., 2012). So 100m is already a compromise and too little for some species.

The logging of an average flying squirrel habitat of 5.7 Ha results in the loss of 4 of 5 individuals, and the fragmentation effect further increases losses (Koskimäki *et al*, 2014), underlying the need to retain meaningful forest between cuts, and for set-aside. Other Nordic species presenting similar scenarios of sensitivity to over clearance include capercaillie and hazel hen.

It is also necessary to ensure the unharvested gaps remain in place long enough for the adjacent harvested areas to have recovered meaningful tree growth, for a minimal level of habitat continuity over time.

*When clearing 0,2 ha with gap between cuts of min. 100m: imagine the clearcuts as circles in the corners of a larger square. Since the radius of circle with area 0,2 ha is 25m, then the diameter of each circle is 50m. If they are 100 m apart, then the side of the square must be 200m in length. That means the area of the square is 200m x 200m = 4ha. The sum of the four circle clearcuts is 0,8ha and 0,8/4 = 20% of total is logged. In effect the clearcut

<table>
<tr><td colspan="3">circles can be thought of as squares, in which case their total area is 1 ha --> 1/4 = 25% of the area is clearcut. So it is >70% forested as long as new small clearing are not made at less than 40 year intervals.<br><br><u>On clear cuts and neighbours' actions</u><br><br>For the avoidance of doubt, there are no dependencies between actions of neighboring FMUs. Criteria apply only at the holding level, so two neighbors can both cut to their boundaries. However, if they are doing a group submission, the rules apply to the entire (group) holding – collaboration is needed to ensure harvest coupes and gaps meet the criteria across the entire (group) holding.</td></tr>
<tr><td colspan="3">2.3.1 No extraction of deadwood of any kind (trees, snags, stumps, logs, or fine woody debris)</td></tr>
<tr><td>FMA 1: Close to nature:<br><br>No extraction of deadwood of any kind (trees, snags, stumps, logs, or fine woody debris) except in the exceptional case of a mass mortality event (such as storm damage) requiring salvage to recoup yield, in which case:<br><br>• a specific ecological assessment is undertaken by professional ecologist of a salvage harvest plan, AND<br>• salvage harvesting only proceeds if the assessment concludes it will not significantly harm biodiversity through adversely affecting the species diversity (any taxa) of forest, including the health of populations of threatened species (as listed in Habitats and Birds directives and national IUCN red-lists).<br>• If salvage harvesting proceeds, it must not reduce deadwood levels to below, either:<br><br>A) 75 $m^3$ $Ha^{-1}$ of deadwood (standing or lying) of at least 12 cm diameter[119]</td><td>FMA 2: Intensive, even-aged mixed native species:<br><br>No Criterion</td><td>FMA 3: Intensive even-aged monocultures:<br><br>No Criterion</td></tr>
</table>

[119] A higher level could be set by the operator, for instance where evidence suggests a higher levels of deadwood occurs in local reference old-growth forests under normal conditions or after a mortality event.

The given minimum level of deadwood to be retained after salvage is specified based at a low to medium level of dead wood in Scandinavia. This is probably an *underestimate* in most situations, not only for being conservative in relation to Scandinavian levels, and because other biomes often have higher deadwood levels, but also because some studies exclude fractions of deadwood in their definitions and because mortality events such as storm damage result in a sudden increase in deadwood levels above old-growth averages (Tikkanen and Kouki, 2006) & (Vanha-Majamaa et al., 2007). "The average volume of coarse woody debris in old-growth forests [including very sparse northern and high altitude forests with as low as 20 $m^3$] is generally 60-90 $m^3$ in southern Fennoscandia… the volume is even much higher following disturbance"

| | | |
|---|---|---|
| OR<br><br>B) A lower threshold may be applied where it can be demonstrated (with peer reviewed, preferably competent body recognised data) that, in the absence of any logging activity, deadwood levels in local reference old-growth forests, after natural disturbance, would be less than A).<br><br>In the case of B), deadwood levels after salvage are never less than as specified in 2.3.2. below.<br><br>AND<br><br>Standing dead wood (standing dead trees and snags) must not be removed[120] | | |

| **2.3.2. General Management guarantees accumulation of deadwood** | | |
|---|---|---|
| FMA 1: Close to nature: | FMA 2: Intensive, even-aged mixed native species: | FMA 3: Intensive even-aged monocultures: |
| General Management guarantees accumulation of at least 30 $m^3$ $Ha^{-1}$ of deadwood (standing or lying, of at least 12 cm diameter) in broadleaf or mixed forest, and 20 $m^3$ $Ha^{-1}$ in conifer forest of the largest possible diameters ensuring all stages of decay are present **[~/- 20% of this threshold value]**.<br><br>Where prescribed burning is necessary due to reasons of a fire adapted ecosystem (see 1.3.2, also 3.2), or if unplanned fire occurs (force majeure event), these deadwood levels can be temporarily relaxed if the prescribed burn (which must be appropriate to natural intensity and frequency) causes a temporary dip in deadwood level below these minimums. In this case, deadwood accrual can | | No Criterion |

(Siitonen, 2001). Müller & Bütler (2010) cite Siitonen as concluding average pine and spruce forest reserves at between 60-120 $m^3$ $Ha^{-1}$.

Whilst leeway is given where evidence points to lower natural levels of deadwood, in most situations this is not anticipated – even in the tropics where decomposition rates are higher (Seibold et al., 2021) old-growth deadwood levels *prior* to storms are usually greater than the figure given (e.g. 96-154 $m^3$ $Ha^{-1}$ in four tropical rainforests of different regions (Gale, 2000)), and temperate forests can be far higher (see next footnote / rationale).

[120] Due to its high value to nesting birds, bats and invertebrates.

| | |
|---|---|
| proceed according to the site's natural dynamics, but must be restored by latest at next felling time through deadwood creation. Prior to prescribed burns, the deadwood level must be assessed, recorded, and within the deadwood levels of 2.3.2<br><br>For FMA2 - In coppice with standards, when underwood is replaced, old stools are not removed. | |

*Rationale for criteria 2.3.1 and 2.3.2:*

*The importance of deadwood to forest biodiversity*

*Deadwood is an essential feature of forests on which much biodiversity depends. In Europe, up to a third of European forest species depend on veteran trees and deadwood for their survival (IUCN 2004), perhaps more in natural conditions - half of Bialowieza's 12,000 species are dependent on decaying logs (see EEA 2016, p.50).*

*Deadwood reference levels for old-growth forests vary markedly: 66.3 $m^3$ $Ha^{-1}$ in southern USA; 96-154 $m^3$ $Ha^{-1}$ in tropical rainforest (Gale, 2000); up to 868 m $m^3$ $Ha^{-1}$ in British Columbia (Stevens, 1997); between 158 $m^3$ $Ha^{-1}$ and 1890 $m^3$ $Ha^{-1}$ in New Zealand (Richardson et al., 2009). (Hahn and Christensen, 2004) reviewed a range of natural deadwood levels in Europe, ranging from 59 $m^3$ $Ha^1$ in northern boreal coniferous forests to 216 $m^3$ $Ha^{-1}$ in mixed mountainous forest in central Europe, with higher levels not uncommon after storm events, such as 256 $m^3$ $Ha^{-1}$ in the UK[1]. (Siitonen, 2001) found deadwood in Fennoscandinavia averaging 60-90 $m^3$ $Ha^{-1}$ and 60-120 $m^3$ $Ha^{-1}$ in pine and spruce forest reserves (Siitonen 2001, cited by Müller & Bütler 2010). In various types of forest in Poland's Bialowieza (from lowland to subalpine) average levels are 172 $m^3$ $Ha^{-1}$ rising to 427 $m^3$ $Ha^{-1}$ (Bujoczek, Szewczyk and Bujoczek, 2018).*

*European forests, without exploitation, would often average 130-150 $m^3$ $Ha^{-1}$ deadwood (Nilsson et al., 2002). However, deadwood in managed forests is typically far too low to safeguard biodiversity, and typically consists of fine woody debris (small twigs and branches) and short post-harvest stumps (Svoboda & Bace, 2012). Today, European forests average 10$m^3$ / ha (EEA 2017). Often it is practically nothing – in Finland just 1 to 1.4 $m^3$ $Ha^{-1}$ (Lier & Parviainen, 2013); in Fennoscandinavia, between 2 to 10$m^3$ – a 90-98% reduction (Siitonen, 2001). This situation is mirrored globally. Usually, aboveground deadwood does not exceed 10$m^3$ $Ha^{-1}$ (FAO, and many others, cited by Svoboda & Bace, 2012).*

*Forest certification standards do not guarantee ecologically meaningful levels of deadwood. Most of Finland is PEFC certified. Sweden's FSC standard stipulates leaving 3 standing dead trees per Ha, and Swedish spruce forests average only 10.2 $m^3$ $Ha^{-1}$ deadwood (Johnsson et al., 2016).*

*Thresholds beyond which deadwood-requiring species are lost vary widely and are often far higher than the safeguard levels listed here. Müller & Bütler (2010) present many examples, such as: in Germany, cavity-breeding* *birds may be absent under 141 $m^3$ $Ha^{-1}$ and lichens under 127 m3 Ha-1 ; generally the fungus Antrodiella citronella is not found in stands with less than 120 $m^3$ $Ha^{-1}$; various endangered saproxylic beetles become absent under 70 $m^3$ $Ha^{-1}$.*[121] *The main reason for declines in forest birds (e.g., several woodpecker species, specialist tits, forest game birds) are the steep decline in deadwood along with related changes in tree composition and age structure (Hanski & Walsh, 2004, p22): three-toed woodpeckers, for instance, are also very unlikely in forests with less than 20m3/Ha (Bütler & Schlaepfer 2004), though may become at levels varying between 11-74 $m^3$ $Ha^{-1}$ (Müller & Bütler, 2010). In a Finnish study, out of 8 threatened indicator fungi species, none were found in stands with less than 20$m^3$ / ha decaying wood, and only 2 species found at 20$m^3$ / ha. (see Hanski & Walsh, p.22; also Valnonen 2019). Bouget et al (2014) similarly found beetle species only present in old growth forest conditions of deadwood. Saproxylic species (involved in the decay of dead wood) directly dependent on dead and dying trees range across beetles (and their parasitic diptera), fungi, bryophytes, lichens, beetles, amphibians, birds, small mammals, molluscs, bugs, and syrphids (various, cited by Müller & Bütler, 2010) – often important components of the greater food-web.*

*A minimum level of post-salvage deadwood is presented as a safeguard for FMAs 1 and 2, based on levels necessary to keep the majority (i.e. this still risks nearly half) of deadwood species according to a review of 29 mainly European forests: 30-50 $m^3$ $Ha^{-1}$ was deemed necessary in broadleaf forest, and 20 - 30 $m^3$ $Ha^{-1}$ in conifer (boreal-alpine) (Müller and Bütler, 2010). This is not excessive: (Rondeux and Sanchez, 2010) conclude 40 $m^3$ $Ha^{-1}$ to be a useful threshold to apply globally for conservation of diverse saproxylic communities. Such figures are likely underestimates of the deadwood thresholds for species, because they depend on finding enough samples to be statistically significant, but in most cases we are already studying "reduced species communities" – so there is a "danger that derived thresholds are still too low for those species that have survived only in densities that make a statistical consideration impossible" (Müller and Bütler, 2010).*

*Although the minimum deadwood levels are applied to FMA 1, in reality as no deadwood is extracted under normal operations, CTN forestry will accumulate far more than these minimum levels. Deadwood levels are not stipulated for the most intensive even-aged plantation – FMA 3 is given more flexibility for maximum within strand extraction because it makes its contribution to B&ES through set-aside.*

*On salvage logging*

[121] Saproxylic beetles may be used as an indicator of forest quality and biodiversity. Eckert *et al* (2017) identified 168 beetles of central Europe that can be used as forest conservation umbrella species, which they call "primeval forest relict beetles…They were selected because of their dependence on the continuous presence of primeval forest habitat features, such as over-mature trees, high amounts of dead wood, and dead wood diversity, as well as their absence in managed Central European forests."

*FMAs 2 and 3 are more intensive than FMA 1 and compensate through higher set-aside, and so salvage logging in response to storm events and other disturbances is not limited (beyond safeguard deadwood levels in 2.3.2). However, FMA 1 (CTN) more closely approximates natural structure and function and so deadwood removal under normal operation is not permitted. However, to protect CTN operators against unexpected mass mortality (e.g. storm damage) resulting in lost yield, permissible salvage logging is defined.*

*The minimum level of deadwood to be retained after salvage is specified at low to medium levels of dead wood in Scandinavia. This is probably an underestimate in most situations: the levels are on the low end of Scandinavian baselines; other biomes often have higher deadwood levels; some studies exclude fractions of deadwood in their definitions and so numbers could be higher; mortality events such as storm damage result in a sudden increase in deadwood levels above old-growth averages (Tikkanen and Kouki, 2006; Vanha-Majamaa et al., 2007). "The average volume of coarse woody debris in old-growth forests [including very sparse northern and high altitude forests with as low as 20 $m^3$] is generally 60-90 $m^3$ in southern Fennoscandia… the volume is much higher following disturbance" (Siitonen, 2001). Müller & Bütler (2010) cite Siitonen as concluding average pine and spruce forest reserves at between 60-120 $m^3$ $Ha^{-1}$. [Siitonen's paper is not publically available – I'd like to check if we're pitching it at first quartile or at halfway]. See section 1.3 for more on ecological impacts of salvage logging.*

*Whilst leeway is given where evidence points to lower natural levels of deadwood, in most situations this is not anticipated – even in the tropics where decomposition rates are higher (Seibold et al., 2021) old-growth deadwood levels prior to storms are usually greater than the figure given (e.g. 96-154 $m^3$ $Ha^{-1}$ in four tropical rainforests of different regions (Gale, 2000)), and temperate forests can be far higher (see above).*

*Defining deadwood*

*Definitions of deadwood differ (and therefore volumes of deadwood cited in literature may vary accordingly).*

- *Usually underground deadwood is excluded, as it is here (it must always be left in place in all 3 of the FMAs herein).*
- *We also exclude deadwood within living trees*
- *The "deadwood" levels herein refer to standing and lying deadwood of diameters more than 12 cm. Although the IPCC and others use 10 cm and industry often less (see Merganiov et al., 2012; Siitonen et al., 2000), we use 12 cm in order to be consistent with most data on deadwood species loss thresholds (Müller & Bütler, 2010; also Müller, Bußler and Kneib (2008)), otherwise the safeguard levels of deadwood given would have to adjusted upwards. Most coarse woody debris in old-growth forest is anyway greater in diameter (mostly in size classes 20-29 cm and 30-39 cm - Siitonen et al., 2000).*

**2.4.1. Natural tree and shrub layer**

| FMA 1: Close to nature: | FMA 2: Intensive, even-aged mixed native species: | FMA 3: Intensive even-aged monocultures: |
|---|---|---|
| Natural tree and shrub layer where all local species are present in viable populations including non-productive species. | Stand composed of at least 3 native species* **<br><br>constituting at least 90% of the total stand (i.e. up to 10% exotic species | No criterion |

| | | |
|---|---|---|
| | permitted[122]) **[~/- 20% of this threshold value]**.<br><br>* In unusual circumstances of struggling to find 3 commercially valuable native species, not all 3 species need be commercially exploited (species may be included simply for biodiversity). Exceptions can be made in rare situations where less than 3 native species naturally occur. [123]<br><br>**For coppice with standard, this applies to the combined stand of underwood and overwood.<br><br>A minimum of 20% area is required for each native species (unless the number of native species is high enough to make this unfeasible). In the case of coppice with standard, this can be relaxed with regards standard trees when more than 1 native standard is used.<br><br>All naturally regenerating native tree and shrub species to be present in viable populations | |
| **2.4.2. Use of native species and local genotype** | | |

[122] No invasive alien species as recognised by competent-body (see 2.5.1) can be included, irrespective of when introduced to the locality (i.e. archaeophyte – before 1493, or neophyte – since 1493 (Essl *et al*., 2021)). This does not include archaeophytes not classified as invasive species, dispersed spread during ancient times by people and whose natural ranges may now be difficult to ascertain, such as European chestnut (Castanea sativa), olive (Olea europaea) or Mediterranean stone pine (Pinus pinea) (Petit *et al.*, 2004).

[123] E.g., in poor sandy soil in Latvia there could be only Scots pine.

Climate change can be expected to alter distributions of species (e.g., moving latitude or altitude), in which case this can be taken into account through reference to updated classifications of local reference biomes and native species, for instance using Global Tree Search.

| FMA 1: Close to nature: | FMA 2: Intensive, even-aged mixed native species: | FMA 3: Intensive even-aged monocultures: |
|---|---|---|
| Use of 100% native species and local genotype | No Criterion | No Criterion |

*Rationale for criterion 2.4.1 and 2.4.2:*

National and international databases on natural species distributions can be used to ascertain native species, such as Global Tree Search – which is a live database, offering practitioners the ability to check how, for instance, species may be changing latitudes in response to climate change (see Beech et al, 2017; Rivers, 2017).

FMA 2 includes some inclusion of non-invasive exotic species to ensure that forestry that is mostly native species but with some non-invasive exotics (such as legacy or particularly high value timber trees, or free trees), need not be excluded.

**2.5.1. No use of known invasive, alien species** – in accordance with competent body's guidelines (in Europe, Regulation (EU) 1143/2014 on invasive alien species).

**2.5.2. Risk assessment of potential impacts of non-native species**, and precautionary principle employed to prevent spread of non-native species.

**2.5.3. FMP explains measures to prevent introduction of invasives / naturalising species** including through route of planting material/machinery

**2.5.4. FMP includes active management of spontaneous invasives** within management unit, in accordance with other safeguards

*Rationale for criterion 2.5.1 - 2.5.4:*

The appearance of alien species, whether of animals, plants, fungi or micro-organisms, in new locations is not always a cause for concern. However, a significant subset of alien species can become invasive and have serious adverse impact on biodiversity and related ecosystem services, as well as have other social and economic impact, which should be prevented. Some 12 000 species in the environment of the Union and in other European countries are alien, of which roughly 10 to 15 % are estimated to be invasive" (EC 2014). After horticulture, the forestry industry is the next highest cause of (13%) tree and shrub invasive species (Richardson & Rejmánek, 2011)[124].

**2.6.1. Natural regeneration**

[124] "Species used for forestry are selected for fast growth (one of a package of traits typically associated with species with adaptations for rapid colonization and thus inherent 'weediness'; Grotkopp et al., 2010) and are typically grown in large plantations, allowing for the accumulation of massive propagule banks.".

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| FMA 1: Close to nature:<br><br>Natural regeneration only - except in situations where not feasible, e.g., due to lack of sufficient mother trees (either in number or species diversity), challenging restoration conditions, etc. in which case enrichment planting is permitted. | FMA 2: Intensive, even-aged mixed native species:<br><br>No Criterion | FMA 3: Intensive even-aged monocultures:<br><br>No Criterion |
| **2.7.1. Forest areas should ensure functional connectivity needs for priority species**, and this is explained in the FMP | | |
| FMA 1: Close to nature:<br><br>Applicable in stand, and set-asides | FMA 2: Intensive, even-aged mixed native species:<br><br>Applicable in set-asides | FMA 3: Intensive even-aged monocultures:<br><br>Applicable in set-asides |
| **2.8. No degradation / simplification of the composition, structure & function**<br><br>These measures must be monitored through use of a biodiversity / forest structure index (see 1.3.3), where possible approved by national conservation authorities to record stand-level forest structure in a representative sample of utilised forest[125]. | | |
| FMA 1: Close to nature:<br><br>No degradation / simplification of the composition, structure & function of stand structure continually (i.e. taking into account single stem selection or small group selection, and section 2 criteria on retention trees and harvest area). | FMA 2: Intensive, even-aged mixed native species:<br><br>No degradation / simplification of the composition, structure & function within stands prior to harvest.^ | FMA 3: Intensive even-aged monocultures:<br><br>No Criterion |

[125] i.e. as per 1.3.3. on set-aside management, but here applied to utilised stands. Such tools should be able to track evolution of naturalness structure according to local reference biome. Where information is lacking, a competent body approved participatory approach between foresters and ecologists can be undertaken to define "forest development types, which describe the long-term forest composition and structure appropriate for a specific site and climate, and then outline the silvicultural actions required to guide actual forest stands in the desired direction", as undertaken for Danish forests overseen by the Danish Forest and Nature Agency (see Larsen and Nielsen, 2007; quote from Mason *et al.,* 2022).

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| e.g., through reduced tree species richness, density, age-structure, and prevalence of dead wood. | e.g., through reduced tree species richness, density, age-structure, and prevalence of dead wood. | |

*Rationale for criterion 2.8*

*"Global sustainability agendas focus primarily on halting deforestation, yet the biodiversity crisis resulting from the degradation of remaining forests is going largely unnoticed. Forest degradation occurs through the loss of key ecological structures, such as dying trees and deadwood, even in the absence of deforestation" (Thorn et al, 2020).*

*In addition to ensuring remaining high conservation value forests (listed in 1.1) remain unexploited, it is also important to safeguard against a creeping deterioration in the quality of forests that are used for wood extraction.*

*Forest assessment tools can be used to monitor forest structural features on which biodiversity depends, and demonstrate no regression as well track improvements through the significant contributions made.*

*This is not required of FMA 3, however, whose principal contribution is through set-aside.*

**3. Fire prevention and control^**

**3.1. If in a region prone to forest fire, a fire risk management plan is part of the Forest Management Plan. The fire risk management plan sets out:**

- **Fire risk assessment** (e.g., likely sources of ignition, wind directions, most flammable areas, biodiverse areas at risk, etc)
- **Biodiversity oriented fire prevention plan** setting out measures on:
- Preventing fire damage to biodiversity-sensitive areas (per section 1)
- Responding to fire whilst preventing damage to forest biodiversity (e.g., harmful clearing understorey

**3.2. No use of fire** except prescribed burns where required for habitat management -either allowing natural fire dynamics where required by the natural ecosystem or instigating prescribed burning where the natural fire regime is impeded (e.g., by surrounding land management). The use of fire is only permitted in fire-adapted ecosystems, which must be commensurate to the intensity and frequency of natural fire incidence in the given ecosystem.

*N.B. 1.3.2. deals with prescribed burning in set-asides*

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| *Rationale for criterion 3:*<br><br>*In some areas, such as Indonesia, without a fire prevention plan there is the risk of fire spreading catastrophically to HCV forests.*<br><br>*In many locations, flammable plantations pose risks to high biodiversity habitats.* |

<table>
<tr><td colspan="3">4. Chemical use^</td></tr>
<tr><td colspan="3">4.1. Use of herbicides, pesticides, fungicides etc.</td></tr>
<tr><td rowspan="2">FMA 1: Close to nature:<br><br>No use of herbicides, pesticides or any chemicals other than for time-limited, localised control of exotic invasive species if mechanical treatment is not viable (in which case, the below to be adhered to).</td><td>FMA 2: Intensive, even-aged mixed native species:</td><td>FMA 3: Intensive even-aged monocultures:</td></tr>
<tr><td colspan="2">• Pesticide use minimised through compliance with Integrative Pest Management as set out in Annex III, EU Directive 2009/128/EC.<br>• No use of chemicals banned in EU (or nationally if outside EU)<br>• Chemical-free buffer zones (200m) around high biodiversity forest areas (per section 1) [~/- 20% of this threshold value]<br>• No aerial spraying of pesticides, herbicides or incendiary agents<br>• Annual records kept of types and volumes of chemicals used</td></tr>
<tr><td colspan="3"><u>Rationale for criterion 4.1:</u><br><br>Measures are necessary to avoid toxic and persistent chemicals accumulating in soils, waters, organisms and food webs.<br><br>In CTN, chemicals are not to be used on native insect pests (e.g., pine processionary moth in Portugal), which in near-to-natural forest conditions will have more intact predator-prey feedback mechanisms. Exceptions can be made for time-limited, localised control of exotic invasives (e.g., Asian longhorn beetle, in Europe).<br><br>In plantations and monocultures, where natural predator-controls are less likely to be functional, measures are required to minimise adverse ecological impacts. EU Directive 2009/128/EC aims to achieve a sustainable use of pesticides in the EU by reducing the risks and impacts of pesticide use on human health and the environment and promoting the use of Integrated Pest Management (IPM) and of alternative approaches or techniques, such as non-chemical alternatives to pesticides. General principles for IPM are given in Annex III of the directive.</td></tr>
<tr><td colspan="3">4.2. Use of fertiliser</td></tr>
</table>

<table>
<tr><td rowspan="2">FMA 1: Close to nature:<br><br>No use of fertiliser except if required at initial establishment stage as a one-off intervention to remedy soils that are impoverished in comparison to baseline reference levels for the locality (for instance due to previous intensive land uses), in which case a soil analysis shows this to be required.</td><td>FMA 2: Intensive, even-aged mixed native species:</td><td>FMA 3: Intensive even-aged monocultures:</td></tr>
<tr><td colspan="2">100% of fertilisers to be circular economy outputs (e.g., waste ash, etc) except for nutrient replenishment [~/- 20% of this threshold value] *. Noting that such circular economy outputs must comply with national pollution law/ must be assessed to ensure no accumulation in the forest of pollutants such as heavy metals, microplastics or synthetic chemicals.<br><br>*Where a soil analysis shows levels are below local baseline figures, for instance which can be the case for boron after past slash-and-burn activities</td></tr>
</table>

<table>
<tr><td colspan="3">5. Water management^</td></tr>
<tr><td colspan="3">5.1 No new drainage or improved efficiency (e.g., deepening) of existing drainage</td></tr>
<tr><td colspan="3">5.2. Restoration of natural hydrological regime</td></tr>
<tr><td>FMA 1: Close to nature:<br><br>Restoration of natural hydrological regime in stand.</td><td>FMA 2: Intensive, even-aged mixed native species: Restoration of natural hydrological regime only in set aside areas</td><td>FMA 3: Intensive even-aged monocultures: Restoration of natural hydrological regime only in set aside areas</td></tr>
<tr><td colspan="3">5.3. Compliance with water abstraction licenses (according to local law)</td></tr>
<tr><td colspan="3">5.4. No irrigation of forestry operations – except if necessary for a limited period during seedling establishment phase.</td></tr>
<tr><td colspan="3">5.5. No alteration of water bodies (diverting / canalising / damming of rivers, streams, etc)</td></tr>
<tr><td colspan="3"><u>Rationale for criterion 5:</u><br><br>CTN forestry should be well adapted to local hydrology, and its hydrological regime should be intact.<br><br>Intensive even aged forestry should not require irrigation beyond establishment phase as that would show inappropriate species selection or densities for location. This discourages development of intensive forestry in already water-stressed ecosystems.</td></tr>
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| **6. Soil protection and use of machinery^** |
| **6.1 Machinery is deployed in such a way as to safeguard good soil structure without deterioration** such as soil compaction, disturbance, erosion. At least 90% of harvest area should be unaffected |
| <u>*Rationale for criterion 6.1:*</u><br><br>*Mechanization is now part of the daily routine of forestry operations. However, many studies are highlighting the negative consequences of uncontrolled mechanization and the compaction of forest soils, disturbance, erosion and impacts on soil biodiversity, water infiltration, etc.*<br><br>*Regarding compaction, by reducing the porosity of the soil - an essential property for the proper circulation of water and gases (as well as maintaining hydrological ecosystem services) - it significantly disturbs the development of plants. Thus, soil compaction can increase the impact of certain diseases or predators. It opposes the development of the root system, thus affecting both the regeneration of stands and their productivity. Biodiversity is thus significantly and durably affected – for several decades or longer in some cases.*<br><br>*Repeated use of heavy machines may also increase the internal road network with concomitant soil impacts and influence on access to forest (see Forest Access, below).* |
| **6.2 Logging restrictions on sloping terrain**<br><br>**6.2.1. Measures are taken sufficient to ensure soil erosion is prevented on sloping soils**.<br><br>The following apply to all FMAs (except where specified otherwise).<br><br>On slopes of 10-20 degrees (all FMAs): **[~/- 20% of the following threshold values]**<br><br>• Maximum harvest gap 1 Ha (exotic and native plantations) (0.2 ha max in FMA 1, as per 2.2.1)<br>• Maximum 10% sloping area can be logged in one rotation<br>• Minimum 100m unharvested area between harvest areas (per 2.2.1)<br><br>On slopes of 20-35 degrees (all FMAs): **[~/- 20% of the following threshold values]**<br><br>• 0.2 Ha maximum harvest gap<br>• Maximum 10% sloping area can be logged in one rotation<br>• Minimum 100m unharvested area between harvest area (per 2.2.1)<br><br>No harvest* on slopes of:<br><br>• 20 degrees or more (very high erosion soils)<br>• 35 degrees or more (any soils) |

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| * Unless the SFMP includes a steep-slope harvesting plan that explains how cable systems, or traditional low impact approaches such as very selective thinning extracted by horse, ensure that soil erosion is prevented and compaction reduced to less than 10% area (see 6.1).<br><br>N.B. The above figures are not averages (steeper areas within an overall flatter average are to be treated according to the above stipulations) |
| *Rationale for criterion 6.2:*<br><br>*Logging – sometimes even with best practices in place - can lead to unsustainable levels of soil erosion. This not only reduces soil biodiversity but has a range of impacts on biodiversity through altered hydrology, not least impacts to downstream freshwater and estuarine environments. Sediment thresholds can be exceeded in aquatic ecosystems resulting in changes in composition of freshwater species. Local conditions and thresholds should be considered and not exceeded (Wenger et al 2018), and harvest methods, machinery, design of extraction tracks etc, planned carefully (e.g., see Haas et al 2021).*<br><br>*Some countries set no-logging rules on slopes above threshold gradients. Restrictions are sometimes placed on any logging above certain altitudes (with implications not only for erosion but also rain generation), which is not addressed here.*<br><br>*The criteria proposed herein set safeguards against high erosion practices, but much discretion remains in the hands of operators. It is to be hoped a precautionary principle approach will be adopted by operators keen to safeguard the essentially non-renewable resource of soil on which forestry also depends (see Edwards & Zierholz, 2001).*<br><br>*Where operators have high altitude forests and steep slopes, these areas may lend themselves well to set-aside (although set-aside should ideally also include lowland forest – which can be the most biodiverse).*<br><br>*Whilst the risks of logging on steep slopes are recognised and these criteria seek to minimise them through maximum harvest areas on slopes, max % of slope harvested, and unharvested areas, alpine forestry should not be entirely ruled out because when best practices are utilised it may be a relatively low impact approach - for instance when selective thinnings are extracted using cables (see Mologni et al., 2016) or traditional low-impact approaches.* |

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| *The figures and rationale above are primarily based on Wenger et al. 2018, and examples and sources therein*[126]. |
| **6.3. Harvest methods on wet soils**<br><br>No heavy machinery use on waterlogged soil. |
| *<u>Rationale for criterion 6.3:</u>*<br><br>*To prevent damage to soils from movement and/ or compaction. The operator may consider a range of approaches from avoiding harvest in wet periods, to use of lighter machinery, zip lines, horses, etc.* |

| **7. Forest access and security^** |
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| **7.1 Planning** A section of the FMP deals with layout design of linear infrastructure such as roads, tracks, and routes for removal of timber (such as skid trails, cables, etc), be they permanent or temporary, ensuring they are planned for efficient forestry that minimises both land-take by such infrastructure and other impacts on biodiversity and ecosystem services. Impacts on biodiversity to be considered should include those listed in 7.3. Wider ecosystem services consideration to include minimising soil compaction and erosion (see section 6). The role of tracks and firebreaks to be considered (see 3.1). |
| **7.2 No expansion of roads into roadless areas** i.e. where distances to nearest road is 1km[127] or more |
| **7.3 The FMP sets out how forest will be safeguarded to prevent access from adverse external influences** including (but not necessarily limited to): |

[126] For instance, at low levels of logging (10%) with best management practices in place, the environmental water quality threshold is rarely exceeded" (Solomon Islands case study, in Wenger *et al.*, 2018).

Selective harvesting only on slopes above 20 degrees (Solomon Islands).

No harvest on slopes more than 20 degrees on very high erosion soils, or 31 degrees on high erosion soils (Code of Practice for Forest Harvesting in Asia-Pacific), no harvest on slopes more than 22 degrees (Guyana), 24.2 degrees (Brazil), 25 degrees (Fiji), 30 degrees (Vanuatu). No harvest on hilltops and ridges above 100m and mean slope 14 degrees or more (Brazil).

All the above from national logging codes cited by Wenger et al, 2018.

[127] This definition after Ibisch *et al.* (2016)

- Unauthorised logging
- Unauthorised mining
- Unauthorised hunting
- Unauthorised extraction of other resources (e.g., NTFPs)
- Any intensification of such adverse biodiversity impacts both within the holding and areas of biodiversity importance listed in section 1 to which the holding may provide access to.

The above do not exclude usage by indigenous peoples and authorised and sustainable utilisation arrangements, which do no prejudice biodiversity, made with local communities

*Rationale for criteria 7:*

Road planning in forestry should demonstrate a high level of "strategic landscape planning [to] design road networks that concentrate efficient forest exploitation and conserve roadless areas" (Kleinschroth & Healey, 2017).

*"The planet's remaining large and ecologically important tracts of roadless areas sustain key refugia for biodiversity and provide globally relevant ecosystem services... Global protection of ecologically valuable roadless areas is inadequate. International recognition and protection of roadless areas is urgently needed to halt their continued loss" (Ibisch et al, 2016). See also McKinley et al (2020) for a USA context, and Selva et al (2010) for European context.*

*Roads can be a proxy for degradation and deforestation when established in natural forests, enabling a range of destructive practices to encroach, intensify, and lead to habitat destruction, fragmentation and deterioration. In addition to themselves causing fragmentation, roads may intensify forest exploitation and many activities with adverse effects on forest ecosystems (from new conurbations to mining to poaching to "human ignited wildfires associated with roads" (Popatov et al., 2017[128]).*

*In other contexts, roads may also attract illegal or unhelpful (motorized) traffic (e.g., quads and motorbikes) that can be detrimental to soils and watercourses, cause disturbance of species, etc.*

*Kleinschroth & Healey (2017, citing various) summarise the situation in the tropics:*

*"Road networks are expanding in tropical countries, increasing human access to remote forests that act as refuges for biodiversity and provide globally important ecosystem services. Logging is one of the main drivers of road construction in tropical forests. We evaluated forest fragmentation and impacts of logging roads on forest*

[128] "fragmentation of in-tact forest landscapes by logging and establishment of roads and other infrastructure initiates a cascade of changes that lead to landscape transformation and loss of conservation values"

*resilience and wildlife, considering the full life cycle of logging roads. Through an extensive evidence review we found that for logging road construction, corridors between 3 and 66 m (median 20 m) width are cleared, leading to a loss of 0.6 to 8.0 percent (median 1.8%) of forest cover.*

*"More severe impacts are increased fire incidence, soil erosion, landslides and sediment accumulation in streams."*

*"Once opened, logging roads potentially allow continued access to the forest interior, which can lead to biological invasions, increased hunting pressure and proliferation of swidden agriculture. Some roads, initially built for logging, become converted to permanent, public roads with subsequent in-migration and conversion of forest to agriculture."*

*"At low harvest levels (< 4 trees per ha), which are common in many tropical regions, damage from road construction is much higher than from tree felling"*

*Ibisch et al. (2016) note that "roads facilitate "contagious development," in that they provide access to previously remote areas, thus opening them up for more roads, land-use changes, associated resource extraction".*

*There has been concern over these impacts for a long time. A 1998 global review (Spellerburg & Morrison) concluded, "The detrimental effects of roads on nature by far outweighs any advantages to wildlife; both in the short-term and particularly in the long-term", identifying "the most important and serious impact of roads on nature is through habitat fragmentation".*

*Ibisch et al (2016): "Roads fragment landscapes and trigger human colonization and degradation of ecosystems, to the detriment of biodiversity and ecosystem functions" Even "roadless areas" (i.e. 1 km away from a road) are generally very fragmented - "more than half of which are <1 square kilometer and only 7% of which are larger than 100 square kilometers."*

*Given calls for more protected areas to stem the loss of biodiversity, it has been suggested that Europe should include roadless areas in its conservation area network (as they often buffer them and by nature have little human activity): "Our results demonstrate that Roadless Areas adjacent to Natura 2000 sites cover >65% of the total Natura 2000 surface. As Roadless Areas have limited human access, we suggest integrating Roadless Areas into biodiversity conservation networks as a timely solution to minimize conflicts over expanding PAs in the European Union and to achieve the goals of the European Union's 2020 Biodiversity Strategy (Psaralexi et al, 2017).*

**8. No direct harm to wildlife^**

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| **8.1. No intentional capture or killing of vertebrate wild animals other than:**<br><br>• For legally permitted subsistence or recreational wild hunting (adhering to all laws on target species, methods, season, quota etc)<br>• Indoor pest control – measures to prevent affecting non-target animals. Only EU permitted chemicals used. (See section 4: Chemical use)<br>• Control of invasive alien species or species control as part of a biodiversity conservation plan sanctioned by a competent national authority<br>• No use of unselective methods in accordance with EU Habitats Directive Annex 6 |
| **8.2. No intentional killing of species (any taxa) classified by national or international IUCN red lists as 'near threatened' or more severe categories (e.g., vulnerable, endangered, critically endangered, etc)** |
| **8.3. Limiting barriers to wildlife movement**<br><br>Fencing & other barriers (permanent and temporary) should not interrupt movement capabilities of wild animal populations, especially migratory species. Where fences are used (e.g., to protect seedlings) extensively enough to affect movements of wild species, wildlife connectivity needs to be identified and sufficient measures taken to enable movement (e.g., design of or gaps in fencing, tunnels, bridges, etc). |
| *Rationale for criterion 8:*<br><br>*Unselective methods stipulation – relevant to hunting as well as control of invasive species and measures being taken under a conservation plan.* |

*Table 3: Guidance and additional safeguard criteria for those moving between FMAs (to assist in the interpretation of criteria in Table 2)*

| **Eligible conversions** | |
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| **Conversion from more intensive to less intensive FMAs**, i.e.:<br><br>- FMA 3 to FMA 2<br>- FMA 3 to FMA 1<br>- FMA 2 to FMA 1<br><br>**Conversion from less intensive to more intensive FMAs**, i.e.:<br><br>- FMA 2 to FMA 3<br><br>*For the avoidance of doubt, conversion of FMA 1 (CTN) to FMA 2 or FMA 3 is not compliant with these provisions.* | Operators may see the incentive to switch fr intensive to less intensive management in order the amount of set-aside required. This is to be en provided it does not result in any habitat loss (see section). It may well be in the operator's interest to decision early.<br><br>Even though the loss of mature mixed specie represents a temporary loss of biodiversity, this is a case when such stands are harvested. Compensati |

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| | loss by moving to FMA 3 with the higher levels of set-aside required, is permitted, whilst ensuring that set-aside is created from mature conditions to minimise habitat disruption and speed the creation of valuable set-aside conditions. (see following section)<br><br>Conversion from FMA 1 to FMA 2 or 3 is not eligible as loss of CTN forest would constitute the loss of semi-natural forest, which is to be avoided. |
| **Safeguards against habitat loss** | |
| **For conversions from less intensive to more intensive FMA** (i.e., FMA 2 to FMA 3): **100% of any new set-aside should come from mature mixed stands** (with appropriate restoration measures – see section 1.3). This means mixed stands cannot be felled and then allocated to set-aside in their clear-cut state.<br><br>**For all conversions: areas of natural and semi-natural forest cannot be reduced (see section 2.8).** This means:<br><br>• The total area of natural and semi-natural forest cannot be reduced, nor can specific areas be destroyed and replaced.<br>• Intensive monocultures (FMA 3) can convert to FMA 2 or FMA 1, and intensive mixed (FMA 2) can convert to CTN (FMA 1), but only if all natural and semi-natural forest areas are retained, even if that results in higher set-aside than the minimum requirements. | Because FMA 2 requires at least 20% set aside and 80% mixed species, the conversion to FMA 3 which requires a further 30% set aside (or only 10% more if moving to FMA 3 with a mix of approaches) can be done through allocation of mature stands to set-aside rather than allocation of clear-cut areas to set-asides.<br><br>It's important not to allow loss of natural and semi-natural habitats as they take time to accrue valuable features of biodiversity interest. AFI also call for all "natural forest" (i.e. including semi-natural forest, in contrast to "plantation") to be protected (AFI 2019 & 2019b). See earlier footnote for the definition of semi-natural used herein. |
| **Timescales of compliance with criteria in Table 2 when converting** | |
| **The following criteria from Table 2 must be completed <u>within 10 years</u>** as evidenced in the FMP, which demonstrates at least 1/10 of this work is completed each year:<br><br>• Establishment of **age-structure criteria** (see Table 2, 2.1.1) **when working with mature stands (i.e. thinning)**. This means an operation has 10 years to ensure whole area has re-established uneven aged processes even | For certain criteria relating to structure, it may be unrealistic to expect an operator to implement or achieve this criteria over an entire property within a year. Therefore, the FMP must show they will be complete over 10 years, but the new approach is in place from day 1 albeit with a grace period to effecting the change. |

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| though the germination and establishment of all age classes may take considerably longer to happen.<br>• Establishment of **species mix criteria** (see Table 2, 2.4.1 and 2.4.2) **when working with mature stands (i.e. thinning)**<br>• Establishment of **minimum deadwood levels** (see Table 2, 2.3.2) – active deadwood creation[129] is required to reach minimum levels across all holding within 10 years, and where not yet achieved within that period, must be achieved through active deadwood creation at felling times (through physical means only, no use of herbicides).<br>All other criteria in Table 2 must be immediately adhered to. | |

| Do no significant harm ('DNSH') | |
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| (1) Climate change mitigation | For afforestation only[130]<br><br>1. Afforestation plan and subsequent forest management plan or equivalent instrument<br><br>1.1. The area on which the activity takes place is covered by an afforestation plan of a duration of at least five years, or the minimum period prescribed in national law, developed prior to the start of the activity, and continuously updated until this area matches the definition of forest as set out in national law or where not available, is in line with the FAO definition of forest. |

[129] Again, by physical means only. No use of herbicides.

[130] As defined in ANNEX 1 to the Commission Delegated Regulation (EU) .../...

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| | The afforestation plan contains all elements required by the national law relating to environmental impact assessment of afforestation.<br><br>1.2. Preferably through the afforestation plan, or if information is missing, through any other document, detailed information is provided on the following points:<br><br>(a) description of the area according to its gazetting in the land registry;<br><br>(b) site preparation and its impacts on pre-existing carbon stocks, including soils and above-ground biomass, in order to protect land with high carbon stock[131];<br><br>(c) management goals, including major constraints;<br><br>(d) general strategies and activities planned to reach the management goals, including expected operations over the whole forest cycle;<br><br>(e) definition of the forest habitat context, including main existing and intended forest tree species, and their extent and distribution;<br><br>(f) compartments, roads, rights of way and other public access, physical features including waterways, areas under legal and other restrictions;<br><br>(g) measures deployed to establish and maintain the good condition of forest ecosystems;<br><br>(h) consideration of societal issues (including preservation of landscape, consultation of stakeholders in accordance with the terms and conditions laid down in national law);<br><br>(i) assessment of forest related risks, including forest fires, and pests and diseases outbreaks, with the aim of preventing, reducing and controlling the risks and measures deployed to ensure protection and adaptation against residual risks; |

[131] Land with high-carbon stock means wetlands, including peatland, and continuously forested areas within the meaning of Article 29(4)(a), (b) and (c) of Directive (EU) 2018/2001.

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| | (j) assessment of impact on food security;<br><br>(k) all DNSH criteria relevant to afforestation<br><br>1.3. When the area becomes a forest, the area is subject to a forest management plan or an equivalent instrument, as set out in national law or, where national law does not define a forest management plan or equivalent instrument, as referred to in the FAO definition of 'forest area with long-term forest management plan'[132]. The forest management plan or the equivalent instrument covers a period of 10 years or more and is continuously updated.<br><br>1.4. Information is provided on the following points that are not already documented in the forest management plan or equivalent system:<br><br>(a) management goals, including major constraints[133];<br><br>(b) general strategies and activities planned to reach the management goals, including expected operations over the whole forest cycle;<br><br>(c) definition of the forest habitat context, including main existing and intended forest tree species, and their extent and distribution;<br><br>(d) definition of the area according to its gazetting in the land registry;<br><br>(e) compartments, roads, rights of way and other public access, physical features including waterways, areas under legal and other restrictions;<br><br>(f) measures deployed to maintain the good condition of forest ecosystems; |

[132] Forest area that has a long-term (ten years or more) documented management plan, aiming at defined management goals, and which is periodically revised, FAO Global Resources Assessment 2020. Terms and definitions (version of [adoption date]: http://www.fao.org/3/I8661EN/i8661en.pdf).

[133] Including an analysis of (i) long term sustainability of the wood resource and (ii) impacts/pressures on habitat conservation, diversity of associated habitats and condition of harvesting minimizing soil impacts.

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| | (g) consideration of societal issues (including preservation of landscape, consultation of stakeholders in accordance with the terms and conditions laid down in national law);<br><br>(h) assessment of forest related risks, including forest fires, and pests and diseases outbreaks, with the aim of preventing, reducing and controlling the risks and measures deployed to ensure protection and adaptation against residual risks (i) all DNSH criteria relevant to forest management.<br><br>1.5. The activity follows the best afforestation practices laid down in national law, or, where no such best afforestation practices have been laid down in national law, the activity complies with one of the following criteria:<br><br>(a) the activity complies with Delegated Regulation (EU) No 807/2014;<br><br>(b) the activity follows the "Pan-European Guidelines for Afforestation and Reforestation with a special focus on the provisions of the UNFCCC"[134].<br><br>For all other forestry activity except afforestation[135]<br><br>1. Forest management plan or equivalent instrument<br><br>1.1. The activity takes place on area that is subject to a forest management plan or an equivalent instrument, as set out in national law or, where national regulation does not define a forest management plan, as referred to in the FAO definition of 'forest area with long-term forest |

[134] Forest Europe Pan-European Guidelines for Afforestation and Reforestation with a special focus on the provisions of the UNFCCC adopted by the MCPFE Expert Level Meeting on 12-13 November, 2008 and by the PEBLDS Bureau on behalf of the PEBLDS Council on 4 November, 2008 (version of [adoption date]: https://www.foresteurope.org/docs/other_meetings/2008/Geneva/Guidelines_Aff_Ref_ADOPTED.pdf).

[135] As defined in ANNEX 1 to the Commission Delegated Regulation (EU) .../...

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| | management plan'[136]. The forest management plan or the equivalent instrument covers a period of 10 years or more and is continuously updated.<br><br>1.2. Information is provided on the following points that are not already documented in the forest management plan or equivalent system:<br><br>(a) management goals, including major constraints;<br><br>(b) general strategies and activities planned to reach the management goals, including expected operations over the whole forest cycle;<br><br>(c) definition of the forest habitat context, main forest tree species and those intended and their extent and distribution, in accordance to the local forest ecosystem context; (d) definition of the area according to its gazetting in the land registry;<br><br>(e) compartments, roads, rights of way and other public access, physical features including waterways, areas under legal and other restrictions;<br><br>(f) measures deployed to maintain the good condition of forest ecosystems;<br><br>(g) consideration of societal issues (including preservation of landscape, consultation of stakeholders in accordance with the terms and conditions laid down in national law);<br><br>(h) assessment of forest related risks, including forest fires, and pests and diseases outbreaks, with the aim of preventing, reducing and controlling the risks and measures deployed to ensure protection and adaptation against residual risks;<br><br>(i) all DNSH relevant to forest management. |

[136] Forest area that has a long-term (ten years or more) documented management plan, aiming at defined management goals, and which is periodically revised. FAO Global Resources Assessment 2020. Terms and definitions (version of [adoption date]: http://www.fao.org/3/I8661EN/i8661en.pdf).

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| | 1.3. The sustainability of the forest management systems, as documented in the plan referred to in point 1.1, is ensured by choosing the most ambitious of the following approaches:<br><br>(a) the forest management matches the applicable national definition of sustainable forest management;<br><br>(b) the forest management matches the Forest Europe definition[137] of sustainable forest management and complies with the PanEuropean Operational Level Guidelines for Sustainable Forest Management[138];<br><br>(c) the management system in place complies with the forest sustainability criteria laid down in Article 29(6) of Directive (EU) 2018/2001, and as of the date of its application with the implementing act on operational guidance for energy from forest biomass adopted under Article 29(8) of that Directive.<br><br><u>For all forestry activities:</u><br><br>1.6. The activity does not involve the degradation of land with high carbon stock[139].<br><br>1.7. The management system associated with the activity in place complies with the due diligence obligation and legality requirements laid down in Regulation (EU) No 995/2010.<br><br>1.8. The afforestation plan (if relevant) and the (subsequent) forest management plan or equivalent instrument provides for monitoring that |

[137] "The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems."

[138] Annex 2 of the Resolution L2. Pan-European Operational Level Guidelines for Sustainable Forest Management. Third Ministerial Conference on the Protection of Forests in Europe 2-4 June 1998, Lisbon/Portugal ( version of [adoption date]: https://foresteurope.org/wp-content/uploads/2016/10/MC_lisbon_resolutionL2_with_annexes.pdf#page=18)

[139] Land with high-carbon stock means wetlands, including peatland, and continuously forested areas within the meaning of Article 29(4)(a), (b) and (c) of Directive (EU) 2018/2001.

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| | ensures the correctness of the information contained in the plan, in particular as regards the data relating to the involved area.<br><br>The Forest Management Plan identifies the management practices or other measures that ensure compliance with these criteria. The same requirements for audit and provisions for group assessment apply as for the TSC to Mitigation. |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) 2021/2139 supplementing Regulation (EU) 2020/852.<br><br>The Forest Management Plan identifies the management practices or other measures that ensure compliance with these criteria. |
| (4) Transition to a circular economy | n/a |
| (5) Pollution prevention and control | • For conservation forestry[140]: The activity does not use pesticides or fertilisers. Alternatively, for all other forestry activities: The use of pesticides is reduced and alternative approaches or techniques, which may include non-chemical alternatives to pesticides, are favoured, in accordance with Directive 2009/128/EC of the European Parliament and of the Council[141], with exception of occasions where the use of pesticides is needed to control outbreaks of pests and of diseases.<br><br>• The activity minimizes the use of fertilisers and does not use manure. The activity complies with Regulation (EU) 2019/1009 of the European Parliament |

[140] As defined in ANNEX 1 to the Commission Delegated Regulation (EU) .../...

[141] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

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| | and of the Council[142] or national rules on fertilisers or soil improvers for agricultural use.<br><br>• Well documented and verifiable measures are taken to avoid the use of active ingredients that are listed in Annex I, part A, of Regulation (EU) 2019/1021[143] of the European Parliament and of the Council[144], the Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade[145], the Minamata Convention on Mercury[146], the Montreal Protocol on Substances that Deplete the Ozone Layer[147], and of active ingredients that are listed as classification Ia ('extremely hazardous') or Ib ('highly hazardous') in the WHO Recommended Classification of Pesticides by Hazard[148]. The activity complies with the relevant national law on active ingredients.<br><br>• Pollution of water and soil is prevented and cleaning up measures are undertaken when pollution occurs.<br><br>The Forest Management Plan identifies the management practices or other measures that ensure compliance with these criteria. |

142 Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003 (OJ L 170, 25.6.2019, p. 1).

143 Which implements in the Union the Stockholm Convention on persistent organic pollutants (OJ L 209, 31.7.2006, p. 3.).

144 Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants (OJ L 169, 25.6.2019, p. 45).

145 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (OJ L 63, 6.3.2003, p. 29).

146 Minamata Convention on Mercury (OJ L 142, 2.6.2017, p. 6.).

147 Montreal Protocol on Substances that Deplete the Ozone Layer (OJ L 297, 31.10.1988, p. 21)

148 The WHO Recommended Classification of Pesticides by Hazard (version 2019), (version of [adoption date]: https://apps.who.int/iris/bitstream/handle/10665/332193/9789240005662-eng.pdf?ua=1).

Rationale

**The scope of activities selected**

The forestry activities according to the NACE codes listed above are addressed here under one set of criteria for 'forestry and logging' due to significant commonality in the criteria required. The intention is to address the economic activity through its full lifecycle, from planting to management (including tending, thinning, logging) over the forest's rotation cycle, and including any initial land conversion. Hence it incorporates both Afforestation and Forest Management, listed as two separate activities in the EU Taxonomy Climate Delegated Act[149], and expands this to also address logging.

NACE codes A.02.30 (Gathering of wild growing non-wood products) and A.02.40 (Support services to forestry) are *not* covered by these criteria due to time constraints but are recommended to be addressed in a subsequent round of criteria development.

Production of Christmas trees are excluded as they more usually resemble agricultural production than forestry (and rarely exceed 5m in height), so will be more likely to qualify for significant contribution through criteria on crops. Were Christmas trees to be produced within a wider forestry system, that system would be covered by these criteria.

**Interrelations between the forest & logging sector and biodiversity & ecosystems**

Forestry and logging is a hugely important sector when considering the objective of the protection and restoration of biodiversity and ecosystems. The sector has high potential for both, contributing to biodiversity loss and – at the same time – for being a lead driver for carbon storage and biodiversity protection.

The principle of sustainability has a long standing tradition in the forestry sectors. Hannß Carl von Carlowitz used the term already in 1713 in his book *Sylvicultura oeconomica* regarding sustainable yield forestry. In the forestry community the term has then gradually evolved further over the centuries. The current definition for Sustainable Forest Management provided by the

[149] Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 [EUR-Lex - 32021R2139 - EN - EUR-Lex (europa.eu)]

pan-European Ministerial Conference on the Protection of Forests in Europe (see above) dates already back to 1993 and includes the focus on biodiversity.

The potential of the forestry sector to comply with this definition and thus contribute to a certain level of biodiversity protection is widely recognized: “Hands-on nature-positive management is possible in every forest managed for wood production, including plantation forests. Doing so begins with increasing tree species diversity, the retention of more deadwood and habitat trees coupled with the use of disturbance patches, all of which are within the means of every forest manage”[150]

Biodiversity protection in forests and within forest management schemes is urgent, given that the loss of biodiversity has accelerated at an alarming rate; worldwide, 1 million species face extinction[151]. And a very high share of the threatened terrestrial biodiversity is harboured by forests (there is no precise estimate but it is generally reported that forests harbour around 80 % of the terrestrial biodiversity[152]).

Globally, forests host about 80% of the world’s biodiversity. They also provide many other crucial ecosystem services, from climate and hydrological regulation to provision of clean air, to regulating the prevalence of zoonotic diseases that can switch to humans (WWF, 2020). Ecosystem services of forests have long been valued in the trillions of dollars per annum[153]. But globally, a third of pre-industrial forest has been cleared and 82% of the remainder is degraded. 70% of world’s forests are within 1 km of a forest edge (and rising) (see Watson *et al.*, 2018 & Haddad *et al.*, 2015). Illegal and unsustainable logging activities have been leading to forest degradation and access to new areas, followed by forest conversion for agriculture (Betts et al. 2021 Watson et al. 2018; Maxwell et al. 2016). Non sustainable forest management

[150] Muys, Bart & Angelstam, Per & Bauhus, Jürgen & Bouriaud, Laura & Jactel, Hervé & Kraigher, Hojka & Müller, Jörg & Pettorelli, Nathalie & Pötzelsberger, Elisabeth & Primmer, Eeva & Svoboda, Miroslav & Thorsen, Bo & Meerbeek, Koenraad. (2022). Forest Biodiversity in Europe. 10.36333/fs13.

[151] IPBES (2019), Global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

[152] FAO 2020. State of the World’s Forests 2020 (fao.org)

[153] An update of Costanza *et al’s* seminal 1997 paper, put the 2011 estimate of the annual financial value of forest ecosystem services at $16.2 trillion (Costanza *et al*, 2014).

has contributed to the loss by reducing old forest to simplified forest structure and composition" (Betts et al, 2022).

Within Europe, forests are the largest terrestrial ecosystem, covering around 40% of the territory. 85% of this forest land is available for wood supply[154].

There are concerns over the degradation of forest biodiversity within and outside Europe (EEA 2016).

Forest loss and degradation are the greatest threats to biodiversity worldwide (Betts *et al*., 2021). Outright forest clearance is the greatest single threat (Maxwell et al., 2016) and "forest degradation from logging is the most pervasive threat facing species inhabiting intact forest" (Watson et al, 2018). Logging at commercial intensities reduces a wide range of environmental values by damaging "forest characteristics including physical structure, species composition, diversity, abundance and functional organisation compared with their natural state" (ibid). "in many regions of the world, forest management has reduced old forest and simplified forest structure and composition" (Betts et al, 2022). The multifunctional attributes of forests are not resilient to intensive forestry (Thompson et al, 2011; Pohjanmies et al, 2021).

Europe has only 5% remaining undisturbed forests - half of which are in Finland, Sweden, central and eastern Europe, and the area of these forests continues to decline (Angelstam, 2020; Angelstam & Manton, 2021; Sabatini *et al*., 2018 & 2021).

European forest biodiversity is in a poor state, both within and outside Natura 2000 sites (IUCN, 2019). Forests make up almost half the area of Annex 1[16] Natura 2000 sites: only 15% are in 'favourable condition', the vast majority in poor condition (26% "unfavourable-bad', and 54% unfavourable-inadequate). Of Red-List forest species, 2-7% are already extinct, 15% are critically endangered, 40% (especially birds and plants) endangered, etc (see EEA 2016). Less than 35 % of forest species are associated with a favourable conservation status (ibid).

Forest and forest biodiversity loss and degradation come at a high price. Forests provide many crucial ecosystem services, from climate and hydrological regulation to the provision of clean

[154] Forest Europe 2020, FISE

air, to regulating the prevalence of zoonotic diseases that can switch to humans (WWF, 2020). Ecosystem services of forests have long been valued in the trillions of dollars per annum[155].

Biodiversity loss leads to major financial risks for many sector economies; it threatens the availability of ecosystem services on which economic activities depend. “By financing companies that depend on ecosystem services, financial institutions are exposed to physical risks. The loss of ecosystem services can threaten companies’ production processes and this can translate into a deterioration in their financial position. […] Financing companies with a negative impact on biodiversity and ecosystem services also exposes financial institutions to transition and reputational risks”[156]

Sustainable forest management has an important role in preventing further forest and biodiversity loss as it represents an economic alternative to land uses dependent on forest clearings. Furthermore, the forestry sector’s pressure on the quality of especially European forest habitats can be substantially reduced by sustainable management schemes that avoid removal of deadwood and old/dying trees, clear cutting, conversion into monoculture plantations, hydrological changes, and replacement with non-native or invasive species (EEA, 2020; EU, 2016).

Highly intact forest ecosystems have higher biodiversity than intensively managed plantations, typified by even age, regular spacing, and low diversity of native trees[157]. Even where the forest

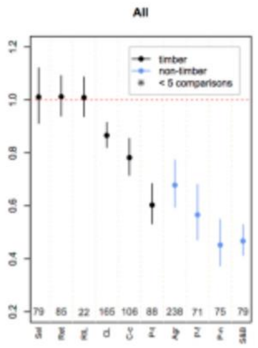
[155] An update of Costanza *et al’s* seminal 1997 paper, put the 2011 estimate of the annual financial value of forest ecosystem services at $16.2 trillion (Costanza *et al*, 2014).

[156] DNB & PBL (2020), Indebted to nature: Exploring biodiversity risks for the Dutch financial sector. link

[157] “Industrial forestry typically leads to a simplified forest structure and altered species composition” (Fedrowitz et al., 2014; see also Pohjanmies et al., 2019; Angelstam *et al*, 2020; Hua *et al*., 2020).

Chaudhary et al. (2016) reviewed 287 studies, concluding that in terms of species loss across taxa, forest management approaches can be ranked along a gradient of increasing intensity of deviation from naturalness, with most diversity at lower intensities (e.g. “selection and retention systems”, “reduced impact logging”, “conventional selective logging”) and least diversity at highest intensities (“clear-cutting, agroforestry, timber plantations, fuelwood plantations”). (Extract from figure, below, shows deviations from full species complement (1.0) along increasing gradient of FMA intensity.)

cover increases, if the forest structure is degraded it results in habitat loss for forest species and therefore population declines (see Betts et al 2022[158]; also Eckelt *et al.*, 2018). There are




Sky and Wagner, 2007, similarly reported “lower biodiversity in plantation forest compared to other forests” in 94% of studies, and Paillet et al’s (2010) review concludes similarly, with clear-cut involving species change having the highest negative impact. In summary, the most natural structure and function forest ecosystems have... “consistently higher numbers of forest-dependent species“ (Watson, 2018). See Huuskonen *et al. (*2021) for a (Scandinavian boreal focussed) exposition of how the more natural structure and species mix of mixed forests result in greater biodiversity. 1

[158] Betts et al (2022) showed, in the Acadian forest in Canada, that “forest degradation as a result of frequent clear-cutting and a broad-scale transformation to intensified forestry”, including “conversion from mixed-species forests to single-species conifer-dominated plantations…has led to habitat declines for the majority of forest bird species… and habitat loss was associated with population declines”

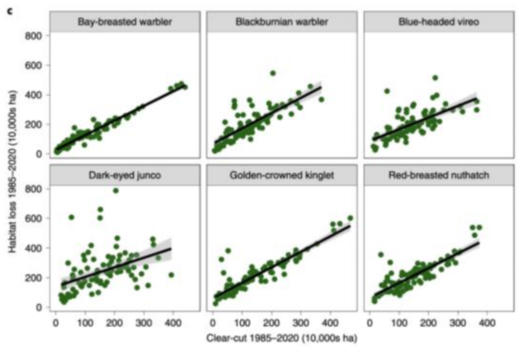



**Figure. Examples of habitat loss effect of forest simplification (i.e. clear-cut replaced by even-aged low species stands) to some of the 54 Acadian forest bird species studied by Betts et al, 2022.**

concerns that the multifunctional attributes of forests are not resilient to intensive forestry (Thompson et al, 2011; Pohjanmies et al, 2021).

**Pillars for substantial contribution**

Underpinning the criteria is the principle that greater naturalness is a pre-requisite to maintaining global forest biodiversity.

"Forest naturalness correlates with forest structural diversity and with biodiversity… greater naturalness is one of the main prerequisites for maintaining global forest biodiversity and should be a main focus of forest and conservation management at all scales" (Winter, 2012; see also Watson 2018; Pohjanmies *et al*., 2019; Angelstam 2020).

Naturalness is recognised in EU policy. The European Environment Agency uses naturalness "as a reference for assessments of the degree of degradation of forest ecosystems" (e.g., see EEA 2016, p.52), noting that primary forests are of high conservation value (HCV), that semi-natural forests can be, but plantations cannot. The EC acknowledges the naturalness spectrum implicitly by seeking to protect all remaining old growth forests (EU Biodiversity Strategy 2030), recognising their superior value to modified forests.

The criteria for substantial contribution to biodiversity and ecosystems per Table 2 therefore combine two areas of implementation – set-asides and in-stand measures - in order to:

Consistently, even not considering alterations in tree species and variability of age structure, just the process of transitioning forests into younger stands affects biodiversity. Whilst species assemblages alter over successional stages, Bengtsson *et al.* (2020) found (in a Swedish study) that "services related to biodiversity were typically highest in old stands (120-185 years)… In boreal forests, natural stands can be several hundred years old, whereas managed forests rarely are allowed to get older than 100 years, and often only 70–80 years, before being harvested… since most of the studied ecosystem services were at their maximum after 120 years, the decreased stand age caused by modern largescale forestry has inadvertently resulted in forest landscapes that have lost much of their multifunctionality, as suggested in a simulation study by Triviño et al (2017)".

- Safeguard and improve the state and extent of natural and semi-natural forests (SC 1A and SC1B)[159]. Clear and necessary stipulations are set out not just to prevent the ongoing destruction of quality forest habitat, but also restore and increase it, crucial for meeting EU Biodiversity Strategy targets.

- Ensure pressures on forest biodiversity are reduced and biodiversity improved in managed systems (SC 2B)

In areas where forestry activities can proceed without inflicting major damage on natural systems, a landscapes / systems approach is presented that combines more set-aside with best practice approaches in extensive (close to nature) and intensive forestry, as widely called for in the literature.[160] This approach recognizes that strictly protected areas are currently insufficient in size, and insufficiently connected through the landscape, to achieve global and EU conservation goals (even more so in the context of climate change), so the wider working landscape must play its role in providing habitat for biodiversity.[161] In addition, cross-cutting

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[159] This typology of substantial contribution is after JRC, 2022.

[160] Given the interplay between biodiversity needs and other land-uses, landscape planning is crucial in scenarios to reduce ongoing biodiversity loss. See Leclère et al (2020) for global modelling assuming landscape planning. As an example of national modelling, Trivino et al (2017) discuss the trade-off between a maximum productivist approach and ecosystem services, in Finland, concluding that “we need to give up the all-encompassing objective of very intensive timber production, which is prevailing particularly in Fennoscandian countries”, but that “with small reductions in timber… it [is] possible to greatly increase the multifunctionality of the landscape, especially the biodiversity indicators” through “forest management actions, alternative to business-as-usual management, such as reducing thinnings, extending the rotation period and increasing the amount of area set aside”. To reduce trade-offs, they call for applying planning at the landscape level (similar to triad forest management), utilising “a combination of different regimes” (similar to the different FMAs herein).

[161] Reserves alone are insufficient to adequately conserve forest biodiversity (Sugal, 1997; Daily et al., 2001; Lindenmayer et al, 2002), in part because 92% of the world’s forests are outside formally protected areas. Large ecological reserve systems are rarely comprehensive, representative and adequate for all elements of biodiversity (Margules and Pressey, 2000; Scott et al., 2001). In other cases, past land management means there are few or no opportunities to set aside large ecological reserves (e.g., in parts of southern Sweden - Gustaffson et al., 1999).

“Fragmentation of intact forest blocks (and associated edge effects) is a severe threat to forest-dependent species, especially those requiring large areas to maintain viable populations (e.g., predators, trees occurring at low densities)” (Watson 2018).

Climate change greatly underlines the need for habitat continuity throughout the landscape as species will be forced to move to new areas as local conditions change: for instance, African apes are expected to lose 90% of their range in coming decades, safeguards that apply to all types of forestry, anywhere, are also set out and monitoring tools are deployed to track improvements in forest structure and biodiversity.

This landscapes / systems approach is consistent with the EU's Green Infrastructure Strategy (EC 2013) that promotes "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services" to help achieve many goals including those of the EU's Biodiversity Strategy for 2030 (EC 2020) which aims, for instance, that "Europe's biodiversity will be on the path to recovery by 2030", to "strictly protect all the EU's remaining primary and old-growth forests", "build a truly coherent Trans-European Nature Network", "set up ecological corridors", and so forth.

More specifically, the New EU Forest Strategy for 2030, calls for "stand and landscape level" of more "diverse, mixed-species forests…instead of monocultural plantations. Also, management practices like uneven aged and continuous cover forestry[162], sufficient quantities of deadwood, regulation of wildlife densities[163] and the establishment of protected habitat patches or set aside areas in production forests help ensure long-term environmental and viability of forests" (EC 2021, p.12).

The approach herein draws on lessons from Triad Forest Management in which a forest operation (or wider landscape), may be divided between set aside and intensive and extensive (i.e. close to nature) operations. "The triad has the potential to minimise trade-offs…for timber products and forest ecosystem services" through maximising productivity where conditions most favour it, whilst ensuring contribution to biodiversity through areas of less intensive forestry where productivity and biodiversity are combined, and set-aside where biodiversity is the priority (see Himes *et al.,* 2022). Whilst these criteria draw on the logic of this approach by

half this loss from changes in suitability of protected areas (Carvalho et al, 2021). Climate change's multiplies the need for habitat throughout a viable landscape matrix to increase the chances species can move (see Table 2, section 1.2). "Hence, credible plans for forest biodiversity conservation must incorporate off-reserve approaches that complement reserve-based approaches" (Lindenmayer and Franklin, 2002; see also Angelstam *et al*. 2020, Felton et al 2020, IUCN 2020, Ellis et al 2021, Lindenmayer et al, 2006 & 2016; Ellis, 2019; Samways & Pryke 2016, and many more)."

"In most cases, effective designs should incorporate strategies for increasing forest cover (restoration) and improving the quality of the surrounding anthropogenic matrix" (Arroyo-Rodrigue et al 2020, citing many others).

162 The Strategy also specifically aims to encourage "closer to nature" forestry (p.14).

163 One assumes "regulation" to mean safeguarding of.

integrating land allocations, the option of a three-way allocation is provided in only one of the three groupings of management approaches (FMA 3, see below).

**Aligned with but with increased precision and/ or ambition compared to existing codifications of sustainable forest management**

Table 2 presents the criteria that must be met in order for the activity to be recognized as making a substantial contribution to the protection and restoration of biodiversity and ecosystems. These criteria cover a range of topics representing various management aspects, taking into account the many ways forestry and logging impact upon biodiversity and ecosystems. Sections marked with a '^' represent safeguard levels of performance. Together, as a bundle, compliance with these criteria would demonstrate a substantial contribution to the protection and restoration of biodiversity and ecosystems.

The topics addressed in the proposed criteria are similar to forestry biodiversity criteria and indicators elsewhere. However, other typologies, forestry codes and sets of principles lack the specific and quantified definitions required for a taxonomy to clearly define measures equating to substantial contribution to biodiversity, so it has been necessary to generate bespoke, self-sufficient criteria, integrating and building on best practice principles in biodiversity conservation and forestry initiatives.

The Forest Europe process[164], for example, includes a definition of 'sustainable forest management' and, under its Criterion 4, sets out 10 generic 'indicators' to address its 'maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems'. The concept of set aside is also within Forest Europe's criteria, though by different names and with no minimum requirements[165].

This approach addresses a key problem identified variously in the literature and in the EU Forest Strategy, namely a lack of minimum standards to ensure biodiversity is maintained (or

[164] Forest Europe (2015). Madrid Ministerial Declaration, Seventh Ministerial Conference. Annex 1: Updated pan-European indicators for sustainable forest management.

[165] "Set-aside" is analogous to MCPFE class 1 of "protected" forest, with "main management objective biodiversity", through: 1.1 ("no active intervention"), 1.2 "minimum intervention", or 1.3 "conservation through active management" (see Frank et al, 2005; Forest Europe, 2015).

enhanced), and a deferral to national level to monitor compliance with these undefined 'indicators'.

The EU Forest Strategy, for instance (EC 2021), notes that "in order to better respond to new challenges and needs, and in light of the increasing role of forests in the delivery of the EU's commonly agreed climate and biodiversity objectives, the sustainable forest management framework will have to be enhanced, notably as regards criteria relating to ecosystem health, biodiversity and climate change so that it can become a more detailed screening tool to determine and compare different management approaches, their impact and the overall state of EU forests. The sustainable forest management already covers several relevant indicators, such as deadwood and species diversity, but it does not yet define thresholds or ranges as benchmarks for the desirable condition."

In Finland, despite more than 90% of forests being PEFC certified[166], 76% of forest habitats are now threatened, and another 21% are nearly threatened" (Finnish Environment Institute, 2018; Kontula & Raunio, 2019). The situation in Sweden is similar: despite high levels of forest certification, remaining high conservation value (HCV) intact forest landscapes are being lost as a result of standard forestry practices, protected areas and set-asides are often too small at both property and landscape scale to meet conservation objectives (Angelstam *et al.,* 2020; Sabatini 2018 & 2021;) and "forestry and logging" is "a major threat" to red list mammals, molluscs, beetles and more[167].

It is therefore necessary to outline specific and measurable indicators that identify what substantial contribution looks like in practice and that can help to improve the implementation of national legislation and existing certification schemes. It is imperative for the EU Sustainable Finance Taxonomy to be unambiguous in its definitions, using ecologically clear terminology. The criteria presented herein are therefore compatible with Forest Europe's Criterion 4 – but define clear safeguards and indicators to define minimum standards and achieve a substantial contribution to biodiversity and ecosystems.

[166] Largely based on mandatory group certification, see Kuulavainen *et al*. (2019).

[167] Around 70% of Swedish forest is certified with PEFC or FSC according to Swedish Wood (undated), but forest red list species are threatened (IUCN 2013) and in decline (The Swedish Species Information Centre, cited by FERN et al, 2021).

**The selected criteria per Table 2**

The approach taken was not to seek to maximise biodiversity potential in all locations, but rather to establish a level playing field with a shared rule set consistent with a level of impact that represents a substantial contribution to biodiversity and ecosystems. This is consistent with the approach taken for the majority of criteria for substantial contribution to mitigation – where selected emissions thresholds represent high performance in absolute terms, not relative improvements from a site specific baseline.

From a review of the scientific literature, these criteria have been selected because it is believed they would, if implemented correctly, deliver substantial impacts for biodiversity and ecosystems with relatively high certainty across a range of biophysical and forestry conditions. I.e., they provide minimum levels to ensure a level playing field that constitutes substantial contribution. They should therefore be widely applicable. It will, of course, be necessary to regularly review this list of practices to integrate new advances in scientific knowledge.

The scientific literature provides insights on the impacts on biodiversity and ecosystems from various forestry management practices. However, it is a complex topic covering many biomes. Whilst forestry operations and biotopes differ, being based on evidence-backed principles it is expected the deployment of this bundle will deliver much needed substantial contribution in the vast majority of cases.

However, at the same time, it is important to recognise the diversity of local conditions and contexts. This has been done in a variety of ways within specific criteria.

Numerous criteria herein are *qualitative*, with more operator discretion in some cases deferring to local context and implementation of EU directives, such as consideration of national conservation priorities and connectivity needs of priority species (2.7.1 & 8.3); the extent to which set-asides or CTN areas require rehabilitation such as enrichment planting (1.3, 2.6.1) or hydrological restoration (5); defining locally native species (2.4.2); defining and managing locally invasive species (2.5); the use of fire (3.2); application of stand-quality assessment tools (1.3.4, 2.8); the use of chemicals (4.1); compliance with local water licenses (5.3); harvest methods on wet soils (6.3); and the permitting of hunting (8) and the local red list species to protect from hunting (8.2).

Where criteria are quantitative, some refer specifically to local authority, for example in the potential case of salvage logging deadwood levels (see 2.3.1). A limited number of criteria allow for a 'variation allowance' on the set threshold in certain circumstances. This variation allowance allows for some flexibility in specific thresholds in specific circumstances but has been limited in terms of both permissible circumstance and value, the latter in recognition that the thresholds set are deemed to already be at the lower ends of ranges indicated in the literature as appropriate for a substantial contribution to biodiversity and ecosystems. See the key to Tables 1 and 2 for more information here.

Overall, flexibility has also been addressed by the identification of Mandatory versus Selective Criteria. All mandatory criteria must be met, but only 50% of selective criteria need to be met. Whilst adherence to all criteria would ensure a substantial contribution to the biodiversity objective, some of the criteria are less important if others are fully implemented (the mandatory list). These include provisions for planning and access, options to restore hydrological regime and general water management, functional connectivity, and so on. These selective criteria need also to be seen in the context that for many of the criteria there is variation in requirements between FMAs and flexible thresholds in other criteria that are mandatory. See the key to Tables 1 & 2 for more information here.

However, as discussed above, it was not deemed appropriate to devolve to national legislation as a default position across the full set of criteria as this would result in a variety of ambition levels across jurisdictions with a number not meeting the thresholds for 'substantial contribution'. Indeed, if legislation were sufficient globally to deliver a substantial contribution to biodiversity and ecosystems, we would not now be in a position of needing to substantially restore that biodiversity.

In all cases, if local rules require higher standards (e.g. on set-aside), local law must be adhered to. It is also at the operator's discretion to go beyond the targets herein if there is a locally compelling biodiversity reason to do so (e.g. going beyond the minimum levels for set-aside, deadwood, retention trees, native species). These criteria aim to provide the smallest possible number of meaningful targets to ensure substantial contribution whilst allowing appropriate local flexibility. Local discretion can always be drawn upon (for instance, to optimise layout of forest types, further define most beneficial types of deadwood or which are the priority species of old trees to retain).

Supporting evidence for each individual element of the criteria is given in Table 2.

**Working with different forest management approaches**

As noted above, underpinning the criteria is the principle that greater naturalness is a pre-requisite to maintaining global forest biodiversity. There is scientific consensus that there is a trade-off between intensity of logging and biodiversity, with a large difference between unlogged and logged forests, and continuing losses of biodiversity along a gradient of intensity of management from selective logging of semi-natural forests to heavily managed forests such as plantations.

For this reason, the structure of the criteria recognises three broad categories of forest management approaches (FMAs). These categories are intended to capture but simplify the full spectrum of forest management approaches in a way that is manageable for the purposes of criteria setting and use. The categories, or groups, are linked to intensity of logging and forest management, using a number of indicators such as species representation, age-classes, intensity of harvesting and number of retention trees, how much deadwood accrues, and approaches to fertilisers, pesticides and drainage.

The FMAs are not detailed silvicultural prescriptions, they are broad descriptors relevant to substantial contribution to biodiversity. The idea is not that one looks at a forest and assigns an FMA as an off-the-peg management plan. Instead, the operator can consider which is the FMA (combination of characteristics) their operation is most relevant to, *or wishes to comply with going forward*, and the operator's management plan is developed to ensure compliance with the chosen FMA.

The three broad forest management approaches (FMAs) presented herein are:

- **FMA 1: Close to Nature Managed Forest (CTN)** – Exploited forests of naturally regenerated[168] native trees closely resembling natural forest structure and function (e.g. natural forest disturbance regimes, species mix, uneven age class and

[168] For full definitions, see technical screening criteria tables below, e.g. for when enrichment planting may be necessary

distribution, continuity of canopy, deadwood and naturalness legacies (see Larsen et al, 2022))[169]

- **FMA 2: Intensive, mixed native species –** i.e. intensively managed forestry consisting of at least 3 native tree species[170] established by planting or sowing[171], such as even or uneven-aged mixed plantation or coppice with standards. This category can also include plantation-like forest that is naturally regenerated with native species but of similar even-aged structure and regular spacings with high intensity management[172]

- **FMA 3: Intensive even-aged monocultures** – i.e. intensively managed even-aged forestry of a one or two non-native or native species where the stand origin is artificial by planting or sowing.

This approach provides industry with flexibility, giving the opportunity for all forms of forestry, anywhere in the world, to be Taxonomy compliant. The criteria *do not* exclude monocultural plantations, even of exotics, but enable them to contribute through higher set-aside.  And the

[169] "Close to nature' (CTN) and "continuous cover forestry' (CCF) are synonyms.  Although CCF is a term more widely used in forestry and with a large academic literature, herein we use the term CTN simply for the clearly worded implication of closely resembling natural structure and function (in more ways than just canopy, which CCF is not limited to but the title might suggest so). These criteria include criteria on extent of canopy cover and maximum harvest gaps permitted.

Uneven-aged forestry is commonly associated with superior biodiversity and other aspects of "multifunctionality" including climate change resilience, resistance to disease and wind-damage, maintenance of soil fungi, etc (see also Gauthier et al, 2015; Laiho *et al.* (2011); Parkatti & Tahvonen (2021); Peura *et al.,* 2018; Pukkala 2016; 2022; Pukkala *et al.* (2011, 2022); Tahvonen & Rämö, 2016; Díaz-Yánez et al. (2019); Axellson *et al.,* 2020; Pohjanmies *et al.,* 2020; Eyvindson *et al., 2021;* Kim *et al.,* 2021; Juutinen *et al.* (2020).  Blattert *et al.* (2022) conclude that in order to best meet the current goals in Finland's National Forest Strategy, approx. 40% CCF should be deployed (plus 25% set-aside, 28% intensive). Eyvindson *et al*. (2021), not limiting themselves to the analysis of goals of existing strategies, compared CCF and rotational forestry (RF) and concluded more than double the biodiversity and deadwood accrual in CCF than RF (e.g. at €5000 per Ha net present income), and far higher multifunctionality when combining biodiversity with carbon sequestration, productivity, and wider ecosystem services such as bilberry and mushroom provision (see their Fig. 3).  They conclude that "CCF should be considered as a primary management alternative, with selective application of rotation forestry [at 10-25%] wisely planned at the landscape scale

[170] Note, there is a caveat that fewer species would be acceptable where fewer species are naturally available. See Criterion 2.4.1.

[171] According to Messier *et al.* (2022): "monospecific planted forests typically have less potential for providing ecosystem services other than timber or fibre and they often harbor lower associated biological diversity (Bauhus et al., 2010). They are also more susceptible to pests and diseases, saturation or collapse of wood product markets, and climate change when compared to diverse planted forests" (see also Hildebrandt & Knoke, 2011; Huuskonen et al., 2021; Klapwijk *et al.,* 2016; Klapwijk & Björkman, 2018; Jactel *et al.,* 2021; Hines *et al.,* 2022).

[172] Such as Buchwald's (2005) N1 typology of plantation-like natural forest.

criteria recognize operators moving between FMAs, who would be Taxonomy compliant provided they meet the requirements of the FMA being moved to. For this, Table 3 provides guidance and safeguards on how to interpret the criteria in Table 2 for operators moving between FMAs. For example, whilst an operator can always move from a more to a less intensive FMA, there must be no loss of natural/semi-natural habitat in doing so, and because FMA 1 (CTN) is semi-natural forest, an operator cannot move from FMA 1 to a more intensive FMA. Provision is made to enable immediate compliance with the new FMA, for example leap-frogging directly from FMA 3 to FMA 1 – with clarifications given as to which criteria need to be immediately implemented and which can be delivered over a 10 year period.

These criteria do not preclude regional or landscape-scale strategies, and are compatible with such. The criteria ensure that taxonomy compliant forestry makes a genuine contribution to biodiversity, and leaves the chosen model of forestry to the operator.

It has been noted that there is a lack of commonly accepted terminology on forests and their management, especially for the purpose of clarifying achievement of biodiversity objectives (see Buchwald, 2005; Schulz *et al.* 2019). The three FMAs used here are broad classifications reflecting well established models of forestry such as Triad Forest Management (Seymour & Hunter, 1992) and the five forest management approaches proposed by Duncker (2012). Options commonly modelled in multifunctionality papers (such as Blattert et al, 2022[173]) also reflect this continuum of naturalness and the deviation from it expressed as intensity of management. Table A illustrates how the FMAs defined herein broadly correlate with other typologies.

To illustrate how these categories might work in practice, given there is variability within CTN forestry, mixed-plantations, also monocultures, below is a non-exhaustive list of examples illustrating how different systems of forestry might use these FMA categories:

- A semi-natural forest of mixed species practising selective felling would be applicable to FMA 1 (including tropical selective felling provided safeguards in section 1.1 are met).

[173] Whose modelling categories included business as usual (i.e. even-aged rotations) and intensified BAU (both of which are relevant to FMA 3 herein), continuous cover forestry (FMA 1) and set-aside. Numerous other such modelling papers are cited herein.

- Operations committed to achieving Close to Nature characteristics within the timeframe of the 10 year Forest Management Plan, could adhere to FMA 1.

- A coppice system could, if based on native species, adhere to FMA 2 if it meets stipulations on set-aside area, number of native species, etc. It can either simply adhere to the species mix and retention trees, or to the specific coppice + standards options provided in FMA 2.

- A more intensive short-rotation coppice, of less than 3 native species, could aim for compliance in FMA 3, requiring a greater level of set-aside;

- A coppice system that is part of a competent body approved conservation scheme (either for the habitat or priority species therein) may adhere to FMA 1 with some flexibility in interpretation of uneven age structure (see 2.1.1) provided remaining FMA 1 conditions are met.

- A mixed species plantation, with less than the required 90% of native species for FMA 2, could could increase its % of natives in order to adhere to FMA 2. Or, if the operator chooses not to increase the % native species to comply with FMA 2, the plantation could instead meet FMA 3 requirements (FMA 3 is for monocultures as well as plantations with some diversity but insufficient to meet FMA 2).

- A monoculture eucalyptus plantation would aim for compliance with FMA 3 due to the mono-specific culture. However, if the operation is in Australia where eucalyptus is native, and commits to integrating at least 3 native species, it could adhere to FMA 2.

- A rotational forest management (RFM) boreal forest, clear felled and regenerating with even-aged stands (planted or naturally regenerating) would, depending on species involved, likely be most interested in complying with FMA 3 (if only 1 species, either native or exotic) or with FMA 2 (if at least 3 native species).[174] E.g. A sitka spruce

[174] "In the last few decades, rotation forestry has been clearly the dominant method for timber extraction throughout the boreal forest, as well as in large areas of planted forests in temperate regions. Since 1950s, intensive practices using clear-cut harvesting resulted in impoverished stand structural diversity, fragmented forest structures, and lowered structural variability at the landscape scale in most forests in Fennoscandia" (Pohjanmies, Eyvindson and Mönkkönen, 2019). See also Siitonen *et al*, 2000; Tikkanen and Kouki, 2006; Vanha-Majamaa et al., 2007; Peura et al., 2018; Virkkala *et al.,* 2022). According to Koivula & Vanha-Majamaa (2020), "hundreds of species have been red-listed because of [this prevailing] forest management".

monoculture in Europe (where sitka spruce is an exotic) would aim to comply with FMA 3.

- RFM areas with established trees could be converted into FMA 1 (over 10 years) through introducing selective felling to vary the age and spatial structure, restoration measures such as enrichment planting and deadwood creation, and committing to the FMA 1 criteria henceforward.

- RFM in regeneration phase could convert to FMA 1 through natural regeneration re-seeding/planting of wild genotypes of representative mixed species at irregular spacings and committing to other FMA 1 criteria going forward (e.g. deadwood accrual).

- If the forest has experienced logging within the cut-off for long untouched (less than 60 years), it has the following options for compliance[175]:

- FMA 1 - Selective logging would likely aim for FMA 1 compliance. Ensuring all species are present across age-structures, with set-aside for natural conditions, is an improvement on the vast majority of concessions.[176]

- FMAs 2 & 3 - Where compliance with FMA 2 or FMA 3 does not involve regression in forest structure as per Table 2, 2.8 - e.g., the concession has already become a monoculture or similar, or deforestation occurred prior to 2008 (Table 2, 1.1.1) - these FMAs may also be adhered to.

Applied examples of forestry combining set-aside with productive FMAs include:

[175] For the avoidance of doubt, if the concession is in one of the habitat types in Table 2, 1.1.1 (e.g., HCV, old-growth, long-untouched), it's exploitation cannot align with these criteria as those tropical habitats are amongst the world's most biodiverse and it is imperative to protect them from logging impacts.

[176] Application of FMA 1 in tropical forestry concessions equates to a selective felling approach that ensures the continuation of all tree species in viable populations and across age-structures, rather than a rotational model in which the most valuable species are often taken out first, leading to subsequent cutting cycles taking out less valuable species with substantial forest modification over time (e.g. as described by Putz et al, 2012).

- Three-way allocations such as Triad Forest Management (Coté *et al.*, 2010; Betts *et al.*, 2021; Himes *et al.,* 2022) – as practiced across Nova Scotia and Quebec, for instance – which combines intensive (plantation), extensive (CCF), and set-aside, and;

- Two-way models where intensive plantations are combined with set-aside (e.g. a third of all of South African forestry is set-aside - see Samways

- et al (2009) & Samways & Pryke (2016), and WWF's New Generation Plantations also generally allocate a third to set-aside (NGP, 2017) and sometimes more – such as the half that is dedicated to restoration of Atlantic Rainforest in the Mata Atlantica pact.

Two options are put forward for agroforestry / silvicultural systems.

Option 1: Where wood products (including cork) are harvested within agroforestry / silvicultural systems, they can:

- Seek compliance with these criteria (provided they qualify as definition of forest (FAO - see p.1)) by adhering to one of the 3 FMAs based on applying the criteria to the tree layer/s of the system (in addition to the wider criteria on no conversion of valuable habitat, provision of forest set-aside etc); or

- Consider compliance via the Animal Production or Crop Production fiches - which will often be the easiest route to compliance (e.g., through providing sufficient semi-natural habitat either at tree or ground-cover layers - such as meadows within orchards or montado/dehesa, native tree coverage in spice forests, etc).

If the activity wishes both its wood (or cork) and its agricultural outputs to be separately taxonomy compliant, the appropriate FMA herein is to be selected, or in certain cases the wood portion of the system can be deemed compliant with this fiche provided the activity is compliant with either option A in the Animals or Crops fiches.

**A note on cork systems under this approach:** Cork is an anomaly because it is an outer layer that is peeled approximately once a decade, leaving the tree standing and living. Whilst it is most often grown in a cork-oak savannah (montado/dehesa), cork plantations are increasingly popular, but the tree naturally occurs in mixed forest. Therefore, options for compliance within the three FMAs herein include:

- Forest cork: a natural/semi-natural cork forest can adhere to FMA 1. This is to be encouraged as there is little of the original forest left in many montado/ dehesa landscapes.

- Cork plantation: depending on the mix of species, can adhere to FMA 2 or FMA 3.

- See Option 2 below for montado / dehesa achieving compliance via agriculture criteria

**A note on chestnut systems under this approach**

- Where the chestnut system is growing chestnuts - it would need to seek compliance via agricultural fiches.

- Where the chestnut is growing wood - it can be compliant herein based on the appropriate FMA (e.g. see coppicing options, or in FMA 1 if in a mixed forest format).

- If there is a project to rehabilitate a culturally valued chestnut grove, for instance, it might also be applicable to the Restoration fiche.

Option 2: Alternatively, if the tree cover of an agroforestry/ silvipasture system is below 35% of a holding which is growing pasture or crops under and between the tree cover (e.g., wooded pastures such as dehesa/ montado, alpine and baltic wooded pastures, UK oak-pasture parkland, etc.), the wood from that system can be deemed forestry-fiche compliant provided:

- The activity demonstrates compliance with the biodiversity criteria of the Option A routes to compliance in either the Animals or Crops fiche - i.e., Grazing is Beneficial for Biodiversity (Animals criteria), or large areas of the holding are under high-biodiversity landscape features or are otherwise biodiversity rich (Crops criteria). N.B. Both these agricultural criteria preclude any reduction in non-productive high biodiversity landscape features which include native trees and woodland.

- The % coverage of productive (e.g., cork/timber providing) native trees in such systems is at least maintained and is not reduced.

**Table A. How the Forest Management Approaches (FMAs) in these criteria relate to some other well-known categorisations.**

N.B. This table presents broad equivalents, though definitions do vary slightly, for this reason, it is the criteria presented herein that must be met. This table serves to help people orient these criteria with other typologies.

| **Our forest types and forest management approaches (FMAs)** | **Set-asides** (cross-cutting theme across the 3 FMAs) | **FMA 1:**<br><br>**Close to Nature** | **FMA 2:**<br><br>**Intensive, even-aged mixed native species** | **FMA 3:**<br><br>**Intensive e monocultures ( native)** |
|---|---|---|---|---|
| Triad forest management typologies<br><br>(Betts *et al.*, 2021; Himes *et al.*, 2022) | • Reserve | • Ecological / Extensive management | • Intensive management | • Intensive man |
| Duncker "Forest Management Approaches" (Duncker et al 2012) | • Passive intensity / "Unmanaged forest nature reserve" | • Low intensity / "close to nature forestry" | • Medium intensity "combined forestry"<br>• High intensity "intensive even aged<br>• Intensive intensity / "short rotation fo<br><br>Duncker, not being a biodiversity typology as such, does not distinguish native and exotic species in these 3 FI | |
| Buchwald categories (Buchwald, 2005) | • Long untouched forest (N5) upwards are | • Exploited Natural Forest (N2) | • Native Plantation (P3) (depending on number of species) | • Exotic Plantati<br>• Native Planta (depending o of species) |

| | | | | |
|---|---|---|---|---|
| | protected in these criteria, but any area of forest could be designated as set-aside. , | • Specially Managed Forest (N3) | • Plantation-like Natural Forest (N1) | |

**Economic considerations**

It should not be assumed, as it has been over the decades and sometimes still is, that Close to Nature (CTN) forestry (common synonyms for which include 'extensive, 'continuous cover', 'uneven aged' forestry' and 'ecological forestry'[177]) is less viable or less profitable than clear-cut rotation based operations. Even after 20th and 21st century intensifications of forest management, "between 22% and 30% of European forests are managed through CCF"[178] (Mason *et al.,* 2022). Numerous studies show CTN can be as or more profitable and should

[177] CCF is broadly defined by Prosilva (2012). See also Pukkala & Gadow (2012), Seymour & Hunter (1999), Franklin *et al.* (2018), Palik *et al.* (2020).

[178] Mason et al. (2022) estimate CCF practice in European countries, including several with considerable amounts, such as 76-100% in Switzerland, Slovenia, Boznia & Herzegova and Greece; 51-75% in Italy and Romania; 26-50% in Germany and parts of Eastern France, etc. Denmark is in the 6-25% bracket (along with several other countries) and includes the entirety of its state owned forest (Larsen & Nielson, 2006; EFI, 2019).

see increased uptake in order to optimise multifunctionality of forestry[179]. Triad Forest Management may also outperform status quo approaches[180].

**Enhancing the usability of these criteria**

As noted above, the intention has been to set base criteria that can be interpreted in all locations and contexts globally, and use globally recognised terminology, and apply a consistent interpretation of 'substantial contribution to biodiversity and ecosystems' globally. Once these criteria are established, then existing regulations or legislation, or certification schemes such as FSC or PEFC or any other systems can be evaluated for compliance with these base criteria. Where compliant, that regulation, scheme or other would then represent established 'proxy indicators' for all or part of these criteria, increasing the usability of the criteria.

Reference sources for the development of the criteria:

AFI (Accountability Framework Initiative) (2019). Terms and Definitions. www.accountability-framework.org/minor-revisions

[179] The purpose of this footnote is not to espouse one FMA over others – this choice is for the operator and the criteria provide a route to compliance for all FMAs. However, it is pertinent to point out that still-common assumptions that uneven aged forestry (CCF) is not commercially viable, are often unjustified. For many years flawed assumptions were commonly made about uneven aged forestry, leading to unnecessary dismissal of its viability in some quarters (Lundqvist, 2017; see also Himes *et al.,* 2022), such that "psychological barriers may prevent forest owners from applying CCF due to a lack of familiarity, preventing the most appropriate management option to be selected for a specific forested area" (Eyvindson *et al.,* 2021). Whilst, depending on various factors, total wood growth can be less in uneven aged systems (Lundqvist, 2017), there are often flawed assumptions in models which, when corrected, can "suggest that applying more natural forms of forest management may not be overly expensive… as a matter of fact, the reverse seems to be true" (Tahvönen & Rämo, 2016). Total wood growth is only one factor and not the only option from a profitability perspective. Uneven aged forestry often has a greater ratio of higher value saw wood to pulp wood, and far lower costs associated with regeneration phase. Such factors lead to many studies now concluding uneven aged forestry can be more profitable (see Tahvonen (2009), Tahvonen et al. (2010), Laiho *et al.* (2011) and Pukkala *et al.* (2011, 2022), Díaz-Yánez et al. (2019), Juutinen *et al.* (2020); Parkatti & Tahvonen (2021).

[180] Coté et al (2010) model several forestry scenarios, in which half of the triad forest management scenarios produce more harvest volume than standard industry practices and government proposed practices. Blattert & Eyvindson (2022) modelled the most suitable FMAs to apply to existing Finnish forestry stands to achieve current goals of Finlands' National Forest, Biodiversity, and Circular Economy strategies, and "all policy scenarios resulted in forest management programmes dominated by continuous cover forestry, set aside areas, and intensive management zones, with proportions depending on policy focus".

AFI (Accountability Framework Initiative). (2019b). Core Principles. www.accountability-framework.org/minor-revisions

Aguiar, T. R., Rasera, K., Parron, L. M., Brito, A. G., & Ferreira, M. T. (2015). Nutrient removal effectiveness by riparian buffer zones in rural temperate watersheds: The impact of no-till crops practices. Agricultural Water Management, 149, 74–80. https://doi.org/10.1016/j.agwat.2014.10.031

Ancrenaz M, Ambu L, Sunjoto I, Ahmad E, Manokaran K, Meijaard E, et al. (2010) Recent Surveys in the Forests of Ulu Segama Malua, Sabah, Malaysia, Show That Orang-utans (*P. p. morio*) Can Be Maintained in Slightly Logged Forests. PLoS ONE 5(7): e11510. https://doi.org/10.1371/journal.pone.0011510

Angelstram & Breuss (2004). Measuring Forest Biodiversity at the Stand Scale: An Evaluation of Indicators in European Forest History Gradients Article in Ecological Bulletins.

Angelstam *et al.* (2004). Targets and tools for the maintenance of forest biodiversity – an introduction. Ecological Bulletins 51: 11–24, 2004.

Angelstram *et al., 2020.* Sweden does not meet agreed national and international forest biodiversity targets: A call for adaptive landscape planning. Landscape & Urban Planning: 202, 2020

Angelstam, P., & Manton, M. (2021). Effects of Forestry Intensification and Conservation on Green Infrastructures: A Spatio-Temporal Evaluation in Sweden. Land: 10; 531. https://doi.org/10.3390/land10050531

Arroyo-Rodriquez, V. *et. al* (2020). Designing optimal human-modified landscapes for forest biodiversity conservation (2020). Ecology Letters

Asbeck *et al.* (2021). Biodiversity response to forest management intensity, carbon stocks and net primary production in temperate montane forests. Nature Research.

Axelsson, E. P., Girona, M. M., Keith, J. (n.d.). Continuous-cover forestry maintains soil fungal communities in boreal ecosystems. https://www.researchgate.net/publication/342917518

Beech, E., Rivers, M., Oldfield, S., & Smith, P. P. (2017). GlobalTreeSearch: the first complete global database of tree species and country distributions. Journal of Sustainable Forestry, 1-36.

Berglund, H., & Kuuluvainen, T. (2021). Representative boreal forest habitats in northern Europe, and a revised model for ecosystem management and biodiversity conservation. Ambio, 50(5), 1003–1017. https://doi.org/10.1007/s13280-020-01444-3

Betts et al. (2021). Producing wood at least cost to biodiversity: integrating triad and sharing–sparing approaches to inform forest landscape management.

Betts, M. G., Yang, Z., Hadley, A. S., Smith, A. C., Rousseau, J. S., Northrup, J. M., Nocera, J. J., Gorelick, N., & Gerber, B. D. (n.d.). Forest degradation drives widespread avian habitat and population declines. https://doi.org/10.1038/s41559-022-01737-8

Biggs, T. W., Santiago, T. M. O., Sills, E., & Caviglia-Harris, J. (2019). The Brazilian Forest Code and riparian preservation areas: spatiotemporal analysis and implications for hydrological ecosystem services. Regional Environmental Change, 19(8), 2381–2394. https://doi.org/10.1007/s10113-019-01549-w

Björklunda et al (2020). Predicting valuable forest habitats using an indicator species for biodiversity. Biological Conservation.

Blattert, C., Eyvindson, K., Hartikainen, M., Burgas, D., Potterf, M., Lukkarinen, J., Snäll, T., Toraño-Caicoya, A., & Mönkkönen, M. (2022). Sectoral policies cause incoherence in forest management and ecosystem service provisioning. Forest Policy and Economics, 136. https://doi.org/10.1016/j.forpol.2022.102689

Bouget et al (2014). Does a set-aside conservation strategy help the restoration of old-growth forest attributes and recolonization by saproxylic beetles? C. Animal Conservation 17.

Buchwald, E. (2005). A Hierarchical Terminology for More of Less Natural Forests in Relation to Sustainable Management and Biodiversity Conservation. Third Expert Meeting on Harmonizing Forest-Related Definitions, Rome.

Bujoczek, L., Szewczyk, J., & Bujoczek, M. (2018). Deadwood volume in strictly protected, natural, and primeval forests in Poland. In European Journal of Forest Research (Vol. 137, Issue 4, pp. 401–418). Springer Verlag. https://doi.org/10.1007/s10342-018-1124-1

Burivalova *et al.* (2014). Thresholds of Logging Intensity to Maintain Tropical Forest Biodiversity. Current Biology.

Bütler, R. & Schlaepfer, R. (2004). Wie viel Totholz braucht der Wald? | Dead wood in managed forests: how much is enough?

Carvalho, J. S., Graham, B., Bocksberger, G., Maisels, F., Williamson, E. A., Wich, S., Sop, T., Amarasekaran, B., Barca, B., Barrie, A., Bergl, R. A., Boesch, C., Boesch, H., Brncic, T. M., Buys, B., Chancellor, R., Danquah, E., Doumbé, O. A., Le-Duc, S. Y., … Kühl, H. S. (2021). Predicting range shifts of African apes under global change scenarios. Diversity and Distributions, 27(9), 1663–1679. https://doi.org/10.1111/ddi.13358

Chaudhary, A., Burivalova, Z., Koh, L. P., & Hellweg, S. (2016). Impact of Forest Management on Species Richness: Global Meta-Analysis and Economic Trade-Offs. Scientific Reports, 6(1), 23954. https://doi.org/10.1038/srep23954

Chiarucci, A., & Piovesan, G. (2020). Need for a global map of forest naturalness for a sustainable future. Conservation Biology, 34(2), 368–372. https://doi.org/10.1111/cobi.13408

Costanza et al (1997). The Value of the World's Ecosystem Services and Natural Capital. Nature: 387.

Costanza, R., de Groot, R., Sutton, P., van der Ploeg, S., Anderson, S. J., Kubiszewski, I., Farber, S., & Turner, R. K. (2014). Changes in the global value of ecosystem services. Global Environmental Change, 26, 152–158. https://doi.org/10.1016/j.gloenvcha.2014.04.002

Coté *et al.* (2010). Comparing different forest zoning options for landscape scale management of the boreal forest: possible benefits of the TRIAD. Forest Ecology & Management 259.

Cole, L. J., Stockan, J., & Helliwell, R. (2020). Managing riparian buffer strips to optimise ecosystem services: A review. *Agriculture, Ecosystems & Environment*, *296*, 106891.

Díaz-Yáñez, O., Pukkala, T., Packalen, P., & Peltola, H. (2020). Multifunctional comparison of different management strategies in boreal forests. Forestry, 93(1), 84–95.

Dinerstein, E., Olson, D., Joshi, A., Vynne, C., Burgess, N. D., Wikramanayake, E., Hahn, N., Palminteri, S., Hedao, P., Noss, R., Hansen, M., Locke, H., Ellis, C., Jones, B., Victor Barber, C., Hayes, R., Kormos, C., Martin, V., Crist, E., … Saleem, M. (2017). Forum 534 BioScience. 67(6). https://doi.org/10.1093/biosci/bix014

Duncker et al. (2012). Classification of Forest Management Approaches: A New Conceptual Framework and its Applicability to European Forestry. *Ecology and Society 17 (4): 51.*

EC (2013). Green Infrastructure (GI) — Enhancing Europe's Natural Capital

EC (2014). REGULATION (EU) No 1143/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species.

EC (2020). EU Biodiversity Strategy for 2030: Bringing nature back into our lives.

EC (2021a). New EU Forests Strategy for 2030.

EC (2021b). EU biodiversity strategy for 2030: bringing nature back into our lives.

Eckelt, A., Müller, J., Bense, U., Brustel, H., Bußler, H., Chittaro, Y., Cizek, L., Frei, A., Holzer, E., Kadej, M., Kahlen, M., Köhler, F., Möller, G., Mühle, H., Sanchez, A., Schaffrath, U., Schmidl, J., Smolis, A., Szallies, A., … Seibold, S. (2018). "Primeval forest relict beetles" of Central Europe: a set of 168 umbrella species for the protection of primeval forest remnants. Journal of Insect Conservation, 22(1), 15–28. https://doi.org/10.1007/s10841-017-0028-6

Edwards & Zierholz, 2000. Soil formation and erosion rates. *Soils: Their Properties and Management*. Ed. P. E. V. Charman and B. W. Murphy.

EFI. (2019, December). Danish integrated forest management. https://efi.int/articles/danish-integrated-forest-management

Ellis, E.C. (2019). To Conserve Nature in the Anthropocene, Half Earth is Not Nearly Enough. **One Earth**, 1, 163-167.

Essl, F., Glaser, M., & Schertler, A. (2021). New and old invaders in forests in eastern Austria: The role of species attributes and invasion history. Flora: Morphology, Distribution, Functional Ecology of Plants, 283. https://doi.org/10.1016/j.flora.2021.151922

EU(2016). European Red List of Habitats: Part 2. Terrestrial and freshwater habitats. https://doi.org/10.2779/091372

European Environment Agency (EEA), 2016. European Forest Ecosystems: State and trends. EEA Report No 5/2016

European Environment Agency (EEA), 2017. Indicator Assessment: Forest Deadwood. https://www.eea.europa.eu/data-and-maps/indicators/forest-deadwood-1/assessment-1

European Environment Agency (EEA), 2020. State of Nature in the EU. EEA Report No 10/2020.

Eyvindson, K., Duflot, R., Triviño, M., Blattert, C., Potterf, M., & Mönkkönen, M. (2021). High boreal forest multifunctionality requires continuous cover forestry as a dominant management. Land Use Policy, 100. https://doi.org/10.1016/j.landusepol.2020.104918

Fedrowitz, K., Koricheva, J., Baker, S. C., Lindenmayer, D. B., Palik, B., Rosenvald, R., Beese, W., Franklin, J. F., Kouki, J., Macdonald, E., Messier, C., Sverdrup-Thygeson, A., & Gustafsson, L. (2014). REVIEW: Can retention forestry help conserve biodiversity? A meta-analysis. Journal of Applied Ecology, 51(6), 1669–1679. https://doi.org/10.1111/1365-2664.12289

Felton et al (2020). Keeping pace with forestry: Multi-scale conservation in a changing production forest matrix. **Ambio** : 49, 1050–1064

FERN et al. (2021). Joint NGO letter on the EU Forest Strategy.

Fischer, R. A. (2000). Width of riparian zones for birds. EMRRP Technical Notes Collection. (TN-EMRRP-SI-09) US Army Engineer Research and Development Centre, Vicksburg, MS. https://www.arlis.org/docs/vol1/EMRRP/946618517.pdf

Finnish Environment Institute (2018). Assessment of threatened habitat types in Finland 2018: The status of natural habitats continues to deteriorate. https://www.environment.fi/en-US/Nature/Assessment_of_threatened_habitat_types_i(48849)

Forest Europe. (2015). Relevant terms and definitions used for the updated pan-European indicators for sustainable forest management.

Forest Europe (2020). State of Europe's Forests 2020: Summary for Policy Makers. Ministerial Conference on the Protection of Forests in Europe - FOREST EUROPE Liaison Unit Bratislava.

Forest Stewardship Council (FSC). FSC Principles and Criteria for Forest Stewardship. FSC-STD-01-001 V5-2

Frank, G., Latham, J., Declan, ;, Parviainen, J., Schuck, A., & Vandekerkhove, K. (2003). Analysis of protected forest areas in Europe-Provisional results of COST Action E27 PROFOR. https://www.researchgate.net/publication/228484621

Franklin, J. F., Johnson, D. L., & Johnson, K. N. (2018). Ecological forest management. Waveland Press.

Gale, N. (2000). The aftermath of tree death: coarse woody debris and the topography in four tropical rain forests. Canadian Journal of Forest Research, 30(9), 1489–1493. https://doi.org/10.1139/x00-071

Garibaldi, L. A., Oddi, F. J., Miguez, F. E., Bartomeus, I., Orr, M. C., Jobbágy, E. G., Kremen, C., Schulte, L. A., Hughes, A. C., Bagnato, C., Abramson, G., Bridgewater, P., Carella, D. G., Díaz, S., Dicks, L. v., Ellis, E. C., Goldenberg, M., Huaylla, C. A., Kuperman, M., … Zhu, C. D. (2021). Working landscapes need at least 20% native habitat. In Conservation Letters (Vol. 14, Issue 2). John Wiley and Sons Inc. https://doi.org/10.1111/conl.12773

Gauthier, S., Bernier, P., Kuuluvainen, T., Shvidenko, A. Z., & Schepaschenko, D. G. (n.d.). Boreal forest health and global change. Science (349).

Geburek et al. (2010). The Austrian Forest Biodiversity Index: All in one. Ecological Indicators 10 (2010) 753–761

Götmark et al (2000). Buffer zones for forest reserves: opinions of landowners and conservation value of their forest around nature reserves in southern Sweden. Biodiversity and Conservation 9: 1377–1390.

Gustafsson, et al (2012). Retention Forestry to Maintain Multifunctional Forests: A World Perspective. *BioScience*, Volume 62, Issue 7, July 2012, Pages 633–645

Hahn, K., & Christensen, M. (2004). Dead Wood in European Forest Reserves-A Reference for Forest Management. EFI Proceedings (51). https://www.researchgate.net/publication/312974444

Hågvar, S., Nygaard, P., & Tore Bækken, B. (2004). Retention of Forest Strips for Bird-life Adjacent to Water and Bogs in Norway: Effect of Different Widths and Habitat Variables. *Scandinavian Journal of Forest Research*, *19*(5), 452–465. https://doi.org/10.1080/02827580410019427

Hågvar, S., Nygaard, P., & Tore Bækken, B. (2004). Retention of Forest Strips for Bird-life Adjacent to Water and Bogs in Norway: Effect of Different Widths and Habitat Variables.

*Scandinavian Journal of Forest Research*, *19*(5), 452–465. https://doi.org/10.1080/02827580410019427

Hagvar, S., & Baekken, B. T. (2005). Forest strips left along water and bog. Ornis Norvegica, 28, 51–57.

Hansen, B. D., Reich, P., Lake, P. S., & Cavagnaro, T. (2010). Minimum width requirements for riparian zones to protect flowing waters and to conserve biodiversity: a review and recommendations with application to the State of Victoria. University of Monash. https://www.researchgate.net/publication/266349164

Hanski & Walsh (2004). How Much, How To: Practical Tools for Forest Conservation. Birdlife International.

Hanski, Ilkka., Walsh, Marcus., & BirdLife Suomi. (2004). How much, how to? : practical tools for forest conservation. BirdLife Finland.

Hanski, I. (2011). Habitat loss, the dynamics of biodiversity, and a perspective on conservation. Ambio, 40(3), 248–255. https://doi.org/10.1007/s13280-011-0147-3

Haas et al (2021). Modeling soil erosion after mechanized logging operations on steep terrain in the Northern Black Forest, Germany. European Journal of Forest Research volume 139

Hilary, B., Chris, B., North, B.E., Maria, A.Z.A., Lucia, A.Z.S., Alberto, Q.G.C., Beatriz, L.G., Rachael, E. and Andrew, W., 2021. Riparian buffer length is more influential than width on river water quality: A case study in southern Costa Rica. Journal of Environmental Management, 286, p.112132.)

Himes, A., Betts, M., Messier, C., & Seymour, R. (2022). Perspectives: Thirty years of triad forestry, a critical clarification of theory and recommendations for implementation and testing. Forest Ecology and Management, 510, 120103. https://doi.org/10.1016/j.foreco.2022.120103

Hua, F., Wang, L., Fisher, B., Zheng, X., Wang, X., Yu, D. W., Tang, Y., Zhu, J., & Wilcove, D. S. (2018). Tree plantations displacing native forests: The nature and drivers of apparent forest recovery on former croplands in Southwestern China from 2000 to 2015. Biological Conservation, 222, 113–124. https://doi.org/10.1016/j.biocon.2018.03.034

Huuskonen, S., Domisch, T., Finér, L., Hantula, J., Hynynen, J., Matala, J., Miina, J., Neuvonen, S., Nevalainen, S., Niemistö, P., Nikula, A., Piri, T., Siitonen, J., Smolander, A., Tonteri, T., Uotila, K., & Viiri, H. (2021). What is the potential for replacing monocultures with mixed-species stands to enhance ecosystem services in boreal forests in Fennoscandia? In Forest Ecology and Management (Vol. 479). Elsevier B.V. https://doi.org/10.1016/j.foreco.2020.118558

Ibisch, P. L., Hoffmann, M. T., Kreft, S., Pe'er, G., Kati, V., Biber-Freudenberger, L., DellaSala, D. A., Vale, M. M., Hobson, P. R., & Selva, N. (2016). A global map of roadless areas and their conservation status. *Science*, *354*(6318), 1423–1427. https://doi.org/10.1126/science.aaf7166

IUCN. (2013). Sweden's biodiversity at risk: A call for action.

**IUCN, 2020**. Guidelines for conserving connectivity through ecological networks and corridors

Johansson, T., Hjältén, J., de Jong, J., & von Stedingk, H. (2013). Environmental considerations from legislation and certification in managed forest stands: A review of their importance for biodiversity. In Forest Ecology and Management (Vol. 303, pp. 98–112). https://doi.org/10.1016/j.foreco.2013.04.012

Jokinen, M. (2012). Liito-oravan lisääntymis-ja levähdyspaikkarajausten vaikuttavuus lajin suojelukeinona. Suomen Ympäristö 33.

Jonsson et al. (2016). Deadwood availability in managed Swedish forests – Policy outcomes and implications for biodiversity. Forest Ecology and Management

Jonsson, M., Bengtsson, J., Moen, J., Gamfeldt, L., & Snäll, T. (2020). Stand age and climate influence forest ecosystem service delivery and multifunctionality. Environmental Research Letters, 15(9). https://doi.org/10.1088/1748-9326/abaf1c

Juutinen, A., Shanin, V., Ahtikoski, A., Rämö, J., Mäkipää, R., Laiho, R., Sarkkola, S., Laurén, A., Penttilä, T., Hökkä, H., & Saarinen, M. (2021). Profitability of continuous-cover forestry in norway spruce dominated peatland forest and the role of water table. Canadian Journal of Forest Research, 51(6), 859–870. https://doi.org/10.1139/cjfr-2020-0305

(JRC) Canfora, P., Arranz Padilla, M., Polidori, O., Pickard Garcia, N., Ostojic, S. and Dri, M. (2022). Development of the EU Sustainable Finance Taxonomy - A framework for defining substantial contribution for environmental objectives 3-6, EUR 30999 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-47898-0, doi:10.2760/256390, Joint Research Council, JRC126045.

Justice, C., White, S. M., McCullough, D. A., Graves, D. S., & Blanchard, M. R. (2017). Can stream and riparian restoration offset climate change impacts to salmon populations? Journal of Environmental Management, 188, 212–227. https://doi.org/10.1016/j.jenvman.2016.12.005

Juutinen, A., Shanin, V., Ahtikoski, A., Rämö, J., Mäkipää, R., Laiho, R., Sarkkola, S., Laurén, A., Penttilä, T., Hökkä, H., & Saarinen, M. (2021). Profitability of continuous-cover forestry in norway spruce dominated peatland forest and the role of water table. Canadian Journal of Forest Research, 51(6), 859–870. https://doi.org/10.1139/cjfr-2020-0305

Kim, S., Axelsson, E. P., Girona, M. M., & Senior, J. K. (2021). Continuous-cover forestry maintains soil fungal communities in Norway spruce dominated boreal forests. Forest Ecology and Management, 480, 118659. https://doi.org/10.1016/J.FORECO.2020.118659

Kimo & Hager, 2000). The Floodplain Forests in Europe. EFI Research Report.

Klapwijk, M. J., & Björkman, C. (2018). Mixed forests to mitigate risk of insect outbreaks. Scandinavian Journal of Forest Research, 33(8), 772–780. https://doi.org/10.1080/02827581.2018.1502805

Klapwijk, M. J., Bylund, H., Schroeder, M., & Björkman, C. (2016). Forest management and natural biocontrol of insect pests. Forestry, 89(3), 253–262. https://doi.org/10.1093/forestry/cpw019

Kleinschroth, F., & Healey, J. R. (2017). Impacts of logging roads on tropical forests. *Biotropica*, *49*(5), 620–635. https://doi.org/10.1111/btp.12462

Koivula, M., & Vanha-Majamaa, I. (2020). Experimental evidence on biodiversity impacts of variable retention forestry, prescribed burning, and deadwood manipulation in Fennoscandia. In Ecological Processes (Vol. 9, Issue 1). Springer. https://doi.org/10.1186/s13717-019-0209-1

Koskimäki, J., Huitu, O., Kotiaho, J. S., Lampila, S., Mäkelä, A., Sulkava, R., & Mönkkönen, M. (2014). Are habitat loss, predation risk and climate related to the drastic decline in a Siberian flying squirrel population? A 15-year study. *Population Ecology*, *56*(2), 341–348. https://doi.org/10.1007/s10144-013-0411-4

Kok, M. T. J., Alkemade, R., Bakkenes, M., van Eerdt, M., Janse, J., Mandryk, M., Kram, T., Lazarova, T., Meijer, J., van Oorschot, M., Westhoek, H., van der Zagt, R., van der Berg, M., van der Esch, S., Prins, A. G., & van Vuuren, D. P. (2018). Pathways for agriculture and forestry to contribute to terrestrial biodiversity conservation: A global scenario-study. Biological Conservation, 221, 137–150. https://doi.org/10.1016/j.biocon.2018.03.003

Kontula, T. & Raunio, A. (eds). 2019. Threatened Habitat Types in Finland 2018. Red List of Habitats – Results and Basis for Assessment. Finnish Environment Institute and Ministry of the Environment, Helsinki. The Finnish Environment 2/2019.

Kuuluvainen, T., Tahvonen, O., & Aakala, T. (2012). Even-aged and uneven-aged forest management in boreal fennoscandia: A review. In Ambio (Vol. 41, Issue 7, pp. 720–737). https://doi.org/10.1007/s13280-012-0289-y

Kuuluvainen, T., Lindberg, H., Vanha-Majamaa, I., Keto-Tokoi, P., & Punttila, P. (2019). Low-level retention forestry, certification, and biodiversity: case Finland. In Ecological Processes (Vol. 8, Issue 1). Springer. https://doi.org/10.1186/s13717-019-0198-0

Laiho, O., Lähde, E., & Pukkala, T. (2011). Uneven-vs even-aged management in Finnish boreal forests. *Forestry*, *84*(5), 547–556. https://doi.org/10.1093/forestry/cpr032

Larsen, J. B., & Nielsen, A. B. (2007). Nature-based forest management-Where are we going?. Elaborating forest development types in and with practice. Forest Ecology and Management, 238(1–3), 107–117. https://doi.org/10.1016/j.foreco.2006.09.087

Larsen, J. B., Angelstam, P., Bauhus, J., Carvalho, J. F., Diaci, J., Dobrowolska, D., Gazda, A., Gustafsson, L., Krumm, F., Knoke, T., Konczal, A., Kuuluvainen, T., Mason, B., Motta, R., Pötzelsberger, E., Rigling, A., & Schuck, A. (2022). *Closer-to-Nature Forest Management From Science to Policy 12 2 From Science to Policy 12*. https://doi.org/10.36333/fs12

Lawton, J. H., Brotherton, P. N. M., Brown, V. K., Elphick, C., Fitter, A. H., Forshaw, J., Haddow, R. W., Hilborne, S., Leafe, R. N., Mace, G. M., Southgate, M. P., Sutherland, W. J., Tew, T. E., Varley, J., & Wynne, G. R. (2010). *Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network*. https://www.researchgate.net/publication/268279426

Leclère, D., Obersteiner, M., Barrett, M., Butchart, S. H. M., Chaudhary, A., de Palma, A., DeClerck, F. A. J., di Marco, M., Doelman, J. C., Dürauer, M., Freeman, R., Harfoot, M., Hasegawa, T., Hellweg, S., Hilbers, J. P., Hill, S. L. L., Humpenöder, F., Jennings, N., Krisztin, T., … Young, L. (2020). Bending the curve of terrestrial biodiversity needs an integrated strategy. Nature, 585(7826), 551–556. https://doi.org/10.1038/s41586-020-2705-y

Lier, M. & J. Parviainen 2013. Integration of Nature Protection in Forest Policy in Finland. INTEGRATE Country Report. EFICENT-OEF, Freiburg.

Lillandt, B. G., 2000. Suupohjan kuukkelitutkimus 27 vuotta 1974-2000. Hippianen 30: 11-25 (awaiting confirmation of the reference from author).

Lindenmayer, Franklin & Fischer (2006). General management principles and a checklist of strategies to guide forest biodiversity conservation. BIOLOGICAL CONSERVATION 131 (2006) 433 – 445

Liu, J., Coomes, D. A., Gibson, L., Hu, G., Liu, J., Luo, Y., Wu, C., & Yu, M. (2019). Forest fragmentation in China and its effect on biodiversity. Biological Reviews, 94(5), 1636–1657. https://doi.org/10.1111/brv.12519

Lundmark, H., Josefsson, T., & Östlund, L. (2013). The history of clear-cutting in northern Sweden – Driving forces and myths in boreal silviculture. Forest Ecology and Management, 307, 112–122. https://doi.org/10.1016/J.FORECO.2013.07.003

Lundqvist, L. (2017). Tamm Review: Selection system reduces long-term volume growth in Fennoscandic uneven-aged Norway spruce forests. In Forest Ecology and Management (Vol. 391, pp. 362–375). Elsevier B.V. https://doi.org/10.1016/j.foreco.2017.02.011

Mair, L., Jönsson, M., Räty, M., Bärring, L., Strandberg, G., Lämås, T., & Snäll, T. (2018). Land use changes could modify future negative effects of climate change on old-growth forest indicator species. Diversity and Distributions, 24(10), 1416–1425. https://doi.org/10.1111/ddi.12771

Mason, W. L., Diaci, J., Carvalho, J., & Valkonen, S. (2022). Continuous cover forestry in Europe: Usage and the knowledge gaps and challenges to wider adoption. Forestry, 95(1), 1–12. https://doi.org/10.1093/forestry/cpab038

Maxwell et al (2016). Biodiversity: the ravages of guns, nets and bulldozers. Nature; 536.

Mazziotta, A., Podkopaev, D., Triviño, M., Miettinen, K., Pohjanmies, T., & Mönkkönen, M. (2017). Quantifying and resolving conservation conflicts in forest landscapes via multiobjective optimization. Silva Fennica, 51(1). https://doi.org/10.14214/sf.1778

Mcgrath, T., Pulsifer, M., Seymour, R., Doucette, L., Forbes, G., Mcintyre, R., Milton, R., Cogan, L., Retallack, M., & Crewe, T. (2021). Nova Scotia Silvicultural Guide for the Ecological Matrix Nova Scotia Silvicultural Guide for the Ecological Matrix (2021).

McKinley J. T., Kelly Mott Lacroix, Gregory H. A. R., & Belote, T. (2020). Conservation value of national forest roadless areas . Conservation Science and Practice, 2(11).

Merganiov, K., Mergani, J., Svoboda, M., Bae, R., & ebe, V. (2012). Deadwood in Forest Ecosystems. In Forest Ecosystems - More than Just Trees. InTech. https://doi.org/10.5772/31003

Messier, C., Bauhus, J., Sousa-Silva, R., Auge, H., Baeten, L., Barsoum, N., Bruelheide, H., Caldwell, B., Cavender-Bares, J., Dhiedt, E., Eisenhauer, N., Ganade, G., Gravel, D., Guillemot, J., Hall, J. S., Hector, A., Hérault, B., Jactel, H., Koricheva, J., … Zemp, D. C. (2022). For the sake of resilience and multifunctionality, let's diversify planted forests! Conservation Letters, 15(1). https://doi.org/10.1111/conl.12829

Mikusiński, G., Orlikowska, E. H., Bubnicki, J. W., Jonsson, B. G., & Svensson, J. (2021). Strengthening the Network of High Conservation Value Forests in Boreal Landscapes. Frontiers in Ecology and Evolution, 8. https://doi.org/10.3389/fevo.2020.595730

Mologni, O., Grigolato, S., & Cavalli, R. (2016). Harvesting systems for steep terrain in the Italian alps: State of the art and future prospects. Contemporary Engineering Sciences, 9(25), 1229–1242. https://doi.org/10.12988/ces.2016.68137

Muukkonen, P., Angervuori, A., Virtanen, T., Kuparinen, A., & Merilä, J. (2012). Loss and fragementation of siberian jay habitats. Boreal Environment Research, 17, 59–71.

Müller, J., & Bütler, R. (2010). A review of habitat thresholds for dead wood: A baseline for management recommendations in European forests. In *European Journal of Forest Research* (Vol. 129, Issue 6, pp. 981–992). https://doi.org/10.1007/s10342-010-0400-5

Müller, J., Bußler, H., & Kneib, T. (2008). Saproxylic beetle assemblages related to silvicultural management intensity and stand structures in a beech forest in Southern Germany. *Journal of Insect Conservation*, *12*(2), 107–124. https://doi.org/10.1007/s10841-006-9065-2

New Generation Plantations (2018). Rainforest restoration in Brazil's Atlantic forest. The One third figure was obtained through personal communication with WWF staff. https://newgenerationplantations.exposure.co/rainforest-restoration-in-brazils-atlantic-forest

Nilsson G. (2021). Riparian buffer zones widths, windthrows and recruitment of dead wood. Master's thesis.

Department of Forest Ecology and Management (nilsson_g_210319.pdf (slu.se))

Paillet, Y., Bergès, L., Hjälton, J., ódor, P., Avon, C., Bernhardt-Römermann, M., Bijlsma, R.-J. de Bruyn, L., Fuhr, M., Grandin, U., Kanka, R., Lundin, L., Luque, S., Magura, T., Matesanz, S., Mészáros, I., Sebastià, M.-T.., Schmidt, W., Standóvar, T., Tóthmérész, B., Uotila, A., Valladares, F., Vellak, K. & Virtanen, R. (2010). Biodiversity Differences between Managed and Unmanaged Forests: Meta-Analysis of Species Richness in Europe. Conservation Biology, 24: 101-112. https://doi.org/10.1111/j.1523-1739.2009.01399.x

Palik, B. J., D'Amato, A. W., Franklin, J. F., & Johnson, K. N. (2020). Ecological silviculture: foundations and applications. Waveland Press.

Pardini, R., de Bueno, A. A., Gardner, T. A., Prado, P. I., & Metzger, J. P. (2010). Beyond the fragmentation threshold hypothesis: Regime shifts in biodiversity across fragmented landscapes. PLoS ONE, 5(10). https://doi.org/10.1371/journal.pone.0013666

Parkatti, V.-P., & Tahvonen, O. (2021). Economics of Multifunctional Forestry in the Sámi People Homeland Region. Journal of Environmental Economics and Management, 110. http://hdl.handle.net/10419/228801www.econstor.eu

Petit, R. J., Bialozyt, R., Garnier-Géré, P., & Hampe, A. (2004). Ecology and genetics of tree invasions: From recent introductions to Quaternary migrations. Forest Ecology and Management, 197(1–3), 117–137. https://doi.org/10.1016/j.foreco.2004.05.009

Peura, M., Burgas, D., Eyvindson, K., Repo, A., & Mönkkönen, M. (2018). Continuous cover forestry is a cost-efficient tool to increase multifunctionality of boreal production forests in Fennoscandia. Biological Conservation, 217, 104–112. https://doi.org/10.1016/J.BIOCON.2017.10.018

Pimm, S. L., Jenkins, C. N., & Li, B. v. (2018). How to protect half of Earth to ensure it protects sufficient biodiversity. In Sci. Adv (Vol. 4). https://www.science.org

Pohjanmies, T., Eyvindson, K., & Mönkkönen, M. (2019). Forest management optimization across spatial scales to reconcile economic and conservation objectives. PLOS ONE, 14(6), e0218213. https://doi.org/10.1371/journal.pone.0218213

Pohjanmies, T., Eyvindson, K., Triviño, M. *et al.* Forest multifunctionality is not resilient to intensive forestry. *Eur J Forest Res* (2021). https://doi.org/10.1007/s10342-020-01348-7

Potapov, P., Hansen, M. C., Laestadius, L., Turubanova, S., Yaroshenko, A., Thies, C., Smith, W., Zhuravleva, I., Komarova, A., Minnemeyer, S., & Esipova, E. (2017). The last frontiers of wilderness: Tracking loss of intact forest landscapes from 2000 to 2013. Science Advances

Price, K., Holt, R., & Kremsater, L. (2007). Representative Forest Targets: Informing Threshold Refinement with Science. Report commissioned by Ecosystem Based Management Working Group, British Columbia.

Prosilva (2012). PROSILVA Principles. ASSOCIATION OF EUROPEAN FORESTERS PRACTISING MANAGEMENT WHICH FOLLOWS NATURAL PROCESSES.

Psaralexi, M. K., Votsi, N.-E. P., Selva, N., Mazaris, A. D., & Pantis, J. D. (2017). Importance of Roadless Areas for the European Conservation Network. Frontiers in Ecology and Evolution, 5. https://doi.org/10.3389/fevo.2017.00002

Pukkala *et al* (2011). A multifunctional comparison of even-aged and uneven-aged forest management in a boreal region. Can. J. For. Res. 41.

Pukkala, T., & Gadow, K. (2012). Continuous Cover Forestry (Timo Pukkala & K. von Gadow, Eds.; Vol. 23). Springer Netherlands. https://doi.org/10.1007/978-94-007-2202-6

Pukkala, T. (2016). Which type of forest management provides most ecosystem services? Forest Ecosystems, 3(1), 9. https://doi.org/10.1186/s40663-016-0068-5

Pukkala, T. (2022). Assessing the externalities of timber production. Forest Policy and Economics, 135, 102646. https://doi.org/10.1016/j.forpol.2021.102646

Pukkala (2021a). Measuring the social performance of forest management. J. For. Res. https://doi.org/10.1007/s11676-021-01321-z

Pukkala (2021b). Responsible Forest Management. Blog post. https://blogs.uef.fi/forest-issues/2021/06/16/responsible-forest-management/ Visited 16th June 2021.

Richardson, S. J., Peltzer, D. A., Hurst, J. M., Allen, R. B., Bellingham, P. J., Carswell, F. E., Clinton, P. W., Griffiths, A. D., Wiser, S. K., & Wright, E. F. (2009). Deadwood in New Zealand's indigenous forests. *Forest Ecology and Management*, *258*(11), 2456–2466. https://doi.org/10.1016/j.foreco.2009.08.022

Richardson, D. M., & Rejmánek, M. (2011). Trees and shrubs as invasive alien species - a global review. In Diversity and Distributions (Vol. 17, Issue 5, pp. 788–809). https://doi.org/10.1111/j.1472-4642.2011.00782.x

Riis et al (2020). Global Overview of Ecosystem Services Provided by Riparian Vegetation. BioScience: *Vol. 70 No. 6*

Rivers, M. (2017). THE GLOBAL TREE ASSESSMENT – RED LISTING THE WORLD'S TREES. BGjournal, Vol. 14, No. 1. Botanic Garden Conservation International (BGCI)

Roberge, J.-M., & Angelstam, P. (2004). Usefulness of the Umbrella Species Concept as a Conservation Tool. In Conservation Biology (Vol. 18, Issue 1).

Rondeux, J., & Sanchez, C. (2010). Review of indicators and field methods for monitoring biodiversity within national forest inventories. Core variable: Deadwood. Environmental Monitoring and Assessment (Vol. 164, Issues 1–4, pp. 617–630). https://doi.org/10.1007/s10661-009-0917-6

Sabatini *et al. (*2018). Where are Europe's last primary forests? Biodiversity Review.

Sabatini, F. M., Bluhm, H., Kun, Z., Aksenov, D., Atauri, J. A., Buchwald, E., Burrascano, S., Cateau, E., Diku, A., Duarte, I. M., Fernández López, Á. B., Garbarino, M., Grigoriadis, N., Horváth, F., Keren, S., Kitenberga, M., Kiš, A., Kraut, A., Ibisch, P. L., Kuemmerle, T. (2021). European primary forest database v2.0. Scientific Data, 8(1). https://doi.org/10.1038/s41597-021-00988-7

Samways et al. (2009). Provision of ecosystem services by large scale corridors and ecological networks. Biodiversity and Conservation 19(10):2949-2962

Samways (M.J.) & Pryke (J.S.) (2016). Large-scale ecological networks do work in an ecologically complex biodiversity hotspot. Ambio: 45, 161-172.

Sanchez & Leite (2020). The magnitude and extent of edge effects on vascular epiphytes across the Brazilian Atlantic Forest. Scientific Reports: vol. 10

Schütz, J.-P. (2001). Opportunities and strategies of transforming regular forests to irregular forests. Forest Ecology and Management, 151(1–3), 87–94. https://doi.org/10.1016/S0378-1127(00)00699-X

Schulze, K., Malek, Ž., & Verburg, P. H. (2019). Towards better mapping of forest management patterns: A global allocation approach. Forest Ecology and Management, 432, 776–785. https://doi.org/10.1016/j.foreco.2018.10.001

*Schweizerische Zeitschrift fur Forstwesen* (2004) 155 (2): 31–37.

Svoboda & Bace 2012. *Deadwood in Forest Ecosystems*. Chapter 4 in book: Forest Ecosystems – More Than Just Trees. ISBN: 978-953-51-0202-1

Seibold, S., Rammer, W., Hothorn, T., Seidl, R., Ulyshen, M. D., Lorz, J., Cadotte, M. W., Lindenmayer, D. B., Adhikari, Y. P., Aragón, R., Bae, S., Baldrian, P., Barimani Varandi, H., Barlow, J., Bässler, C., Beauchêne, J., Berenguer, E., Bergamin, R. S., Birkemoe, T., … Müller, J. (2021). The contribution of insects to global forest deadwood decomposition. *Nature*, *597*(7874), 77–81. https://doi.org/10.1038/s41586-021-03740-8

Selva, N., Switalski, A., Kreft, S., & Ibisch, P. L. (2015). Why Keep Areas Road-Free? The Importance of Roadless Areas. In Handbook of Road Ecology (pp. 16–26). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118568170.ch3

Seymour, R. S., & Hunter, M. L. (1992). Production ecology of eastern white pine View project Maine Woodlands Silviculture Column View project. https://www.researchgate.net/publication/259459089

Seymour, R. S., & Hunter, M. L. (1999). Maintaining Biodiversity in Forest Ecosystems (M. L. Hunter, Ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511613029

Siitonen, J., Martikainen, P., Punttila, P., & Rauh, J. (2000). Coarse woody debris and stand characteristics in mature managed and old-growth boreal mesic forests in southern Finland. In *Forest Ecology and Management* (Vol. 128).

Siitonen, J. (2001): Forest management, coarse woody debris and saproxylic organisms: Fennoscandian boreal forests as an example. Ecological Bulletins 49: 11-41.

Skydda Skogen. (2021). *European Court of Justice: Sweden Failed to Protect Species*. https://skyddaskogen.se/european-court-of-justice-sweden-failed-to-protect-species/?lang=en#:~:text=The%20European%20Court%20of%20Justice,and%20forestry%20are%20now%20expected. Visited 14/1/2020.

Spanjer, A. R., Gendaszek, A. S., Wulfkuhle, E. J., Black, R. W., & Jaeger, K. L. (2022). Assessing climate change impacts on Pacific salmon and trout using bioenergetics and spatiotemporal explicit river temperature predictions under varying riparian conditions. *PLOS ONE*, *17*(5), e0266871. https://doi.org/10.1371/journal.pone.0266871

Spellerberg, I. F., & Morrison, T. (1998). The ecological effects of new roads-a literature review. SCIENCE FOR CONSERVATION, 84.

Stevens, V. (1997). *The Ecological Role of Coarse Woody Debris An Overview of the Ecological Importance of CWD in BC* Forests. Res. Br., B.C. Min. For., Victoria, B.C. Work.Pap. 30/1997.

Svensson, J. S., & Jeglum, J. K. (2001). Structure and dynamics of an undisturbed old-growth Norway spruce forest on the rising Bothnian coastline. Forest Ecology and Management, 151(1–3), 67–79. https://doi.org/10.1016/S0378-1127(00)00697-6

Swedish Forest Agency (2021). Negativ trend för miljötillståndet i skogen. Pressmeddelande. https://www.skogsstyrelsen.se/nyhetslista/negativ-trend-for-miljotillstandet-i-skogen/

Swedish Wood. (n.d.). *The Forest and Sustainable Forestry*. Retrieved January 14, 2020, from https://www.swedishwood.com/wood-facts/about-wood/wood-and-sustainability/the-forest-and-sustainable-forestry.

Tahvonen, O., & Rämö, J. (2016). Optimality of continuous cover vs. clear-cut regimes in managing forest resources. Canadian Journal of Forest Research, 46(7), 891–901. https://doi.org/10.1139/cjfr-2015-0474

Thompson, I.D., *et al.* (2011). Forest biodiversity and the delivery of ecosystem goods and services: translating science into policy. Bioscience 61: 972-981.

Thorn *et al.* (2020). The living dead: acknowledging life after tree death to stop forest degradation. Frontiers in Ecology and the Environment

Thorn, S., Chao, A., Georgiev, K. B., Müller, J., Bässler, C., Campbell, J. L., Castro, J., Chen, Y. H., Choi, C. Y., Cobb, T. P., Donato, D. C., Durska, E., Macdonald, E., Feldhaar, H., Fontaine, J. B., Fornwalt, P. J., Hernández, R. M. H., Hutto, R. L., Koivula, M., … Leverkus, A.

B. (2020). Estimating retention benchmarks for salvage logging to protect biodiversity. Nature Communications, 11(1). https://doi.org/10.1038/s41467-020-18612-4

Tikkanen, O.-P., & Kouki, J. (2006). Red-listed boreal forest species of Finland: Associations with forest structure, tree species, and decaying wood. Ann. Zool. Fennici (43).

Tittler, R., Messier, C., & Goodman, R. C. (2016). Triad forest management: local fix or global solution. In Ecological Forest Management Handbook 33.

Triviño, M., Juutinen, A., Mazziotta, A., Miettinen, K., Podkopaev, D., Reunanen, P., & Mönkkönen, M. (2015). Managing a boreal forest landscape for providing timber, storing and sequestering carbon. Ecosystem Services, 14, 179–189. https://doi.org/10.1016/j.ecoser.2015.02.003

Triviño, M., Pohjanmies, T., Mazziotta, A., Juutinen, A., Podkopaev, D., le Tortorec, E., & Mönkkönen, M. (2017). Optimizing management to enhance multifunctionality in a boreal forest landscape. Journal of Applied Ecology, 54(1), 61–70. https://doi.org/10.1111/1365-2664.12790

Uimaniemi, L., Orell, M., Mönkkönen, M., Huhta, E., Jokimäki, J., & Lumme, J. (2000). Genetic diversity in the Siberian jay Perisoreus infaustus in fragmented old-growth forests of Fennoscandia. Ecography, 23(6), 669–677. https://doi.org/10.1111/j.1600-0587.2000.tb00310.x

Unrau, A., Becker, G., Spinelli, R. (2018). *Coppice Forests in Europe*. COST Action FP1301.

UNEP Convention on Biological Diversity (2021). First draft of post 2020 global biodiversity framework. https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf

Valkonen (2019). Pienaukkojen ja osittaishakkuuaukkojen taimettuminen Häiriödynamiikka -hankkeen tutkimusalueilla. (Finnish)

Vanha-Majamaa, I., & Jalonen, J. (2010). Green Tree Retention in Fennoscandian Forestry. Scandinavian Journal of Forest Research, 16(sup003), 79–90. https://doi.org/10.1080/028275801300004433

Vanha-Majamaa, I., Lilja, S., Ryömä, R., Kotiaho, J. S., Laaka-Lindberg, S., Lindberg, H., Puttonen, P., Tamminen, P., Toivanen, T., & Kuuluvainen, T. (2007). Rehabilitating boreal forest structure and species composition in Finland through logging, dead wood creation and fire: The EVO experiment. Forest Ecology and Management, 250(1–2), 77–88. https://doi.org/10.1016/j.foreco.2007.03.012

Vandekerkhove, K., de Keersmaeker, L., Walleyn, R., Köhler, F., Crevecoeur, L., Govaere, L., Thomaes, A., & Verheyen, K. (2011). Reappearance of Old-Growth Elements in Lowland Woodlands in Northern Belgium: Do the Associated Species Follow? http://www.metla.fi/silvafennica/full/sf45/sf455909.pdf

Vanha-Majamaa, I., Lilja, S., Ryömä, R., Kotiaho, J. S., Laaka-Lindberg, S., Lindberg, H., Puttonen, P., Tamminen, P., Toivanen, T., & Kuuluvainen, T. (2007). Rehabilitating boreal forest structure and species composition in Finland through logging, dead wood creation and fire: The EVO experiment. Forest Ecology and Management, 250(1–2), 77–88. https://doi.org/10.1016/j.foreco.2007.03.012

Virkkala, R., Leikola, N., Kujala, H., Kivinen, S., Hurskainen, P., Kuusela, S., Valkama, J., & Heikkinen, R. K. (2022). Developing fine-grained nationwide predictions of valuable forests using biodiversity indicator bird species. Ecological Applications, 32(2). https://doi.org/10.1002/eap.2505

Volenec, Z. M., & Dobson, A. P. (2020). Conservation value of small reserves. Conservation Biology, 34(1), 66–79. https://doi.org/10.1111/cobi.13308

Watson *et al.* (2018). The Exceptional Value of Intact Forest Ecosystems. Nature Ecology & Evolution.

Wenger et al (2018). Predicting the impact of logging activities on soil erosion and water quality in steep, forested tropical islands. Environmental Research Letters 13.

Whitman, J.M. Hagan (2007). An index to identify late-successional forest in temperate and boreal zones. Forest Ecology and Management 246 (2007) 144–154.

Wilson, E. O. (2002). The Future of Life (Abacus). Abacus.

Wilson, E. O. (2016). Half-Earth: Our Planet's Fight for Life. WW Norton & Company.

Winter, S. (2012). Forest naturalness assessment as a component of biodiversity monitoring and conservation management. *Forestry, Vol. 85, No.2.*

(WWF), Richards, B., Vallauri, D., & Dudley, N. (2004). Deadwood, living forests: The importance of veteran trees and deadwood to biodiversity. http://www.panda.org/europe/forests

WWF (2020). The loss of nature and the rise of pandemics: protecting human health and planetary health.

Zhang et al (2010). A review of vegetated buffers and a meta-analysis of their mitigation efficacy in reducing nonpoint source pollution. J. Environ. Qual. 39:76–84.

# 2. Manufacturing

## 2.14 Manufacture of chemicals

*Description of the activity*

Manufacture of chemicals - Activities classified under NACE code C20 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006 and which products consist in a single substance with CAS as an identity

Manufacture of enzymes, classified as respiratory sensitizers, are not within the scope.

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Substantial contribution to pollution prevention and control

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The activity must comply with both sets of technical criteria: A and B (see visual in the rationale).

A. The manufactured substance is a less polluting substitute for another existing chemical classified as hazardous. This condition must be proved by complying with requirements A1, A2 and A3:

A1. The produced substance is not fulfilling any hazardous properties neither specified in the list of Hazardous Classes included below nor the following:

- Acute toxicity for health (Cat. 1-3)
- Severe eye damage (Cat. 1)
- Skin corrosion (Cat. 1, 1A, 1B, 1C)
- Aquatic Acute Cat. 1 (H400)

AND

A2. The produced substance is used as a replacement. Therefore, the operator has to demonstrate that an equivalent substance with comparable functionality, fulfilling any hazardous properties either included in the list of Hazardous Classes or one of the following:

- Acute toxicity for health (Cat. 1-3)
- Severe eye damage (Cat. 1)
- Skin corrosion (Cat. 1, 1A, 1B, 1C)
- Aquatic Acute Cat. 1 (H400)

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is currently produced[181].

AND

A3. The production process does not lead to the use of substances, whether on their own, in mixtures or in an article, that meet the criteria laid in Article 57 of Regulation (EC) 1907/2006) except where their use has been proven to be essential for society and the production process is done under strictly controlled conditions.

AND

B. The activity must comply with requirement B1, B2 and B3 regarding pollution emissions at the facility.

B1. Where the activity falls within its scope, the operator must demonstrate emission levels below the mid-point of the BAT-AEL ranges[182], set out in:

a) The Best Available Techniques Reference Document (BREF) for the large volume inorganic chemicals- Solids and others industry (LVIC-S).
b) The Best Available Techniques Reference Document (BREF) for large volume inorganic chemicals – Ammonia, acids and fertilizers (LVIC-AAF).
c) The Best Available Techniques (BAT) conclusions for common wastewater and waste gas treatment/management systems in the chemical sector (CWW).
d) The Best Available Techniques (BAT) conclusions for common waste gas management and treatment systems in the chemical sector (WGC).
e) The Best Available Techniques (BAT) conclusions for the production of chlor-alkali (CAK).
f) The Best Available Techniques (BAT) conclusions for large volume organic chemicals (LVOC).

No significant cross-media impact occurs. This assessment shall notably ensure that plants within the BAT-AEL range(s) moving to the mid-point ambition will not trigger

[181] It has to be proved with an Analysis to be published and verified by an independent third party.

[182] The requirements under B1 shall tackle the pollutants identified under the key environmental issues of each BREF document or the BAT-AEL of the relevant BAT conclusions Commission Implementing Decisions. Where BAT-AEL differentiate between “existing” and “new plants”, operators have to demonstrate compliance with BAT-AEL for new plants. When there is not a BAT-AEL range but a single value, emission levels have to be below such value. When the BAT-AEL range is expressed as follows: “<x-y unit” (I.e. the lower-end BAT-AEL of the range is expressed as ‘lower than’), the mid-point will be calculated using x and y. Averaging periods have to be the same as in the BAT-AEL of the BREF documents outlined above.

significant cross media effects, negating the Substantial Contribution of the set technical screening criteria.

Installations that have been granted a derogation as per the procedure outlined in the Industrial Emissions Directive (IED, 2010/75/EU) article 15(4) are not considered as fulfilling the TSC.

B2. Where technically applicable, the operator has to apply Continuous Emission Monitoring Systems (CEMS), Continuous Effluent Quality Monitoring Systems (CEQMS) and other measures ensuring the regular verification of non-deterioration of groundwater quality.

B3. The operator must apply solvent waste segregation for solvent recovery from concentrated waste streams – when technically applicable. The maximum solvents loss from total inputs cannot exceed 3%. Total volatile organic compound (VOC) recovery efficiency must be at least 99%.

The operator has to verify that no diffuse emission occurs beyond the criteria specified below as to the ppmv thresholds by carrying out Leak detection and repair (LDAR) campaigns, at least every 3 years. Investments for the use of high integrity equipment is recommended, provided that these are installed in existing plants for cases mentioned under BAT 23b of the WGC BREF, whereas the pressure threshold is set at 200 bar. The minimal verification schedule may be reduced in those cases where quantification of total VOC emissions from the plant is periodically qualified with tracer correlation (TC) or with optical absorption-based techniques, such as differential absorption light detection and ranging (DIAL) or solar occultation flux (SOX) or measures of other equivalent performance.

Diffuse emissions of substances or mixtures classified as CMR1A or 1B from leaky equipment should strive to not exceed a concentration of 100 ppmv. Such LDAR campaigns shall have the features described in BAT19 of the WGC BREF, which include not only detecting but also repairing and maintaining leaks within 30 days of detection and a leak threshold is lower than or equal to 5000 ppmv for substances or mixtures other than those classified as CMR 1A or 1B, which shall be reviewed and updated for the continuous improvement of the installation. Solvent losses and recovery efficiency of VOC should be monitored based on a solvent management plan using a mass balance for verification of compliance, as per Chapter VII of the Industrial Emissions Directive (IED, 2010/75/EU).

List of Hazardous Classes

a) Known & presumed carcinogenicity (Cat. 1A & 1B) (CLP H350)
b) Known & presumed germ cell mutagenicity (Cat. 1A & 1B) (CLP H340)
c) Known & presumed reproductive toxicity (Cat. 1A & 1B) (CLP H360)
d) Persistent, Bioacumulative, Toxic (PBTs), or very Persistent very Bioaccumulative (vPvBs) (identified in accordance with Art. 59 of the REACH Regulation, following criteria in its Annex XIII; criteria to be included in the CLP Regulation)
e) Persistent, Mobile and Toxic (PMT), or very Persistent very Mobile vPvM (when criteria are developed and included in the CLP Regulation)
f) Endocrine disrupting properties (criteria to be included in the CLP Regulation)
g) Respiratory sensitisers Cat. 1 (CLP H334)
h) Specific Target Organ Toxicity - Single Exposure Cat. 1 & 2 (CLP H370 & H371)
i) Specific Target Organ Toxicity - Repeated Exposure Cat. 1 & 2 (CLP H372 & 373)
j) Hazardous to ozone layer (CLP H420)
k) Chronic hazard to the aquatic environment Cat. 1, 2, 3 & 4 (CLP H410-413)
l) Skin sensitisers Cat. 1 (CLP H317)
m) Suspected carcinogenicity (Cat. 2) (H351)
n) Suspected germ cell mutagenicity (Cat. 2) (H341)
o) Suspected reproductive toxicity (Cat. 2) (H361)

| Do no significant harm ('DNSH') | |
|---|---|
| (1) Climate change mitigation | When the substituted activities are included in ANNEX I of Directive 2003/87/EC, greenhouse gas emissions $tCO_2e$ per tonne of product from the production process of the replacement (Calculated in accordance with Regulation (EU) 2019/331) are lower than the median value of the data collected (years 2016-2017) in the context of establishing the Commission Implementing Regulation (EU) 2021/447, determined on the basis of verified information on the greenhouse gas efficiency of installations reported pursuant to Article 11 of Directive 2003/87/EC. |

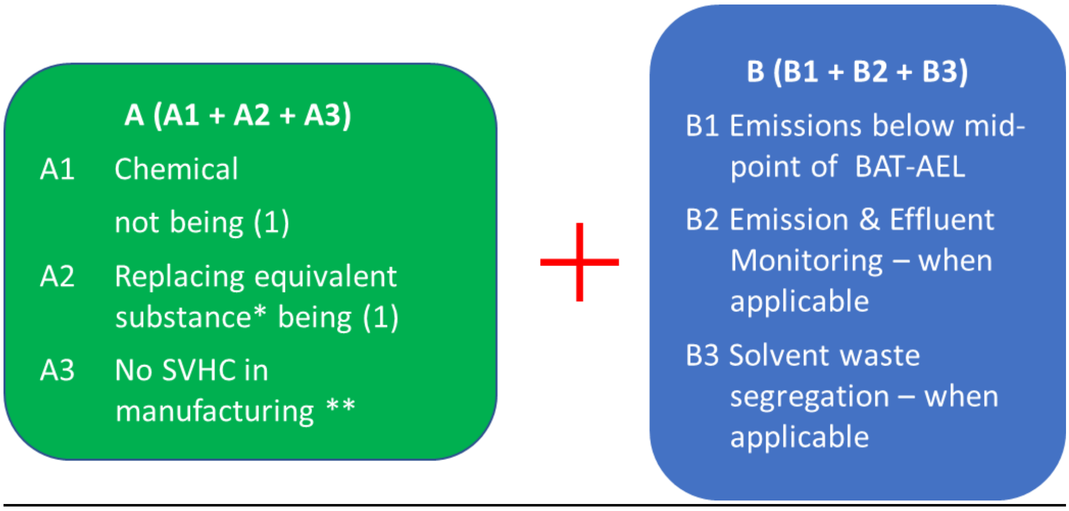
| | |
|---|---|
| | When the substituted activities are not included in ANNEX I of Directive 2003/87/EC. Replacement cannot lead to an increment of Lifecycle GHG emissions higher than 20 % per functional unit. Lifecycle GHG emissions are calculated using Commission Recommendation 2013/179/EU or, alternatively, using ISO 14067:2018 or ISO 14064-1:2018. Quantified life-cycle GHG emissions are verified by an independent third party. |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | All three water criteria have to be applied (W1, W2 and W3)<br><br>W1. Waste water treatment:<br><br>The performance of wastewater treatment processes conducted by or on behalf of the manufacturing plant must not lead to any deterioration of water bodies and marine resources. Contamination of substances falling in any of the hazardous classes listed above contained as impurities is to be eliminated preferably at source (To be consistent with substantial contribution criterion A1).<br><br>When activities fall within their scope, these have to meet the requirements of<br><br>• Urban Wastewater Treatment Directive (91/271/EEC),<br>• Directive 2008/105/EC on Environmental Quality Standards, amended by 2013/39/EU), notably the Maximum Allowance Concentration values.<br>• Groundwater directive 2006/118/EC<br>• Industrial Emissions Directive (2010/75/EU),<br>• Water Framework Directive (2000/60/EC),<br>• Drinking Water Directive (2020/2184)<br>• Bathing Water Directive (76/160/EEC)<br>• JRC Best Environmental Management Practice for the Public Administration Sector. 2019 |

| | |
|---|---|
| | • Marine Strategy Framework Directive (MSFD) 2008/56/EU<br>• Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment<br><br>In cases where wastewater treatment is conducted by an urban wastewater treatment plant on behalf of the manufacturing plant, operators must ensure that:<br><br>(a) the released polluting substances do not impede the operation of such waste water treatment plant;<br><br>(b) the released polluting substances do not harm the health of the staff working in collecting systems and waste water treatment plants;<br><br>(c) the urban waste water treatment plant is designed and equipped appropriately to abate the released polluting substances;<br><br>(d) the overall load of the concerned polluting substances eventually released into the water (and indirectly to the rest of the environment) is not increased compared to the situation where the emissions from the installation concerned remained compliant with emission limit values set for direct releases;<br><br>(e) the usability of the sewage sludge for nutrient (re)cycling is not affected.<br><br>For installations where additional pollutant limits and/or stricter conditions have been included in their environmental permit compared to the requirements of the legislation mentioned above (for example stricter measures required pursuant to Article 18 of the Industrial Emissions Directive, 2010/75/EU), then these conditions apply.<br><br>W2. Soil and groundwater protection:<br><br>Inclusion of appropriate measures to prevent emissions to soil and regular surveillance of those measures to avoid leaks, spills, incidents or accidents occurring during the use of equipment and during storage.<br><br>W3. Water Consumption: |

| | |
|---|---|
| | Manufacturers have to assess the water footprint of the operations according to ISO 14046 and ensure that they do not contribute to water scarcity. Operators have to declare that they do not contribute to water scarcity based on this assessment and this has to be verified by an independent third party. |
| (4) Transition to a circular economy | The activity assesses the availability of and, where feasible, adopts techniques that support:<br><br>1. Reuse and use of secondary raw materials and reused components in manufactured products<br>2. Design for high durability, recyclability, easy disassembly and adaptability of manufactured products<br>3. Waste management that prioritises recycling over disposal, in the manufacturing process<br>1. Information on product ingredients along the supply chain |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |

Rationale

Substantial Contribution




(1) Neither substances fulfilling any hazardous properties specified in the list of Hazardous Classes included above nor substances with the following properties: Acute toxicity for health (Cat. 1-3), Severe eye damage (Cat. 1), Skin corrosion (Cat. 1, 1A, 1B, 1C), Aquatic Acute Cat. 1 (H400)

* Equivalent functionality verified by an independent third party

** Except where their use has been proven to be essential for society and the production process is done under strictly controlled conditions

*A*

General criteria was proposed with the aim to open the chance for eligibility to the whole NACE code C20. The decision to use a general approach was taken because of the short time available, which has not allowed to undertake the detailed analyses of different chemicals required to define a specific criterion for each of them. To promote the substitution of those substances with hazardous properties by less polluting alternatives, a hazard-based approach was chosen. The replacement of both (1) any substance falling in any of the hazardous properties included in the list of Hazardous Classes defined in these criteria and (2) any substances classified as Acute toxicity for health (Cat. 1-3), Severe eye damage (Cat. 1), Skin corrosion (Cat. 1, 1A, 1B, 1C), and Aquatic Acute Cat. 1 (H400) was identified as substantial contribution to Pollution prevention and control. Enzymes, classified as respiratory sensitizer, were excluded from the scope of this activity, due to the difficulties of applying to them this general hazard-based substitution approach (see rationale for Manufacture of chemical products (substantial contribution to pollution prevention and control).

<u>List of Hazardous Classes</u>

Substances having a chronic effect for human health or the environment (Candidate list in REACH and Annex VI to the CLP Regulation). These substances are posing threats to human health and ecosystems.

The groups a. – e. are substances that meet the criteria laid down in Article 57 of Regulation (EC) 1907/2006 (SVHCs) and are already integrated in climate DA as part of the generic DNSH for pollution prevention and control in the appendix C of annex 1. As regards practicality of this criterion, manufacturers have the legal obligation to assess hazard of their substance and classify it according to the criteria set in Annex I of the CLP Regulation and to notify this to the classification and labelling inventory managed by ECHA.

The substantial contribution of manufacturing chemicals will be met by following conditions:

Section A1:

The produced substance is inherently safe.

Section A2:

The newly produced substance is replacing a hazardous substance. Those safer alternatives will decrease the production/use of the former hazardous substances or material containing them and hence decrease pollution at source.

Section A3:

The production process has to be free of those substances fulfilling the criteria of Substances of very high concern (SVHCs in REACH). Many hazardous chemicals are used in the production process and do add to pollution. No process can be regarded as sustainable or substantial contribution that needs those substances.

Section B:

Emissions of the facility must be limited as far as possible.

B1

The EU BAT Reference Documents (BREF) ) drawn up under the framework of the IED and published by the European Commission establish a chapter on BAT conclusions with BAT-AEL (typically an emission concentration range) that Competent Authorities need to use to set environmental permit conditions for operators of IED installations.

Where activities fall within its scope, the operator must demonstrate emission levels below the mid-point of the BAT-AEL ranges set out in the BREF documents outlined in B1 above.

Noting that the focus of sustainable contribution for this activity is on prevention and substitution of hazardous substances (according with the list above), emission levels need to remain equivalent to what is expected of state-of-the-art installations, as per the available information collected during the BREF process. As such, the rationale here has been to require operators to demonstrate emission levels that are at or below the mid-point of the BAT-AEL range. When there is a distinction between existing or new plants, emission levels have to be equivalent to those of new plants. When there is not a BAT-AEL range but a single value, emission levels have to be below such value.  BREFs and BAT conclusions are available: https://eippcb.jrc.ec.europa.eu/reference/

B3

The WGC BREF is in about to be finalised. The maximum solvent loss proposed currently is set to <5% (BAT 23, Table 4.7). However, 21 out of 28 reference plants are already well below the level of 5%. Therefore, a level of ambition is proposed, set to 3% max. Diffuse emissions of substances or mixtures classified as CMR1A or 1B from leaky equipment should strive to not exceed a concentration threshold of 100 ppmv. Such LDAR campaigns shall have the features described in BAT19 of the WGC BREF, which include not only detecting but also repairing and maintaining leaks within 30 days of detection and a leak threshold is lower than or equal to 5000 ppmv for substances or mixtures other than those classified as CMR 1A or 1B, which shall be reviewed and updated for the continuous improvement of the installation.

DNSH criteria Climate Change Mitigation

For those activities included in ANNEX I of Directive 2003/87/EC, the TSC have consistency with the First Delegate Act. Calculation methodology for average greenhouse gases emissions and years of reference are the same than those employed for DNSH-mitigation in the first delegated act for manufacturing of chemical products. All activities related to the manufacture of chemical products included in the First Delegated Act are also included in ANNEX I of Directive 203/87/EC.

For those activities that are not included in ANNEX I of Directive 2003/87/EC:

- Expected lack of information to calculate average emissions and benchmark these with the median of the sector/product.

- Same calculation methodology that used in the First Delegated Act for life cycle greenhouse gases emissions is proposed
- It is assumed that these activities are not major contributors to global warming, so a limited increment of the greenhouse gases emissions could be allowed, to avoid jeopardising substantial contribution criteria with a very marginal increase in GHG in a relatively small amount.

DNSH criteria Water

The DNSH criteria developed for the protection of water and water resources has to be understood in the context of the substantial contribution (SC) criteria outlined in this template. The SC prioritise prevention and substitution of substances classified under specific hazardous classes, with a strong link to BAT and state-of-the-art emission controls and ambitious emission levels.

For DNSH-water, there are 3 criteria that needs to be met (W1, W2, W3). The rationale is as follows:

W1. To be consistent with substantial contribution criterion A, contamination of substances falling in any of the hazardous classes listed above contained as impurities is to be eliminated preferably at source. Additionally, for all other pollutants emissions to water need to comply with the requirements of the Directives and standards listed above.

W2. Appropriate additional measures should be put in place to ensure soil and groundwater protection.

W3. As a minimum, water consumption should not contribute to water scarcity in the location.

It should be noted that Directives 91/271/EEC, 2013/39/EU, 2006/118/EC, 76/160/EEC and 2010/75/EU are under review and may be revised in the near future. As a result, new, more ambitious targets may be included.

## 2.15 Manufacture of chemical products

*Description of the activity*

Manufacture of chemical products – activities classified under NACE code C20 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006 and which products are made of more than one substance with CAS as identity (e.g. formulations and materials).

Manufacture of chemical products not falling in any product category covered by Ecolabel and containing enzymes, classified as respiratory sensitizers, in their formulation are not within the scope.

| Substantial contribution to pollution prevention and control |
| --- |
| The activity must comply with both sets of technical criteria: A and B (see visual in the rationale).<br>A. The manufactured product complies with one of these two requirements (A1 or A2):<br>A1. The manufactured product is a less polluting substitute for another existing chemical product containing hazardous ingredients. This condition must be proved by complying with requirements A1.1, A1.2 and A1.3:<br>A1.1 The manufactured product does not contain any substance fulfilling any hazardous properties specified in the list of Hazardous Classes included below.[183] In addition, the manufactured product does not contain any substance with the following properties<br>– Acute toxicity for health (Cat. 1-3)<br>– Severe eye damage (Cat. 1)<br>– Skin corrosion (Cat. 1, 1A, 1B, 1C)<br>– Aquatic Acute Cat. 1 (H400)<br>at concentrations requiring specific precautions for their safe use in terms of its health or environmental impact as defined by the concentration limits requiring their |

[183] No intentional use allowed; 0.01% threshold for impurities unless a lower limit is set by legislation.

classification or labelling under the CLP regulation including defined cut offs for additional hazards.

AND

A1.2 The operator has to demonstrate that an equivalent product with comparable functionality[184] is currently produced containing at least one substance fulfilling any hazardous properties criteria in the list of Hazardous Classes or a substance with the following properties

- – Acute toxicity for health (Cat. 1-3)
- – Severe eye damage (Cat. 1)
- – Skin corrosion (Cat. 1, 1A, 1B, 1C)
- – Aquatic Acute Cat. 1 (H400)

at concentrations requiring specific precautions for their safe use in terms of its health or environmental impact as defined by the concentration limits requiring their classification or labelling under the CLP regulation including defined cut offs for additional hazards[185].

AND

A1.3 The production process does not lead to the use of substances, whether on their own, in mixtures or in an article, that meet the criteria laid down in Article 57 of Regulation (EC) 1907/2006) except where their use has been proven to be essential for society and the production process is done under strictly controlled conditions.

OR

A2. The manufactured product is certified with a current the EU -Ecolabel or national or regional EN ISO 14024 type I ecolabelling schemes officially recognised in accordance with Article 11 of Regulation (EC) 66/2010 with equivalent or more demanding requirements than the EU Ecolabel for the same product group. For

[184] where the functionality – i.e. the outcome of a process or application involving a chemical product – depends on more than one product, the substitution of one or several of these products can also be demonstrated in this broader process or application context

[185] It has to be proved with an Analysis to be published and verified by an independent third party.

products distributed, when its distribution is located outside the EU only, the EU - Ecolabel certification can be substituted for with a verification by a third party of the compliance with equivalent or more demanding requirements than the EU Ecolabel criteria for that product group.

AND

B. The activity has to comply with requirement B1, B2 and B3 regarding pollution emission at the facility.

B1. Where the activity falls within its scope, the operator must demonstrate emission levels below the mid-point of the BAT-AEL ranges[186] set out in:

a) The Best Available Techniques Reference Document (BREF) for the large volume inorganic chemicals- Solids and others industry (LVIC-S).
b) The Best Available Techniques Reference Document (BREF) for large volume inorganic chemicals – Ammonia, acids and fertilizers (LVIC-AAF).
c) The Best Available Techniques (BAT) conclusions for common wastewater and waste gas treatment/management systems in the chemical sector (CWW).
d) The Best Available Techniques (BAT) conclusions for common waste gas management and treatment systems in the chemical sector taking the formal draft of the WCG BREF into account (WGC).
e) The Best Available Techniques (BAT) conclusions for the production of chlor-alkali (CAK).
f) The Best Available Techniques (BAT) conclusions for large volume organic chemicals (LVOC).

No significant cross-media impact occurs. This assessment shall notably ensure that plants within the BAT-AEL range(s) moving to the mid-point ambition will not trigger

[186] The requirements under B1 shall tackle the pollutants identified under the key environmental issues of each BREF document or the BAT-AEL of the relevant BAT conclusions Commission Implementing Decisions. Where BAT-AEL differentiate between “existing” and “new plants”, operators have to demonstrate compliance with BAT-AEL for new plants. When there is not a BAT-AEL range but a single value, emission levels have to be below such value. When the BAT-AEL range is expressed as follows: “<x-y unit” (I.e. the lower-end BAT-AEL of the range is expressed as ‘lower than’), the mid-point will be calculated using x and y. Averaging periods have to be the same as in the BAT-AEL of the BREF documents outlined above.

significant cross media effects, negating the Substantial Contribution of the set technical screening criteria.

Installations that have been granted a derogation as per the procedure outlined in the Industrial Emissions Directive (IED, 2010/75/EU) article 15(4) are not considered as fulfilling the TSC.

B2. Where technically applicable, the operator has to apply Continuous Emission Monitoring Systems (CEMS), Continuous Effluent Quality Monitoring Systems (CEQMS) and other measures ensuring the regular verification of non-deterioration of groundwater quality.

and

B3. The operator has to apply solvent waste segregation for solvent recovery from concentrated waste streams – when applicable. The maximum solvents loss from total inputs cannot exceed 3%. Total volatile organic compound (VOC) recovery efficiency has to be at least 99%.

The operator has to verify that no diffuse emission occurs beyond the criteria specified below as to the ppmv thresholds by carrying out Leak detection and repair (LDAR) campaigns, at least every 3 years. Investments for the use of high integrity equipment is recommended, provided that these are installed in existing plants for cases mentioned under BAT 23b of the WGC BREF, whereas the pressure threshold is set at 200 bar. The minimal verification schedule may be reduced in those cases where quantification of total VOC emissions from the plant is periodically qualified with tracer correlation (TC) or with optical absorption-based techniques, such as differential absorption light detection and ranging (DIAL) or solar occultation flux (SOX) or measures of other equivalent performance.

Diffuse emissions of substances or mixtures classified as CMR1A or 1B from leaky equipment should strive to not exceed a concentration threshold of 100 ppmv. Such LDAR campaigns shall have the features described in BAT19 of the WGC BREF, which include not only detecting but also repairing and maintaining leaks within 30 days of detection and a leak threshold is lower than or equal to 5000 ppmv for substances or mixtures other than those classified as CMR 1A or 1B, which shall be reviewed and updated for the continuous improvement of the installation. Solvent losses and recovery efficiency of VOC should be monitored based on a solvent management plan using a mass balance for verification of compliance, as per Chapter VII of the Industrial Emissions Directive (IED, 2010/75/EU).

List of Hazardous Classes

p) Known & presumed carcinogenicity (Cat. 1A & 1B) (CLP H350)
q) Known & presumed germ cell mutagenicity (Cat. 1A & 1B) (CLP H340)
r) Known & presumed reproductive toxicity (Cat. 1A & 1B) (CLP H360)
s) Persistent, Bioacumulative, Toxic (PBTs), or very Persistent very Bioaccumulative (vPvBs) (identified in accordance with Art. 59 of the REACH Regulation, following criteria in its Annex XIII; criteria to be included in the CLP Regulation)
t) Persistent, Mobile and Toxic (PMT), or very Persistent very Mobile vPvM (when criteria are developed and included in the CLP Regulation)
u) Endocrine disrupting properties (criteria to be included in the CLP Regulation)
v) Respiratory sensitisers Cat. 1 (CLP H334)
w) Specific Target Organ Toxicity - Single Exposure Cat. 1 & 2 (CLP H370 & H371)
x) Specific Target Organ Toxicity - Repeated Exposure Cat. 1 & 2 (CLP H372 & 373)
y) Hazardous to ozone layer (CLP H420)
z) Chronic hazard to the aquatic environment Cat. 1, 2, 3 & 4 (CLP H410-413)
aa) Skin sensitisers Cat. 1 (CLP H317)
bb) Suspected carcinogenicity (Cat. 2) (H351)
cc) Suspected germ cell mutagenicity (Cat. 2) (H341)
dd) Suspected reproductive toxicity (Cat. 2) (H361)

| Do no significant harm ('DNSH') | |
|---|---|
| (1) Climate change mitigation | When compliance with A1 (replacement) is claimed:<br><br>When the substituted activities are included in ANNEX I of Directive 2003/87/EC, greenhouse gas emissions $tCO_2e$ per tonne of product from the production process of the replacement (Calculated in accordance with Regulation (EU) 2019/331) are lower than the median value of the data collected (years 2016-2017) in the context of establishing the Commission Implementing Regulation (EU) 2021/447, determined on the basis of verified information on the greenhouse gas efficiency of installations reported pursuant to Article 11 of Directive 2003/87/EC. |

| | |
|---|---|
| | When the substituted activities are not included in ANNEX I of Directive 2003/87/EC. Replacement cannot lead to an increment of Lifecycle GHG emissions higher than 20 % per functional unit. Lifecycle GHG emissions are calculated using Commission Recommendation 2013/179/EU or, alternatively, using ISO 14067:2018 or ISO 14064-1:2018. Quantified lifecycle GHG emissions are verified by an independent third party.<br><br>When compliance with A2 (Ecolabel) is claimed: N/A |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | All three water criteria have to be applied (W1, W2 and W3)<br><br>W1. Waste water treatment:<br><br>The performance of wastewater treatment processes conducted by or on behalf of the manufacturing plant must not lead to any deterioration of water bodies and marine resources. Contamination of substances falling in any of the hazardous classes listed above contained as impurities is to be eliminated preferably at source (To be consistent with substantial contribution criterion A1).<br><br>When activities fall within their scope, these have to meet the requirements of<br><br>• Urban Wastewater Treatment Directive (91/271/EEC),<br>• Directive 2008/105/EC on Environmental Quality Standards, amended by 2013/39/EU), notably the Maximum Allowance Concentration values.<br>• Groundwater directive 2006/118/EC<br>• Industrial Emissions Directive (2010/75/EU)<br>• Water Framework Directive (2000/60/EC)<br>• Drinking Water Directive (2020/2184)<br>• Bathing Water Directive (76/160/EEC) |

| | |
|---|---|
| | • JRC Best Environmental Management Practice for the Public Administration Sector. 2019<br>• Marine Strategy Framework Directive (MSFD) 2008/56/EU<br>• Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment<br><br>In cases where wastewater treatment is conducted by an urban wastewater treatment plant on behalf of the manufacturing plant, operators must ensure that:<br><br>(a) the released polluting substances do not impede the operation of such waste water treatment plant;<br><br>(b) the released polluting substances do not harm the health of the staff working in collecting systems and waste water treatment plants;<br><br>(c) the urban waste water treatment plant is designed and equipped appropriately to abate the released polluting substances;<br><br>(d) the overall load of the concerned polluting substances eventually released into the water (and indirectly to the rest of the environment) is not increased compared to the situation where the emissions from the installation concerned remained compliant with emission limit values set for direct releases;<br><br>(e) the usability of the sewage sludge for nutrient (re)cycling is not affected.<br><br>For installations where additional pollutant limits and/or stricter conditions have been included in their environmental permit compared to the requirements of the legislation mentioned above (for example stricter measures required pursuant to Article 18 of the Industrial Emissions Directive, 2010/75/EU), then these conditions apply.<br><br>W2. Soil and groundwater protection: |

| | |
|---|---|
| | Inclusion of appropriate measures to prevent emissions to soil and regular surveillance of those measures to avoid leaks, spills, incidents or accidents occurring during the use of equipment and during storage.<br><br>W3. Water Consumption:<br><br>Manufacturers have to assess the water footprint of the operations according to ISO 14046 and ensure that they do not contribute to water scarcity. Operators have to declare that they do not contribute to water scarcity based on this assessment and this has to be verified by an independent third party. |
| (4) Transition to a circular economy | The activity assesses the availability of and, where feasible, adopts techniques that support:<br><br>4. Reuse and use of secondary raw materials and reused components in manufactured products<br>5. Design for high durability, recyclability, easy disassembly and adaptability of manufactured products<br>6. Waste management that prioritises recycling over disposal, in the manufacturing process<br>7. Information on product ingredients along the supply chain |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |

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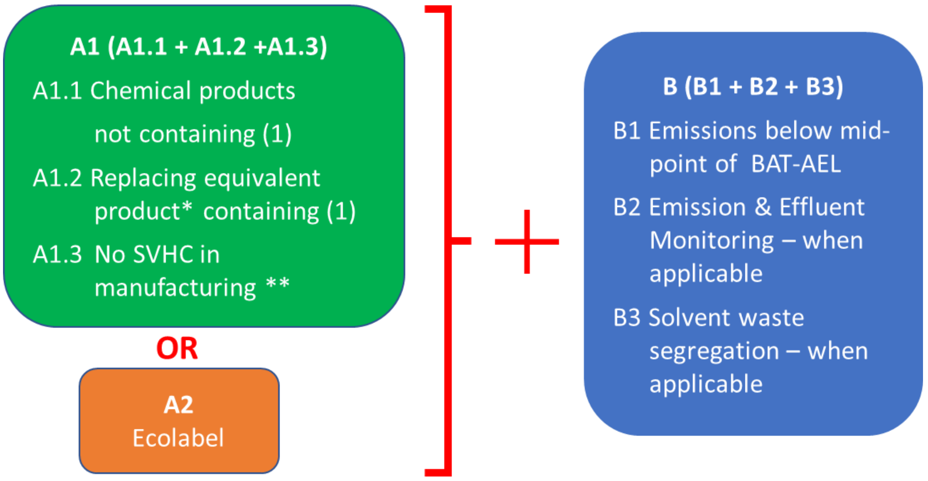
|---|
| Rationale |

Substantial Contribution




(1) Neither substances fulfilling any hazardous properties specified in the list of Hazardous Classes included above (limited to 0.01 % for non-intentional use), nor any substance with the following properties: Acute toxicity for health (Cat. 1-3), Severe eye damage (Cat. 1), Skin corrosion (Cat. 1, 1A, 1B, 1C), Aquatic Acute Cat. 1 (H400) at concentrations requiring specific precautions for their safe use in terms of its health or environmental impact as defined by the concentration limits requiring their labelling under the CLP regulation including defined cut offs for additional hazards.

* Equivalent functionality verified by an independent third party

** Except where their use has been proven to be essential for society and the production process is done under strictly controlled conditions

*A1*

A general criterion was proposed with the aim to open the chance for eligibility to the whole NACE code C20. The decision to use a general approach was taken because of the short time available, which has not allowed to undertake the detailed analyses of different groups of products required to define specific criteria for each of them. To promote the substitution of those products containing hazardous ingredients by less polluting alternatives, a hazard-based approach was chosen. Both (1) to avoid the use of any substance falling in any of the hazardous properties included in the list of Hazardous Classes defined in these criteria and (2) to reduce, below CLP labelling limits, the concentration of substances classified as Acute toxicity for health (Cat. 1-3), Severe eye damage (Cat. 1), Skin corrosion (Cat. 1, 1A, 1B, 1C), and Aquatic Acute Cat. 1 (H400) were identified as substantial contribution to Pollution prevention and control (see above Note 1 of the graphical rationale).

*A2*

Even though the requirement A1 has been identified as a valid criteria definition that allow to prove substantial contribution, its structure do not limit the addition, now or in the future, of specific criteria for those chemical products that, f.i. containing any ingredient classified under one of the listed Hazardous Classes, could substantially contribute to pollution prevention and control or even enabling other activities and products to make a substantial contribution. In these cases, a specific study should be performed to prove the substantial contribution and to develop the related criteria. Taking this into consideration:

- Ecolabel, which can be used to identify environmentally best in the class products including those aspects related to pollution prevention and control, was added as an alternative criterion to A1.
- Chemical products not falling in any product category covered by Ecolabel and containing enzymes, classified as respiratory sensitizers, in their formulation are not within the scope.

*B and DNSH points*

See rationale of Manufacture of Chemicals (NACE Code C20) for Pollution Prevention and Control.

*Clarification for enabling activities*

Additionally, even for activities not complying with either A1 or A2 requirements, the current text does not block the eligibility of those operators manufacturing chemical products, identified as enabling for other eligible activities under pollution prevention and control objective, when:

- The product category is not covered by Ecolabel;

AND

- The activity complies with the set of requirements B1. B2 and B3 for substantial contribution to pollution prevention and control and DNSH for the other five objectives.

## 2.16 Manufacture of basic pharmaceutical products

*Description of the activity*

Manufacture of basic pharmaceutical products, also known as Active Pharmaceutical Ingredients (APIs).

The activity is classified under NACE code C21.1 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. Technical screening criteria.

| Substantial contribution to pollution prevention and control |
| --- |
| The activity must comply with both A and B sets of technical criteria.<br>A. The API must comply with the next two requirements (A1 and A2):<br>A1. The API is a natural substance (e.g., proteins or vitamins) and, in line with the EMA ERA guideline (2006), generally considered to be degradable in the environment. If this is not the case, the API, its key human metabolites and its key transformation products in the environment[187]:<br>○ are classified as readily biodegradable based on at least one of the test methods from OECD 301 (A-F)[188], in accordance with the pass value for ready biodegradability as defined in that guideline,<br>OR |

[187] Key metabolites are human metabolites likely to be excreted into the environment. Those metabolites are identified in (non-)clinical studies on the metabolism of pharmaceuticals available in the marketing authorization applications. Such metabolites have to be identified according to EMA/CPMP/ICH/286/1995, page 8. Key transformation products (TP) of these key human metabolites of the parent compound (API) are those that exceed 10% of Dissolved Organic Carbon (DOC) or Total Organic Carbon (TOC) of the parent compound. The application of the criteria for metabolites and transformation products is immediately effective for APIs registered after 01.01.2023. For the reporting on Fiscal Year 2025 onwards the criteria need apply to all API in the scope of this chapter.

[188] OECD 301 (A-F) studies are used to identify substances which are assumed to rapidly and ultimately biodegrade, i.e., mineralised under aerobic environmental conditions).

- can be concluded to be mineralised based on a specific study (OECD 308)[189] compared to persistence criteria as defined in the EMA ERA guideline (2006).

A2. The API qualifies as an appropriate substitute to another API, within the same therapeutic area or the substance class, available in the market that does not comply with the requirements described in A1.[190]

B. The activity must comply with requirements B1, B2, B3, B4 and B5 regarding pollution levels at the facility:

B1. Where the activity falls within its scope, the operator must demonstrate emission levels below the mid-point of the BAT-AEL ranges[191] set out in:

a) The Best Available Techniques Reference Document (BREF) for Manufacture of Organic Fine Chemicals (OFC);

b) The Best Available Techniques (BAT) conclusions for common wastewater and waste gas treatment/management systems in the chemical sector (CWW);

c) The Best Available Techniques Reference Document (BREF) for the production of speciality inorganic chemicals (SIC);

d) The Best Available Techniques (BAT) conclusions for common waste gas management and treatment systems in the chemical sector (WGC).

No significant cross-media impact occurs. This assessment shall notably ensure that plants within the BAT-AEL range(s) moving to the mid-point ambition will not trigger significant cross media effects, negating the Substantial Contribution of the set technical screening criteria.

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[189] Higher-tier studies (OECD 308) result with so-called half-lives indicating the time after which 50 % biodegradation of the API is achieved. Half-lives acceptable to demonstrate sufficiently quick biodegradation, i.e., non-persistence, according to the REACH REGULATION (EC) No 1907/2006, Annex XIII, which is also referenced in the EMA ERA guideline, apply.

[190] It must be proven with a-publicly available analysis verified by an independent third party.

[191] The requirements under B1 shall tackle the pollutants identified under the key environmental issues of each BREF document or the BAT-AEL of the relevant BAT conclusions Commission Implementing Decisions. Where BAT-AEL differentiate between “existing” and “new plants”, operators have to demonstrate compliance with BAT-AEL for new plants. When there is not a BAT-AEL range but a single value, emission levels have to be below such value. When the BAT-AEL range is expressed as follows: “<x-y unit” (I.e. the lower-end BAT-AEL of the range is expressed as ‘lower than’), the mid-point will be calculated using x and y. Averaging periods have to be the same as in the BAT-AEL of the BREF documents outlined above.

Installations that have been granted a derogation as per the procedure outlined in the Industrial Emissions Directive (IED, 2010/75/EU) article 15(4) are not considered as fulfilling the TSC.

B2. Where technically applicable, the operator has to apply Continuous Emission Monitoring Systems (CEMS), Continuous Effluent Quality Monitoring Systems (CEQMS) and other measures ensuring the regular verification of non-deterioration of groundwater quality.

B3. The operator hast to apply solvent waste segregation for solvent recovery from concentrated waste streams -when technically applicable.

Solvents included in Table 1 of ICH guideline Q3C (R6) on impurities: guideline for residual solvents (EMA,2019[192]) have to be avoided in pharmaceutical products.

The maximum solvents loss from total inputs cannot exceed 3%. Total volatile organic compound (VOC) recovery efficiency has to be at least 99%.

The operator has to verify that no diffuse emission occurs beyond the criteria specified below as to the ppmv thresholds by carrying out Leak detection and repair (LDAR) campaigns, at least every 3 years. Investments for the use of high integrity equipment is recommended, provided that these are installed in existing plants for cases mentioned under BAT 23b of the WGC BREF, whereas the pressure threshold is set at 200 bar. The minimal verification schedule may be reduced in those cases where quantification of total VOC emissions from the plant is periodically qualified with tracer correlation (TC) or with optical absorption-based techniques, such as differential absorption light detection and ranging (DIAL) or solar occultation flux (SOX) or measures of other equivalent performance.

Diffuse emissions of substances or mixtures classified as CMR1A or 1B from leaky equipment should strive to not exceed a concentration of 100 ppmv. Such LDAR campaigns shall have the features described in BAT19 of the WGC BREF, which include not only detecting but also repairing and maintaining leaks within 30 days of detection and a leak threshold is lower than or equal to 5000 ppmv for substances or mixtures other than those classified as CMR 1A or 1B, which shall be reviewed and updated for the continuous improvement of the installation. Solvent losses and

[192] EMA (2019) ICH guideline Q3C (R6) on impurities: guideline for residual solvents. Step 5. European Medicines Agency. https://www.ema.europa.eu/en/documents/scientific-guideline/international-conference-harmonisation-technical-requirements-registration-pharmaceuticals-human-use_en-33.pdf

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| | recovery efficiency of VOC should be monitored based on a solvent management plan using a mass balance for verification of compliance, as per Chapter VII of the Industrial Emissions Directive (IED, 2010/75/EU).<br><br>B4. Sewage, refuse, and other waste (e.g., solids, liquids, or gaseous by-products from manufacturing) should be disposed of in a safe, timely, and sanitary manner. Containers and/or pipes for waste material should be clearly identified. Analytical data demonstrating the conversion of these substances and their residues to non-hazardous waste materials have to be available at the facility and kept up to date.<br><br>B5. The production process does not include intentionally added substances that meet the criteria of Substances of Very High Concern (i.e., substances that meet the criteria laid down in Article 57 of Regulation (EC) 1907/2006) except where their use has been proven to be essential for society and the production process is done under strictly controlled conditions. |
| Do no significant harm ('DNSH') | |
| (1) Climate change mitigation | The substitution cannot lead to an increment of Lifecycle GHG emissions higher than 20 % per functional unit. Lifecycle GHG emissions are calculated using Commission Recommendation 2013/179/EU or, alternatively, using ISO 14067:2018 or ISO 14064-1:2018. Quantified life-cycle GHG emissions are verified by an independent third party. |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | All three water criteria have to be applied (W1, W2 and W3)<br><br>W1. Waste water treatment:<br><br>The performance of wastewater treatment processes conducted by or on behalf of the manufacturing plant must not lead to any deterioration of water bodies and marine resources. |

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| | When activities fall withing their scope, these have to meet the requirements of<br><br>- Urban Wastewater Treatment Directive (91/271/EEC),<br>- Directive 2008/105/EC on Environmental Quality Standards, amended by 2013/39/EU), notably the Maximum Allowance Concentration values.<br>- Groundwater directive 2006/118/EC<br>- Industrial Emissions Directive (2010/75/EU)<br>- Water Framework Directive (2000/60/EC)<br>- Drinking Water Directive (2020/2184)<br>- Bathing Water Directive (76/160/EEC)<br>- JRC Best Environmental Management Practice for the Public Administration Sector. 2019<br>- Marine Strategy Framework Directive (MSFD) 2008/56/EU<br>- Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment<br><br>In cases where wastewater treatment is conducted by an urban wastewater treatment plant on behalf of the manufacturing plant, operators must ensure that:<br><br>(a) the released polluting substances do not impede the operation of such waste water treatment plant;<br><br>(b) the released polluting substances do not harm the health of the staff working in collecting systems and waste water treatment plants;<br><br>(c) the urban waste water treatment plant is designed and equipped to abate the released polluting substances;<br><br>(d) the overall load of the concerned polluting substances eventually released into the water (and indirectly to the rest of the environment) is not increased compared to the situation where the emissions from the |

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| | installation concerned remained compliant with emission limit values set for direct releases.<br><br>(e) the usability of the sewage sludge for nutrient cycling is not affected.<br><br>For installations where additional pollutant limits and/or stricter conditions have been included in their environmental permit compared to the requirements of the legislation mentioned above (for example stricter measures required pursuant to Article 18 of the Industrial Emissions Directive, 2010/75/EU), then these conditions apply.<br><br>W2. Soil and groundwater protection:<br><br>Inclusion of appropriate measures to prevent emissions to soil and regular surveillance of those measures to avoid leaks, spills, incidents or accidents occurring during the use of equipment and during storage.<br><br>W3. Water Consumption:<br><br>Manufacturers have to assess the water footprint of the operations according to ISO 14046 and ensure that they do not contribute to water scarcity. Operators have to declare that they do not contribute to water scarcity based on this assessment and this has to be verified by an independent third party. |
| (4) Transition to a circular economy | The activity assesses the availability of and, where feasible, adopts techniques that support:<br><br>8. Reuse and use of secondary raw materials and reused components in manufactured products<br>9. Design for high durability, recyclability, easy disassembly and adaptability of manufactured products<br>10. Waste management that prioritises recycling over disposal, in the manufacturing process<br><br>Information on product ingredients along the supply chain |

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| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |

| Rationale |
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The description of activity defines that this chapter refers to Active Pharmaceutical Ingredients (APIs).

According to the EU Strategic Approach to Pharmaceuticals in the Environment (2019), the largest source, or "hotspot", of pharmaceuticals entering the environment is use. The chemical and/or metabolic stability of some pharmaceuticals means that up to 90% of the active ingredient is excreted (or washed off) in its original form. This is the reason that the manufacture of sustainable APIs, with a lower risk for the environment, was considered as an activity with a high potential for substantial contribution.

**Substantial Contribution**

The extension of the concept of inherently safe APIs to sustainability results in a new requirement that chemicals should be biodegraded to harmless products, i.e. that they are largely mineralised within a reasonable time upon entering the environment.

Section A:

A1

The A1 criteria apply to all APIs, the key human metabolites, and the key transformation products. The reasoning to consider all three is that APIs may be metabolised in the human body to a certain extent up to full metabolization. Consequently, the parent API would not or only partly be excreted and emitted into the environment. Next to metabolization an API may be degraded in the environment resulting in transformation products and equal to metabolites measures to prevent pollution should take account of these. The criteria for pollution prevention must therefore cover the substance which can be expected to be present in the environment, which is not necessarily the parent compound (only) but metabolites and transformation products as well.

The focus is on key metabolites and key transformation products as this is common regulatory practice. The definition of key metabolites used in the taxonomy criteria corresponds to that existing in the pharmaceutical regulation according to the EMA guideline EMA/CPMP/ICH/286/1995, page 8. The definition of key transformation products was derived by the technical group and somewhat refers to the metabolite definition.

Natural substances such as proteins or vitamins are generally excluded from environmental risk assessment as these are expected to be readily biodegradable in the environment and therefore not of (potential) concern. This approach is in line with, e.g., the EMA ERA requirements outlined in the guideline EMEA/CHMP/SWP/4447/00 corr 2. Natural substances are therefore excluded from the scope of the criteria in the taxonomy as well.

API data on fate and ecotoxicology in the EU only had to be generated after the sunset year of 2006 and therefore many older APIs have partly or complete data gaps. Thus, there is limited or no data to conclude on the EU taxonomy criteria. It was therefore agreed that the criteria should be immediately effective for all APIs authorized after 01.02.2023, i.e., for all APIs authorized now, while for the older APIs industry shall be granted limited time to generate missing data until the fiscal year 2025. This was considered appropriate as a transition period is common in EU legislation. Moreover, granting this limited time is still securing the high level of ambition as data which today is not requested by pharmaceutical legislation would now be generated under EU taxonomy. As mentioned earlier this would potentially mean to generate biodegradation data for huge numbers of APIs.

A substantial contribution to pollution prevention and control is ensured by requesting that APIs should be readily biodegradable. This is the highest possible ambition as ready biodegradation means that the API is eliminated, and potential unfavourable properties may not become effective. Also, many APIs are for pharmacological reasons developed as stable substances which frequently are not readily biodegrade in the environment. Requesting readily biodegradable substances is consequently a trigger for innovative (new) APIs and medicinal products.

The regulatory standard test to assess ready biodegradability is the screening test method OECD 301 with its options A to F. This method defines specific pass levels which must be met for conclusion on ready biodegradability. A positive result is interpreted as rapid and ultimate degradation of a substance/API.

There are however further options to assess biodegradability in the environment in EU regulations. One of the so-called definite studies on transformation in water sediment test systems is OECD 308, which is a standard data requirement according to the pertinent EMA ERA guideline. EU regulations consider definite studies to overrule screening studies according to OECD 301. While OECD 301 reports percent biodegradation after 28 days, OECD 308 reported so-called half-lives, i.e., time by when 50 % of the API is degraded. Under the EU REACH REGULATION (EC) No 1907/2006, Annex XIII thresholds for half-lives determined, e.g., in OECD 308 were defined and allow to conclude if a substance is to be considered persistent or not. The same criteria apply under pharmaceutical legislation. The assessment of half-lives against the thresholds is part of the PBT assessment to conclude if a substance is persistent and bioaccumulative and toxic in the environment. Hence, adding OECD 308 as an option to proof biodegradability next to OECD 301 is providing one more option for industry while the level of ambition is still high.

A2 The production of biodegradable APIs can only be regarded as a substantial contribution to pollution prevention and control when the substances are replacing those non-biodegradable. Thus, the product fulfilling criteria A1 must either replace an API that is not biodegradable but of a similar substance class or has to enable a new or different treatment that can replace a treatment of a patient which requires an API that does not fulfil criteria A1.

Section B:

Prevention and control of pollution at plant level are needed, especially for those plants outside the European Union.

B1-B3 Alignment with those criteria defined for similar activities such a Manufacture of Chemicals and Manufacture of Chemical Products (NACE Code C20) and adapted when necessary.

B4 EudraLex - The Rules Governing Medicinal Products in the European Union, Volume 4, Good Manufacturing Practice (GMP) Medicinal Products for Human and Veterinary Use, Part II: Basic Requirements for Active Substances used as Starting Materials. The European Medicine Agency has a coordinating role for GMP inspections of manufacturing sites for medicines whose marketing authorization in the EU is submitted through the centralized procedure or as part of a referral procedure. EMA chairs and provides the secretariat for the GMP/GDP Inspectors Working Group of senior inspectors appointed by competent authorities from all EEA countries.

B5 Alignment with Technical Screening Criteria defined for similar activities such as Manufacture of Chemicals and Manufacture of Chemical Products (NACE Code C20)

**DNSH:**

Alignment with those defined for similar activities such as Manufacture of Chemicals and Manufacture of Chemical Products (NACE Code C20)

## 2.17 Manufacture of pharmaceutical preparations

*Description of the activity*

Manufacture of pharmaceutical preparations, classified under NACE code C21.2 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006, including dosing and distribution considerations.

| Substantial contribution to pollution prevention and control |
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| The activity hast to comply with one of the following technical criteria (A1 or A2).<br><br>Additionally, set B of criteria has to be complied in any case.<br><br>A1. The pharmaceutical preparation must comply with the next two requirements (A1.1 and A1.2):<br><br>A1.1 The ingredients that constitute the formulation of the pharmaceutical preparation comply with the criteria for biodegrading as defined under A1 of Manufacture of Basic Pharmaceutical Products (NACE Code C21.1).<br><br>A1.2 The Pharmaceutical Preparation qualifies as an appropriate substitute to another Pharmaceutical Preparation, within the same therapeutic area or the substance class, available in the market that does not comply with the requirements described in A1.1[193]<br><br>A2 The manufacturer proves that there are no such ingredients to produce an alternative pharmaceutical preparation that qualifies as an appropriate substitute, within the same therapeutic area or the substance class, that comply with the requirements described in A1.1. In this case the manufacturer must comply with the next six requirements (A2.1, A2.2, A2.3, A2.4, A2.5 and A2.6):<br><br>A2.1 The manufacturer has to perform an analysis that there is no such appropriate substitute to the produced Pharmaceutical Preparation, publishing the core results of this analysis. Furthermore, the company needs to demonstrate that they started initiatives to develop that alternative. |

[193] It must be proven with a publicly available Analysis verified by an independent third party.

A2.2 In line with the EMA (European Medicines Agency) ERA guidelines (2006), the PEC/PNEC ratio for the drug substance obtained in the Environmental Risk Assessment is below 1.[194]

A2.3. Packaging and distribution systems allow – considering the (local) legal requirements - to adjust the sold amount to the required amount by the treatment/s.

A2.4. Public information (e.g. leaflets, websites), updated according to the state of the art, is provided about dose and dosing method to minimize the excess of dosed API.

A2.5 Packaging and distribution systems allow to use the most efficient dosing system available according to the state of the art and considering the kind of administration (e.g. by health care professionals or domestic). The manufacture has to publish the main results of this analysis.

A2.6 The company contributes to mitigate the environmental impact of incorrect waste disposal of unused pharmaceuticals.[195]

B. The activity must comply with requirements B1, B2, B3, B4 and B5 regarding pollution levels at the facility:

B1. Where the activity falls within its scope, the operator must demonstrate emission levels below the mid-point of the BAT-AEL ranges[196] set out in:

a) The Best Available Techniques Reference Document (BREF) for Manufacture of Organic Fine Chemicals (OFC);

[194] PEC = predicted environmental concentration; PNEC = predicted no effect concentration. Since the EMA Guideline required companies to perform these assessments for products registered after 2006, products registered prior to the release of the document will use actual use and consumption data and the reference point for the concentration is the river after the mixing zone. They do not require to meet this criterion until Fiscal Year 2025. Until then, the respective preparations would need to meet the threshold of 0.01 µg/L. The same threshold also applies for substances where a PEC / PNEC is impossible to be derived (e.g. certain Antineoplastic compounds)

[195] Incorrect waste disposal as defined by local authorities

[196] The requirements under B1 shall tackle the pollutants identified under the key environmental issues of each BREF document or the BAT-AEL of the relevant BAT conclusions Commission Implementing Decisions. Where BAT-AEL differentiate between “existing” and “new plants”, operators have to demonstrate compliance with BAT-AEL for new plants. When there is not a BAT-AEL range but a single value, emission levels have to be below such value. When the BAT-AEL range is expressed as follows: “<x-y unit” (i.e. the lower-end BAT-AEL of the range is expressed as ‘lower than’), the mid-point will be calculated using x and y. Averaging periods have to be the same as in the BAT-AEL of the BREF documents outlined above.

b) The Best Available Techniques (BAT) conclusions for common wastewater and waste gas treatment/management systems in the chemical sector (CWW);

c) The Best Available Techniques Reference Document (BREF) for the production of speciality inorganic chemicals (SIC);

d) The Best Available Techniques (BAT) conclusions for common waste gas management and treatment systems in the chemical sector (WGC).

No significant cross-media impact occurs. This assessment shall notably ensure that plants within the BAT-AEL range(s) moving to the mid-point ambition will not trigger significant cross media effects, negating the Substantial Contribution of the set technical screening criteria.

Installations that have been granted a derogation as per the procedure outlined in the Industrial Emissions Directive (IED, 2010/75/EU) article 15(4) are not considered as fulfilling the TSC.

B2. Where technically applicable, the operator has to apply Continuous Emission Monitoring Systems (CEMS), Continuous Effluent Quality Monitoring Systems (CEQMS) and other measures ensuring the regular verification of non-deterioration of groundwater quality.

B3. The operator hast to apply solvent waste segregation for solvent recovery from concentrated waste streams -when technically applicable.

Solvents included in Table 1 of ICH guideline Q3C (R6) on impurities: guideline for residual solvents (EMA,2019[197]) have to be avoided in pharmaceutical products.

The maximum solvents loss from total inputs cannot exceed 3%. Total volatile organic compound (VOC) recovery efficiency has to be at least 99%.

The operator has to verify that no diffuse emission occurs beyond the criteria specified below as to the ppmv thresholds by carrying out Leak detection and repair (LDAR) campaigns, at least every 3 years. Investments for the use of high integrity equipment is recommended, provided that these are installed in existing plants for cases mentioned under BAT 23b of the WGC BREF, whereas the pressure threshold is set at 200 bar. The minimal verification schedule may be reduced in those cases where

[197] EMA (2019) ICH guideline Q3C (R6) on impurities: guideline for residual solvents. Step 5. European Medicines Agency. https://www.ema.europa.eu/en/documents/scientific-guideline/international-conference-harmonisation-technical-requirements-registration-pharmaceuticals-human-use_en-33.pdf

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| | quantification of total VOC emissions from the plant is periodically qualified with tracer correlation (TC) or with optical absorption-based techniques, such as differential absorption light detection and ranging (DIAL) or solar occultation flux (SOX) or measures of other equivalent performance.<br><br>Diffuse emissions of substances or mixtures classified as CMR1A or 1B from leaky equipment should strive to not exceed a concentration of 100 ppmv. Such LDAR campaigns shall have the features described in BAT19 of the WGC BREF, which include not only detecting but also repairing and maintaining leaks within 30 days of detection and a leak threshold is lower than or equal to 5000 ppmv for substances or mixtures other than those classified as CMR 1A or 1B, which shall be reviewed and updated for the continuous improvement of the installation. Solvent losses and recovery efficiency of VOC should be monitored based on a solvent management plan using a mass balance for verification of compliance, as per Chapter VII of the Industrial Emissions Directive (IED, 2010/75/EU).<br><br>B4. Sewage, refuse, and other waste (e.g., solids, liquids, or gaseous by-products from manufacturing) should be disposed of in a safe, timely, and sanitary manner. Containers and/or pipes for waste material should be clearly identified. Analytical data demonstrating the conversion of these substances and their residues to non-hazardous waste materials have to be available at the facility and kept up to date.<br><br>B5. The production process does not include intentionally added substances that meet the criteria of Substances of Very High Concern (i.e., substances that meet the criteria laid down in Article 57 of Regulation (EC) 1907/2006) except where their use has been proven to be essential for society and the production process is done under strictly controlled conditions. |
| Do no significant harm ('DNSH') | |
| (1) Climate change mitigation | The substitution cannot lead to an increment of Lifecycle GHG emissions higher than 20 % per functional unit. Lifecycle GHG emissions are calculated using Commission Recommendation 2013/179/EU or, alternatively, using ISO 14067:2018 or ISO 14064-1:2018. Quantified life-cycle GHG emissions are verified by an independent third party. |

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| (2) Climate change adaptation | DNSH as set out in [Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852]. |
| (3) Sustainable use and protection of water and marine resources | All three water criteria have to be applied (W1, W2 and W3)<br><br>W1. Waste water treatment:<br><br>The performance of wastewater treatment processes conducted by or on behalf of the manufacturing plant must not lead to any deterioration of water bodies and marine resources. When A2 is claimed, contamination of ingredients is to be eliminated preferably at source.<br><br>When activities fall withing their scope, these have to meet the requirements of<br><br>- Urban Wastewater Treatment Directive (91/271/EEC),<br>- Directive 2008/105/EC on Environmental Quality Standards, amended by 2013/39/EU), notably the Maximum Allowance Concentration values.<br>- Groundwater directive 2006/118/EC<br>- Industrial Emissions Directive (2010/75/EU)<br>- Water Framework Directive (2000/60/EC)<br>- Drinking Water Directive (2020/2184)<br>- Bathing Water Directive (76/160/EEC)<br>- JRC Best Environmental Management Practice for the Public Administration Sector. 2019<br>- Marine Strategy Framework Directive (MSFD) 2008/56/EU<br>- Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment<br><br>In cases where wastewater treatment is conducted by an urban wastewater treatment plant on behalf of the manufacturing plant, operators must ensure that: |

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| | (a) the released polluting substances do not impede the operation of such waste water treatment plant;<br><br>(b) the released polluting substances do not harm the health of the staff working in collecting systems and waste water treatment plants;<br><br>(c) the urban waste water treatment plant is designed and equipped to abate the released polluting substances;<br><br>(d) the overall load of the concerned polluting substances eventually released into the water (and indirectly to the rest of the environment) is not increased compared to the situation where the emissions from the installation concerned remained compliant with emission limit values set for direct releases.<br><br>(e) the usability of the sewage sludge for nutrient cycling is not affected.<br><br>For installations where additional pollutant limits and/or stricter conditions have been included in their environmental permit compared to the requirements of the legislation mentioned above (for example stricter measures required pursuant to Article 18 of the Industrial Emissions Directive, 2010/75/EU), then these conditions apply.<br><br>W2. Soil and groundwater protection:<br><br>Inclusion of appropriate measures to prevent emissions to soil and regular surveillance of those measures to avoid leaks, spills, incidents or accidents occurring during the use of equipment and during storage.<br><br>W3. Water Consumption:<br><br>Manufacturers have to assess the water footprint of the operations according to ISO 14046 and ensure that they do not contribute to water scarcity. Operators have to declare that they do not contribute to water scarcity based on this assessment and this has to be verified by an independent third party. |

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| (4) Transition to a circular economy | The activity assesses the availability of and, where feasible, adopts techniques that support:<br><br>11. Reuse and use of secondary raw materials and reused components in manufactured products<br>12. Design for high durability, recyclability, easy disassembly and adaptability of manufactured products<br>13. Waste management that prioritises recycling over disposal, in the manufacturing process<br><br>Information on product ingredients along the supply chain |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |

Rationale

According to the EU Strategic Approach to Pharmaceuticals in the Environment (2019), the largest source, or "hotspot", of pharmaceuticals entering the environment is use. The chemical and/or metabolic stability of some pharmaceuticals means that up to 90% of the active ingredient is excreted (or washed off) in its original form.

Currently, the availability of sustainable APIs (as defined for NACE Code C21.1) and other necessary ingredients (e.g. excipients), with a low risk for the environment, is limited and, for this reason, the manufacture of pharmaceutical preparation, including dosing and distribution considerations, was considered as an activity with a high potential for substantial contribution due its capacity on reducing the amount of APIs and other potentially hazardous ingredients released to the environment during and after the use stage of the life cycle of the pharmaceutical products.

**Substantial Contribution**

Section A1:

Alignment with SC defined for Manufacture of Basic Pharmaceutical Products (NACE Code C21.1) for Pollution Prevention and Control.

Section A2:

Alignment with the EU Strategic Approach to Pharmaceuticals in the Environment.

Section B:

See rationale for section B of the SC defined for Manufacture of Basic Pharmaceutical Products (NACE Code C21.1) for Pollution Prevention and Control.

**DNSH**

See rationale for DNSH defined for Manufacture of Basic Pharmaceutical Products (NACE Code C21.1) for Pollution Prevention and Control

## 2.18 Manufacture of plastic packing goods

*Description of the activity*

The economic activity is classified under NACE code C22.2.2 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

| Substantial contribution to transition to a circular economy |
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Taxonomy eligible activities need to meet either

the criteria for use of circular feedstock and design for recycling in practice or

the criteria for design for reuse in practice and design for recycling in practice.

Use of circular feedstock:

- At least 85% of the packaging product by weight consists of mechanically recycled post consumer material, chemically recycled, biobased or CCU (Carbon Capture and Utilization) based material.

Design for reuse in practice:

- The packaging product has been designed to accomplish, or proves its ability to accomplish on average a minimum of 10 trips or rotations in a system for reuse, where:
- A trip is defined as transfer of packaging, from filling/loading to emptying/unloading, and a rotation is defined as a cycle undergone by reusable packaging from filling/loading to filling/loading.
- The minimum number of trips or rotations refers to the fact that the ‘system for reuse’ in place should be proven to work in practice.
- A system for reuse is defined as established arrangements (organisational, technical or financial) which ensure the possibility of reuse, in closed-loop, open-loop or in a hybrid system.
- Reuse of packaging is an operation by which packaging is refilled or used for the same purpose for which it was conceived

Design for recycling in practice

- The packaging product is designed to enable sorting and recycling at the end of life.
- For the packaging to be evaluated as recyclable, collection, sorting, and recycling is proven to work in practice and at scale, or is proven to be on track to work in practice and at scale.
- Collection, sorting, and recycling works ‘in practice and at scale’ if the plastic packaging material (e.g., PE, HDPE, LDPE, PP) achieves a minimum recycling rate of 50% in line with the 2025 target for plastic set by the Directive (EU) 2018/852[1] either in the jurisdiction where the packaging is put on the market, regardless of the jurisdiction’s size, or in multiple regions that collectively represent at least 100 million inhabitants;
- Collection, sorting, and recycling is on track to work ‘in practice and at scale’ if the packaging material achieves at least a recycling rate that is proportionate to filling the gap between a base year recycling rate and the 50% target for plastic set by the Directive (EU) 2018/852[198].
- The packaging itself must have the ability to be sorted into those existing streams and not contaminating the stream in a harmful way. This includes the combination of different materials.
- The used materials need to be compatible within the same recycling stream or in best case the complete system is made from the same material (mono-material solution).
- If this cannot be achieved, separability needs to be ensured, either at the consumer level (by call-to-action or by design) or within the sorting and recycling process (options here are for example adhesives that are detachable/water-soluble or making use of density separation).
- The packaging itself must not contaminate the recycling stream in a harmful way through additives used to enhance the properties of the material or as processing aids.
- Furthermore, the used colours – like carbon-based black - may not prevent the sorting.
- Most harmful chemicals as defined in the chemical’s strategy for sustainability (i.e. Substances of very high concern (+PMTs, vPvMs, EDs) + Ozone depleting substances,

[198] If and when EU target for plastics is formally provided at a more granular level (e.g., PE, HDPE, LDPE, PP for plastics), then these targets might replace the one currently set by Directive (EU) 2018/852 and used in this definition

+ respiratory sensitizers Cat 1 + STOT SE Cat 1& 2 + STOT RE Cat 1&2) must not be added to the feedstock when producing the packaging material itself.

- Where the nature of the application justifies the use of biodegradable packaging due to an overall substantial contribution of this application to the circular economy – for example in specific food related applications – the above-mentioned principles will have to be demonstrated for the relevant waste recovery and recycling stream, in this case composting. This includes certification according to relevant internationally recognised home-compostability certification schemes (TÜV AUSTRIA Belgium (OK Compost Home), DIN CERTCO (DIN-Geprüft Home compostable), AfOR (FILM home compostable), and ABA (Home compostable) or complying with internationally recognised home-compostability testing norms (NF T 51-800, AS 5810) as well as the availability of collection and organic recycling systems or a significant share of home-composting where the packaging is put on the market.

Do no significant harm ('DNSH')

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| (1) Climate change mitigation | Lifecycle GHG emissions of chemically recycled, biobased and CCU feedstock have to be lower than the life-cycle GHG emissions of the equivalent primary plastic manufactured from fossil fuel feedstock. Life-cycle GHG emissions are calculated using Commission Recommendation 2013/179/EU or, alternatively, using ISO 14067:2018 or ISO 14064-1:2018. Quantified life-cycle GHG emissions are verified by an independent third party. |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |

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| (5) Pollution prevention and control | DNSH as set out in Appendix C of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852<br>For the production of the plastic polymers Emissions are within or lower than the emission levels associated with the best available techniques (BAT-AEL) ranges set out in the Best Available Techniques Reference Document (BREF) for the Production of Polymers: Reference Document on Best Available Techniques in the Production of Polymers (https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/pol_bref_0807.pdf). No significant cross-media effects occur. |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852<br>Any biomass used for packaging (i.e., renewable feedstock) complies with the sustainability requirements of the EU regulatory framework, including Part A of Annex IX of Directive (EU) 2018/2001, EU Forest Law Enforcement Governance and Trade (FLEGT), EU Timber Regulation (EUTR 995/2010), LULUCF Regulation (841/2018), as applicable. In particular, any wood raw materials should be sourced from responsible forest management as defined by intergovernmental definition such as forest Europe H1 resolution and embedded and implemented in existing national forest and nature legislation or market based voluntary systems such as, the Forest Stewardship Council (FSC) scheme or PEFC, with additional due diligence for any high-risk sources as defined by the EUTR and guided by the provisions of the Renewable Energy Directive 2. When claims of renewability are made for virgin materials, evidence is provided to show that those materials shall come from sources that are replenished at a rate equal to or greater than the rate of depletion.<br>For sites/operations located in or near to biodiversity-sensitive areas (including the Natura 2000 network of protected areas, UNESCO World Heritage sites and Key Biodiversity Areas (KBAs), as well as other protected areas), ensure that an appropriate assessment has been |

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| | conducted in compliance with the provisions of the EU Biodiversity Strategy (COM (2011) 244), the Birds (2009/147/EC) and Habitats (92/43/EEC) Directives or in the case of activities located in non-EU countries, other equivalent national provisions or international standards (e.g., IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources) – based on the conservation objectives of the protected area. |

| Rationale |
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| *Activity*<br><br>Plastics used for packaging are the biggest use of plastic in the EU and source of plastic waste in the EU (e.g., ca. 60% of plastic waste results from packaging (source: Eunomia, 2017) / or 40% of plastic demand goes into packaging (source: Plastics Europe, 2016) (data reported in A European Strategy for Plastics in a Circular Economy, European Commission).<br><br>Most plastics used in packaging is generally thermoplastic. They come in solid/granulate form are melted and brought into a certain shape (e.g., a bottle). This process is reversible – means the plastic can be melted and processed again.<br><br>Most rubbers are cross linked / cured / vulcanized (thermoset) with the support of heat. This process is non-reversible – means it cannot be melted again and put into a different shape or form.<br><br>*Rationale for substantial contribution*<br><br>Use of circular feedstock.<br><br>Threshold of 85 % with multiple examples existing on the market. Best cases currently achieve max 98/99% due to virgin material in labelling adhesives or in master batch with dye for coloured packaging – otherwise only clear and white plastic packaging would be possible.<br><br>The demand for recycled content is stimulated through this criterion, the supply through the criteria for “Design of the product”. In this way, the entire system incentivised to scale, and make recycling work in practice. This criterion supports increased use of secondary raw |

materials and their quality, including by high-quality recycling of waste, TR Art 13.1.(f). While in a circular economy it is encouraged that pre-consumer waste is kept in the system, e.g., by replacing virgin resources for the same process, the priority is to avoid such pre-consumer waste as part of optimising manufacturing processes in the first place, and less about substantial contribution to the circular economy. Circular economy is about transforming entire sectors to ensure material and products are kept at their highest value, e.g., through reusable packaging / recycling system connecting different steps of the value chain. Signalling this importance, the post-consumer part is often the largest volume and the focus of reporting: look e.g., for plastics at the Single-Use Plastics Directive (EU) 2019/904 (Article 13 '*data on the post-consumption waste of single-use plastic products'),* and PlasticsEurope's Plastics - The Facts 2020 (p30). This furthermore allows to align with EU legislation & initiatives, including the Single-Use Plastics Directive (EU) 2019/904 aims to tackle environmental damage from "*commonly used fast-moving consumer products that are discarded after having been used once for the purpose for which they were provided"* (Recital 5), so focusing on post-consumer. EU Circular Plastics Alliance - Guidance on Waste Definitions (Sep 2021), p26 in the 'Packaging WG: use of recycled plastics' section: "*It is assumed that the amount of pre-consumer waste will not increase significantly as production waste is limited. The growth must come from post-consumer recyclates.*". In addition, this is aligned with EU and internationally recognised type 1 ecolabels as exclusion of pre-consumer waste in the recycled content calculation is in line with the requirements in EU C(2021) 7500 final, ANNEX I: EU Ecolabel criteria for awarding the EU Ecolabel to cosmetic products: "*The applicant shall provide a signed declaration from the packaging manufacturer for the content of postconsumer recycled material or material from renewable origin in the packaging […] The applicant shall provide third party verification and traceability for postconsumer recycled content."*)The Blue Angel, Products made from Recycled Plastics, DE-UZ 30a: *"The applicant shall submit a certificate (including report) pursuant to the EuCertPlast certification scheme (including a calculated and plausibility-checked verification of the post-consumer percentage) to verify the origin and composition of the PCR materials used."*Its feasibility has been shown by existing practices, such as Magnum's rPP ice cream tub: PlasticsEurope and PackagingWorld. Recycled content should therefore exclude pre-consumer recycled content. ISO 14021 clearly differentiates pre-consumer and post-consumer recycled content, with the former being about materials diverted from the waste stream during a manufacturing process, and thus allows to make this distinction in a standardised way. Of course, pre-consumer recycled content can be included too, but it won't count towards meeting the target.

Design for reuse in practice

With its first “reuse cycle” a reusable packaging product starts to replace potential virgin feedstock and can be considered a contribution to a circular economy. However, reusable packaging tends to be designed to be more durable and therefore more material intensive, requiring several rotation to achieve break-even as shown in various case studies.

Furthermore, this criterion ensures alignment of substantial constribution criteria along the value chain and with the users of plastic packaging products for example for food and beverage.

Design of the product.

For plastic, Directive (EU) 2018/852 sets a 50 % minimum recycling targets by weight for 2025. Collection and in particular recovery rates vary substantially across the EU as well as on local and regional level, as well as between polymers (e.g., PET, PE, PP, HDPE). In order for collection, sorting, and recycling to be able to evolve, the criteria offer the opportunity to demonstrate that the recycling systesm for the plastic packaing work at scale either in the jurisdiction where the packaging is put on the market or in multiple regions that collectively represent at least 100 million inhabitants or can be demonstrated to be on track to work ‘in practice and at scale’. If and when EU targets are formally provided at a more granular level, then these targets replace the material-level ones currently used in this definition. For all packaging materials, if and when EU targets are formally provided at a more granular level (e.g., PET, PE, PP for plastics; clear glass, green glass for glass), then these targets might replace the material-level ones currently set by Directive (EU) 2018/852 and used in this definition.

Some additives can change the characteristics to a point of non-recyclability (for example density changing additives or unstable compounds that can break down during recycling).

Carbon-based black colours for packaging interfere with the current sorting infrastructure. Alternative black colours are available on the market.

The presence of substances of concern in plastic can be an obstacle for recycling. The substances cannot be removed by mechanical recycling and thus will pollute the material stream (e.g. flame retardants in plastics being). The ambition of the chemical’s strategy is to minimise the presence of substances of concern and where they are used, ensure their tracking in articles, to be able to remove those articles from recycling flows.

Biodegradability is generally not considered as “recyclability” and contribution to the circular economy in this context as the material would break down and therefore be lost from the material cycle and not contribute to the EU’s ambition to increase recycled content in plastic packaging materials.

The inclusion of compostability aims to capture the benefits of organic recycling for targeted applications by helping recover nutrients of packaging contents (e.g., food left-overs), while limiting potential unintended consequences through a strict definition. In particular, the intended after-use pathway is collection of the packaging and nutrient contamination as part of the organic waste stream and further industrial treatment through a waste management infrastructure (e.g., industrial composting or anaerobic digestion). The more stringent home-compostability has been required for regions in which the infrastructure is still being built or in which adequate home-composting is in place. Nevertheless, collection and industrial processing is the intended option.

DNSH

Alignment with DNSH defined for similar manufacturing activities in First Delegate Act.

## 2.19 Manufacture of copper

*Description of the activity*

Manufacture of copper (C24.4.4) – The activity is part of the NACE CODE C.24 which covers manufacturing of basic metals (Roasting, Smelting and Refining) from primary and from secondary materials.

The NACE code classification refers to the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

The activity is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to climate change mitigation |
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The economic activity is recognised as substantially contributing to climate change mitigation objective where it manufactures one of the following:

a. **Copper from Primary Resources using Pyrometallurgical Route where the economic activity complies with all of the following criteria:**
   - the direct GHG emissions intensity does not exceed 315 kg $CO_2$ per ton of metal manufactured. *The value is adjusted to reflect ambition required by Paris Agreement.*
   - the electricity consumption for the manufacturing process does not exceed 988 kWh/t metal manufactured. *The value is adjusted to reflect ambition required by Paris Agreement.*
   - the average carbon intensity of the electricity does not exceed 100g $CO_2e$/kWh.

**b. Copper from Secondary Resources using Pyrometallurgical Route where the economic activity complies with both the following criteria:**

- Metal produced using secondary input materials, where secondary input materials / Total input materials >70%
- The average carbon intensity of the electricity does not exceed 265 g $CO_2$ e/kWh.

| Do no significant harm ('DNSH') |
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| (1) Climate change mitigation | Not applicable |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) 2021/2139 supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) 2021/2139 supplementing Regulation (EU) 2020/852. |
| (4) Transition to a circular economy | |
| (5) Pollution prevention and control | The activity complies with the criteria set out in Appendix C of Annex 1 to the Commission Delegated Regulation (EU) 2021/2139 supplementing Regulation (EU) 2020/852.<br><br>Emissions are within or lower than the emission levels associated with the best available techniques (BAT-AEL) ranges set out in the latest relevant best available techniques (BAT) conclusions, including the best available techniques (BAT) conclusions for the non-ferrous metals industries. No significant cross-media effects occur. |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) 2021/2139 supplementing Regulation (EU) 2020/852. |

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| Rationale |

Substantial Contribution

The twin energy and digital transition is metal intensive (Metals-for-Clean-Energy, (page 9, page 16). Electric vehicles, batteries, solar photovoltaic systems, wind turbines, and hydrogen technologies all require significantly more metals than their conventional alternatives to replace fossil fuel needs.

Metals production is an energy intensive process, and as such has a big potential for substantially contributing to the climate change mitigation objective by reducing pressure on the environment,

Metal production operators can decrease the carbon footprint of their own roasting, smelting and refining operations and take steps to improve performance of the upstream value chain (mining activity including the processing at a mining site).

The following **solutions and corresponding technologies** decrease the carbon intensity of metals production (t CO2/t of metals). (Best Available Techniques (BAT) Reference Document for the Non-Ferrous Metals Industries)

1. By improving energy efficiency
2. By use of more metal containing secondary materials
3. By electrification and consumption of renewable and fossil free electricity,
4. By use of non-fossil reduction agents and alternative fossil free fuels.
5. By roasting of carbon containing fraction of the infeed materials before it enters the smelting operation.
6. By carbon capture and storage or carbon capture and use.
7. Innovating in other breakthrough manufacturing technologies (Artificial intelligence, data mining etc.).

The activities being considered for defining TSC's are roasting, smelting and refining of metals from Primary and Secondary infeed materials from pyrometallurgical route and leaching and refining of metals from Primary resources using hydrometallurgical route and fabrication of products using intermediate refined metals and secondary raw materials.

**Manufacturing of Copper - Primary production**

Primary copper can be produced by pyrometallurgical or hydrometallurgical processes. Approximately 20% of primary copper is produced by the direct leaching of ores (hydrometallurgical route). Nowadays, sulfidic concentrates (15–45 % Cu) are the most important raw materials for the pyrometallurgical primary copper route, with a share of more than 85 %. (BREF, page 247).

The use of the parameter carbon intensity (kg CO2e / t metal produced) is appropriate to reflect the implementation of the latest technology, independent of the scale of production.

> *To determine the "Best in Class" values for **carbon direct emissions** for primary smelting and refining, the latest available (2021) carbon emission intensity performance data curves on global level, from a commercial data provider, have been taken as a reference. The 10 percentile position value would be considered as the "Best in Class" performance. The reason for choosing this threshold is because it would not be possible to refer to the EU ETS product benchmark approach. This is in turn due to absence of data from sufficient number of installations in EU, and due to the heterogeneous production routes and process configuration of the copper sector.*

The use of the parameter electricity consumption intensity (kWh/t of refined metal) is appropriate to reflect the performance of an operator in the efficient use of electricity.

> *The "Best in Class" value for **electricity consumption** for smelting would correspond to a position for flash smelters on or near to 10 percentile value in 2021, considering that flash smelters are much more efficient in carbon emissions as compared to other lower electricity consumption technology such as reverberatory furnaces. The "Best in Class" value for electricity consumption for refining would also correspond to 10 percentile position in 2021. Total emissions (direct and indirect) would be calculated using the current electricity grid factor of 265 g CO2e / kWh. This total emissions intensity value (CO2e kg/ton of refined copper) would be considered as "Best in Class" emissions intensity performance for 2021.*

The determination of an electricity grid factor of <100 g CO2e / MWh, is based on the advice by the TEG (Link, page 44), and is considered appropriate to promote the use of renewable or low carbon fossil free electricity.

In order to be aligned with Paris Agreement compliant linear transition trajectory, these total emissions in 2021 would need to reduce further by 40% before 2030, i.e. a reduction of > 4.4% per year. This is in alignment with the recommendations by Science Based Target Initiative (SBTI), i.e. companies can set near-term targets that reduce emissions at a linear annual rate of 4.2% (Link, page 15). Calculations have shown that, from the reference year of 2021, by decreasing direct emissions intensity by 17%, electricity consumption intensity by 17% and improving the electricity grid factor from the current level of 265 g CO2e / kWh to <100 g CO2e /kWh, as advised by TEG (Link, page 44) ensures a decrease of total emissions in 2021 of about 40% before 2030.

**Manufacturing of Copper - Secondary production**

While the non-ferrous metals production already processes a significant amount of secondary raw materials (e.g. pre-consumer metal scrap), a significant potential still exists to increase the recovery of metals from e.g. sludges and slags from metals production and post-consumer metals scrap. Enabling higher recovery of metals from these streams will reduce or limit Europe's import dependence for metals. Furthermore, better treatment of waste streams (which are often landfilled) can reduce the risk of hazardous materials entering the environment. (p45, Metals for Climate Neutral Europe)

Specifically for manufacturing of copper, using up to 70% secondary raw materials is expected to result in carbon emission saving of, on average, 61% for production using high grade scrap and 38% for production using low grade scrap or residues as compared to primary materials, including the emissions for mining as per LCA approach.

The recommendation to the use a grid factor lower than the EU Average in 2021 (<265 g CO2e / kWh) is expected to further promote the contribution to the reduction of indirect emissions during secondary processing.

DNSH criteria

The DNSH criteria proposed refer to those existing and applicable already in the Delegated Regulation (EU) 2021/2139 supplementing Regulation (EU) 2020/852.

# 4. Civil Engineering

## 4.3 Use of concrete in civil engineering works

*Description of the activity*

Building with concrete for new construction, reconstruction, or maintenance of civil engineering objects, except concrete road surfaces[199].

The activity is classified under NACE code F42 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. The criteria only apply where concrete is being used within the context of activities that fall within this NACE code classification.

Maintenance of civil engineering objects is defined as all actions undertaken to maintain and restore the structural health of the structures and thereby extend their service lives.

Demolition activities as classified under NACE code F43 are excluded from the scope of this activity.

*Substantial contribution to transition to a circular economy*

The activity complies with the following criteria:

1. At least 90 % (by weight) of the construction waste deriving from concrete products is prepared for re-use or recycling. The works must avoid down-cycling of materials, specifically the construction waste deriving from concrete products shall be prepared for re-use in new concrete products rather than being used as fill or other non-concrete uses.

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[199] Road surfaces are covered by activity 4.2: Maintenance of roads and motorways.

2. Construction designs and techniques support circularity by demonstrating how they are designed to be resource efficient, adaptable, flexible, and easy to dismantle in order to facilitate reuse and recycling. This should 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. Concrete products shall contain at least 60% recycled content[200]. This criterion applies to in-situ poured concrete, pre-cast products, and all constituent materials, including any reinforcement.

   Deviation from the 60% target is justified where the use of such recycled content leads to higher CO2 emissions than the use of virgin material. This is proven by calculating and comparing the CO2 emissions by a Life Cycle Analysis[201].
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 shall be stored in a digital logbook or equivalent and shall be made available to the owner of the asset.
5. Bridges, tunnels, dikes, and sluices shall be equipped with monitoring functions to predict maintenance needs such as in-built predictive maintenance.

| Do no significant harm (‘DNSH’) | |
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| (1) Climate change mitigation | The built asset is not dedicated to the extraction, storage, transport or manufacture of fossil fuels. |

[200] Recycled content shall be interpreted as defined in EN ISO 14021 section 7.8 and includes pre-consumer recycled content, post-consumer recycled content, recycled materials and recovered materials. For in-situ poured concrete, waste generated at the construction site is included in the definition of pre-consumer material and is not considered reutilisation (which is excluded from being defined as pre-consumer material under ISO 14021).

[201] The calculation is based on EN 17472 modules A1-A4. Alternatively, a third party verified embodied carbon calculator for concrete can be used.

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| | (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| | (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| | (5) Pollution prevention and control | Measures are taken to reduce noise, dust and pollutant emissions during construction works.<br><br>Where appropriate, given the sensitivity of the area affected, in particular in terms of the size of population affected, noise and vibrations from use of infrastructure are mitigated by introducing open trenches, wall barriers or other measures and comply with Directive 2002/49/EC |
| | (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| | Rationale | |
| | Environmental hotspots in civil engineering:<br><br>Construction has the highest raw material consumption when considering all types of materials together (1.8 billion tons) - mostly non-metallic minerals (Eurostat). No specific figures for civil engineering are available. However, an important share can be presumed as civil engineering represent around 20% of investment in construction (FIEC Statistical Report). Data from the Dutch NRA Rijkswaterstaat illustrate the composition of the materials used (in weight): 92% gravel and sand, | |

5% asphalt, 2% concrete, 1% metals (TNO). Equally, civil engineering works generate significant amount of waste. By way of illustration, among the construction segments in France, public works generate the highest amount of waste.

Therefore, substantial contribution can be achieved by:

- Improving resource efficiency at the design stage by taking into circularity principles and by using recycled or re-used content.
  - The 60% content for recycled and re-used concrete is based on best-in-class applications: Partition wall in underpass using 75% recycled concrete; Cycling bridge built from 100% recycled aggregates and geopolymers instead of cement as binder; Viaducts A20/N456 using 50% recycled concrete. Paving stones and roadblocks can be made from 90% recycled concrete aggregate. As an example, the Dutch Building Code recommends to use 50% recycled concrete aggregates for general application (excluding harsh environments). Up to 100% is allowed for specific applications and after a more rigorous assessment.
  - The calculation of CO2 emissions is necessary because the use of recycled material might have a larger CO2 footprint than the use of virgin raw materials in case it is transported over long distances.
- Increasing the maintainability/recyclability/re-usability by making available information about the built asset.
- Preventing the generation of waste during the construction process and during the lifetime of the asset by allowing for targeted and effective maintenance.

Achieving a high re-use or recycling or recovery rate of the waste generated. Due to a lack of data at activity level, the starting point for the criterion is Eurostat data referring to country data which is taken as a proxy. The choice of 90% is justified as in 2018, the EU recycled or prepared for re-use 79% of the treated mineral construction and demolition waste. The 90% will ensure a recycling/re-use rate which is close to 100% but still leaves flexibility for materials which at their end of

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| | life do not have the properties to be either recycled or re-used. A 90% rate will also signify a growth of the secondary materials market. |

# 5. Buildings

## 5.3 Demolition of buildings and other structures

*Description of the activity*

Activities listed by the International Cost Management Standard in the ICMS: Global Consistency in Presenting Construction Life Cycle Costs and Carbon Emissions 3rd edition, Table 1: ICMS Projects with their corresponding codes (page 16)202. In projects associated with the activities 5.1 Construction of New Buildings or 5.2 Renovation of existing buildings, where the demolition works and the new building or renovation works are procured under the same contract, the technical screening criteria for transition to a circular economy referenced in those activities will prevail.

| Substantial contribution to transition to circular economy: |
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| 1. Prior to the commencement of any demolition or wrecking activity, at least the following aspects from level 1 of the Level(s) indicator 2.2 checklist shall be discussed and agreed upon with the client: (i) definition of key performance indicators and target ambition level; (ii) identification of project-specific constraints that may compromise the ambition level (e.g. time, labour and space) and how to minimise these constraints; (iii) details of the pre-demolition auditing procedure and (iv) an outline waste management plan that prioritises selective deconstruction, decontamination and source separation of waste streams. If these actions are not prioritised, an explanation must be provided to justify why selective deconstruction, decontamination or source separation of waste streams are not feasible in the project. Cost or financial considerations are not an acceptable reason to avoid complying with this requirement.<br>2. To conduct a pre-demolition audit in accordance with the EU Demolition and Construction Waste Protocol and producing estimates using the level 2 DW (Demolition Waste) inventory excel worksheet of Level(s) indicator 2.2, or an equivalent tool.<br>3. All demolition waste generated during the project shall be treated in accordance with the EU Demolition and Construction Waste Protocol and logged using the level 3 CDW |

[202] https://icmscblog.files.wordpress.com/2021/11/icms_3rd_edition_final.pdf

excel worksheet of Level(s) indicator 2.2 or an equivalent tool. Each type of DW shall be tagged with the appropriate six-digit code from the European List of Waste established by Commission Decision 2000/532/EC. When logging the type of waste treatment (ie preparation for reuse, for recycling, material recovery, energy recovery or disposal) evidence shall be included that the economic operators receiving the waste has the technical capability to carry out this treatment. Such evidence could be a link to the company's webpages where this is documented or a signed statement from a representative of the company. If the treatment takes place on the demolition site (eg onsite reuse or recycling) then acceptable evidence would be a signed statement from a representative of the company.

4. Overall, at least 90 % (by weight) of the non-hazardous DW (excluding naturally occurring material referred to in category 17 05 04 in the European List of Waste established by Commission Decision 2000/532/EC) shall be prepared for re-use, for recycling or for closed-loop recycling[203]. Alternatively, at least 95% for mineral/stony fraction and 70% for the non-mineral/non-stony fraction for non-hazardous demolition waste shall be separately collected and prepared for reuse, or for recycled. In addition, organic and packaging waste generated during the dismantling process are prepared for reused or recycling in situ or ex situ (excluding backfilling) with the implementation of a sorting system to collect separately inert, organic, packaging and hazardous materials handled during the dismantling process.

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Do no significant harm ('DNSH')

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| (1) Climate change mitigation | |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |

[203] Definition developed at CEN: Process in which post-consumer or industrial waste is collected and recycled preserving the value of the material so it can be used again to make the same product category it came from with minimal loss of quality of function. Source: 3.56 – horizontal terminology standard developed by CEN/TC 249/WG24.

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| (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| (5) Pollution prevention and control | Measures are taken to reduce noise, dust and pollutant emissions during demolition works. |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| Rationale | |
| Substantial contribution<br>• Construction and Demolition Waste is the largest waste stream in the EU in terms of mass (374 million tonnes in the EU-28, in 2016, excluding excavated soil). Most of it is waste resulting from the demolition of built assets, while waste from construction activities represent a minor share.<br>• A qualitative and quantitative approach to the planning and management of demolition activities can ensure that built assets serve as source for secondary materials instead of waste.<br>• The approach defined for demolition activities is in line with the EU Demolition and Construction Waste Protocol and the progressive order of levels 1, 2 and 3 of Level(s) indicator 2.2 on construction and demolition waste. Early planning, a pre-demolition audit and an outline waste management plan prior to the commencement of demolition activities ensure that hazardous materials can be selectively removed and that different waste streams can be segregated onsite prior to shipment. These measures allow for reuse and closed-loop recycling rates to be maximised.<br>• An ambition level of 90% was proposed focusing on preparation for reuse, for recycling and for closed-loop recycling. Due to a lack of data at activity level, national level Eurostat data is taken as a proxy. The choice of 90% is justified due to the fact that the EU recycled or prepared for re-use 79% of the treated mineral construction and demolition waste in 2018. The 90% rate thus ensures that recycling/re-use rates move towards 100%, but still leaves flexibility to deal with materials which, at their end of life, do not have suitable properties to be either recycled or re-used.<br>• Backfilling, which is generally the most convenient approach for operators handling DW, does not contribute to the 90% target in order to oblige operators to seek out reuse markets and recyclers, thus pushing DW higher up the waste hierarchy and | |

helping the secondary materials market to grow. The exclusion of backfilling is further justified due to the fact that excavated soil and stones, precisely the wastes that are most suitable for backfilling, are excluded from the scope of the 90% target.

- The further distinction in requirements on mineral/stony and non-mineral/non-stony fractions for non-hazardous DW is based on studies revealing that total quantities of DW are dominated by the mineral/stony fraction (accounting for approximately 92-96% of total DW), and that very high recyclability rates exist for a number of mineral/stony fractions (e.g. 99% for concrete; 98% for masonry; 97% for asphalt). Consequently, an overall recycling and reuse target of 90% could potentially be complied with even though recycling and reuse rates could be 0% for the non-mineral/non-stony fraction. Hence the reason for introducing a separate minimum requirement for the non-mineral / non-stony fraction. The 70% for the non-mineral/non-stony fraction is based on the current target from the Waste Directive.
- Commission Regulation 849/2010 amending Regulation 2150/2002, Annex III Table of Equivalence should be consulted for the categorization of the non-hazardous DW waste streams into mineral and non-mineral. For the purpose of this set of criteria, mineral waste is considered the non-hazardous waste falling in category 12.1 of the Annex III.

DNSH criteria

- Risks for climate change mitigation stemming from the demolition of built assets are linked to the whole life carbon emission of materials. This aspect is already covered by the EUCDW Protocol and Level(s) in the use of the secondary materials in another chapter. Therefore, no additional criterion is relevant here.
- The demolition as an activity itself does not pose risks to climate change adaptation. Of greater relevance would be what is done with the land after the demolition works, which is beyond the scope of this particular economic activity.

For the other environmental objectives, the criteria have been aligned with the DNSH criteria from the first delegated act as these already reflect the risks that can be associated with demolition activities.

# 6. Transport

Note: The activities listed in this section - specifically in relation to water transport are already covered by the Climate Delegated Act. It was agreed with the Commission that amendments to these criteria could be proposed to address specifically the climate change mitigation requirements post 2025. As such, these activities are presented in an abridged format, with only the amendments noted explicitly. The numbering of these criteria therefore relate directly to those in the Climate Delegated Act, not to the TWG March 2022 publication and thus differ from other criteria presented in this report.

## 3.3 Manufacture of low carbon technologies for water transport

***Note,*** *this activity is already covered by the Climate Delegated Act (Activity 3.3. Manufacture of low carbon technologies for transport) and the recommendations made here are for inclusion of amendments to those criteria to bring it in line with the developed thinking around pollution prevention and control and how this relates to the climate mitigation objective.*

*Description of the activity*

Manufacture, repair, maintenance, retrofitting, repurposing and upgrade of low carbon transport vehicles, rolling stock and vessels.

The economic activities in this category could be associated with several NACE codes, in particular C29.1, C30.1, C30.2, C30.9, C33.15, C33.17 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

An economic activity in this category is an enabling activity in accordance with Article 10(1), point (i), of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to climate change mitigation |
| --- |

The economic activity manufactures, repairs, maintains, retrofits[204], repurposes or upgrades: (...)

(j) inland passenger water transport vessels that :

(i) have zero direct (tailpipe) $CO_2$ emissions;
(ii) until 31 December 2025, are hybrid and dual fuel vessels using at least 50 % of their energy from zero direct (tailpipe) $CO_2$ emission fuels or plug-in power for their normal operation;
(iii – new) are able to derive 100% of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis, have the ability to plug-in at berth and are equipped with plug-in power technology;

(k) inland freight water transport vessels, not dedicated to transporting fossil fuels, that:

(i) have zero direct (tailpipe) $CO_2$ emission;
(ii) until 31 December 2025, have direct (tailpipe) emissions of $CO_2$ per tonne kilometre ($gCO_2/tkm$), calculated (or estimated in case of new vessels) using the Energy Efficiency Operational Indicator[85], 50 % lower than the average reference value for emissions of $CO_2$ defined for heavy duty vehicles (vehicle subgroup 5-LH) in accordance with Article 11 of Regulation (EU) 2019/1242;
(iii – new) are able to derive 100% of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis, have the ability to plug-in at berth and are equipped with plug-in power technology;

(l) sea and coastal freight water transport vessels, vessels for port operations and auxiliary activities, that are not dedicated to transporting fossil fuels, that :

(i) have zero direct (tailpipe) $CO_2$ emissions;
(ii) until 31 December 2025, are hybrid and dual fuel vessels that derive at least 25 % of their energy from zero direct (tailpipe) $CO_2$ emission fuels or plug-in power for their normal operation at sea and in ports;
(iii) until 31 December 2025, and only where it can be proved that the vessels are used exclusively for operating coastal and short sea services designed to enable modal shift of freight currently transported by land to sea, the vessels that have direct (tailpipe) $CO_2$ emissions, calculated using the International Maritime Organization (IMO) Energy Efficiency Design Index (EEDI)[86], 50 % lower than the average reference $CO_2$ emissions value defined for heavy duty vehicles (vehicle subgroup 5-LH) in

[204] For points (j) to (m), the criteria related to retrofitting are covered in Sections 6.9 and 6.12 of this Annex.

accordance with Article 11 of Regulation (EU) 2019/1242;

(iv) until 31 December 2025, the vessels have an attained Energy Efficiency Design Index (EEDI) value 10 % below the EEDI requirements applicable on 1 April 2022[87] if the vessels are able to run on zero direct (tailpipe) CO2 emission fuels or on fuels from renewable sources;

(v - new) until 31 December 2030, the vessels have an attained Energy Efficiency Design Index (EEDI) value at least 20% (container ships and general cargo ships only) or 10% (other ship types) below the EEDI requirements applicable on 1 April 2022, and are able to derive 100% of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis, and have the ability to plug-in at berth.

(m) sea and coastal passenger water transport vessels that :

(i) have zero direct (tailpipe) CO2 emissions;

(ii) until 31 December 2025, hybrid and dual fuel vessels derive at least 25 % of their energy from zero direct (tailpipe) CO2 emission fuels or plug-in power for their normal operation at sea and in ports;

(iii) until 31 December 2025, the vessels have an attained Energy Efficiency Design Index (EEDI) value 10 % below the EEDI requirements applicable on 1 April 2022 if the vessels are able to run on zero direct (tailpipe) CO2 emission fuels or on fuels from renewable sources[89].

(iv - new) until 31 December 2030 the vessels have an attained Energy Efficiency Design Index (EEDI) value at least 20% below the EEDI requirements applicable on 1 April 2022, and are able to derive 100% of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis and have the ability to plug-in at berth.

## 6.7. Inland passenger water transport

***Note,** this activity is already covered by the Climate Delegated Act (Activity 6.7 Inland passenger water transport) and the recommendations made here are for inclusion of amendments to those criteria to bring it in line with the developed thinking around pollution prevention and control and how this relates to the climate mitigation objective.*

*Description of the activity*

Purchase, financing, leasing, rental and operation of passenger vessels on inland waters, involving vessels that are not suitable for sea transport. The economic activities in this category could be associated with NACE code H50.30 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. Where an economic activity in this category does not fulfil the substantial contribution criterion specified in point (a) of this Section, the activity is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852, provided it complies with the remaining technical screening criteria set out in this Section.

| Substantial contribution to Climate change mitigation |
| --- |
| The activity complies with one or more of the following criteria[205]:<br><br>(a) the vessels have zero direct (tailpipe) $CO_2$ emission;<br><br>(b) until 31 December 2025, hybrid and dual fuel vessels derive at least 50% of their energy from zero direct (tailpipe) $CO_2$ emission fuels or plug-in power for their normal operation. |

[205] *The criteria refer to operational requirements. The requirements are covenanted in the financial and contractual agreements between financial institutions/asset and owners/operators and reported ex post minimum annually. Fulfilling of the operational criteria will be evidenced via relevant policies and procedures by vessels operators, or via relevant contractual obligations on the vessels charters/ operators posed by vessel owners.*

(c – new) The yearly average greenhouse gas intensity of the energy used on-board by a ship or a company's fleet during a reporting period[206] shall not exceed the limits set below:

- 76.4 gCO2e/MJ from 1 January 2025;
- 61.1 gCO2e/MJ from 1 January 2030;
- 45.8gCO2e/MJ from 1 January 2035;
- 30.6 gCO2e/MJ from 1 January 2040;
- 15.3 gCO$^2$e/MJ from 1 January 2045;
- XgCO2e/MJ from 1 January 2050.

(d – new) Vessels derive 100% of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis

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[206] *The greenhouse gas intensity of the energy used on-board by a ship shall be calculated as the amount of greenhouse gas emissions per unit of energy according to the methodology and default values specified in Annexes I and II below. From the date of entry into force of the FuelEU Maritime Regulation, these Annexes should be updated accordingly.*

## 6.8. Inland freight water transport

***Note,** this activity is already covered by the Climate Delegated Act (Activity 6.8 Inland freight water transport) and the recommendations made here are for inclusion of amendments to those criteria to bring it in line with the developed thinking around pollution prevention and control and how this relates to the climate mitigation objective.*

*Description of the activity*

Purchase, financing, leasing, rental and operation of freight vessels on inland waters, involving vessels that are not suitable for sea transport. The economic activities in this category could be associated with several NACE code H50.4 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. Where an economic activity in this category does not fulfil the substantial contribution criterion specified in point (a) of this Section, the activity is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852, provided it complies with the remaining technical screening criteria set out in this Section.

| Substantial contribution to Climate change mitigation |
| --- |
| 1. The activity complies with one or more of the following criteria[207]:<br><br>(a) the vessels have zero direct (tailpipe) $CO_2$ emission;<br><br>(b) where technologically and economically not feasible to comply with the criterion in point (a), until 31 December 2025, the vessels have direct (tailpipe) emissions of $CO_2$ per tonne kilometer ($gCO_2/tkm$), calculated (or estimated in case of new vessels) using the Energy Efficiency Operational Indicator[245], 50% lower than the average reference value for emissions of $CO_2$ defined for heavy duty vehicles (vehicle subgroup 5- LH) in accordance with Article 11 of Regulation 2019/1242. |

[207] The criteria refer to operational requirements. The requirements are covenanted in the financial and contractual agreements between financial institutions/asset and owners/operators and reported ex post minimum annually. Fulfilling of the operational criteria will be evidenced via relevant policies and procedures by vessels operators, or via relevant contractual obligations on the vessels charters/ operators posed by vessel owners.

(c – new) The yearly average greenhouse gas intensity of the energy used on-board by a ship or a company's fleet during a reporting period[208] shall not exceed the limits set below:

- 76.4 $gCO_2e/MJ$ from 1 January 2025;
- 61.1 $gCO_2e/MJ$ from 1 January 2030;
- 45.8$gCO_2e/MJ$ from 1 January 2035;
- 30.6 $gCO_2e/MJ$ from 1 January 2040;
- 15.3 $gCO^2e/MJ$ from 1 January 2045;
- X$gCO_2e/MJ$ from 1 January 2050.

(d – new) Vessels derive 100% of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis

2) Vessels are not dedicated to the transport of fossil fuels.

[208] *The greenhouse gas intensity of the energy used on-board by a ship shall be calculated as the amount of greenhouse gas emissions per unit of energy according to the methodology and default values specified in Annexes I and II below. From the date of entry into force of the FuelEU Maritime Regulation, these Annexes should be updated accordingly.*

## 6.9. Retrofitting of inland water passenger and freight transport

***Note,*** *this activity is already covered by the Climate Delegated Act (Activity 6.9. Retrofitting of inland water passenger and freight transport) and the recommendations made here are for inclusion of amendments to those criteria to bring it in line with the developed thinking around pollution prevention and control and how this relates to the climate mitigation objective.*

*Description of the activity*

Retrofit and upgrade of vessels for transport of freight or passengers on inland waters, involving vessels that are not suitable for sea transport. The economic activities in this category could be associated several NACE codes, in particular H50.4, H50.30 and C33.15 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. An economic activity in this category is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to Climate change mitigation |
| --- |
| 1. The retrofitting activity achieves one or more of the following:<br><br>a) ***Reduces*** fuel consumption of the inland ***passenger*** vessel by at least ***15 %*** expressed ***per unit of energy*** per ***complete journey (full passenger cruise)***, as demonstrated by a comparative calculation for the representative navigation areas (including representative load profiles ***and docking***) in which the vessel is to operate or by means of the results of model tests or simulations.<br><br>a 1 (new) Reduces fuel consumption of the inland freight vessel by at least 15 % expressed per unit of energy per tonne kilometer, as demonstrated by a comparative calculation for the representative navigation areas (including representative load profiles) in which the vessel is to operate or by means of the results of model tests or simulations.<br><br>b) (new) enables vessels to derive 100 % of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis, have the ability to plug-in at berth and are equipped with plug-in power technology; |

2. Vessels retrofitted or upgraded are not dedicated to the transport of fossil fuels

## 6.10 Sea and coastal freight water transport, vessels for port operations and auxiliary activities

***Note,*** *this activity is already covered by the Climate Delegated Act (Activity* 6.10. Sea and coastal freight water transport, vessels for port operations and auxiliary activities) *and the recommendations made here are for inclusion of amendments to those criteria to bring it in line with the developed thinking around pollution prevention and control and how this relates to the climate mitigation objective.*

*Description of the activity*

Purchase, financing, **c**hartering (with or without crew) and operation of vessels designed and equipped for transport of freight or for the combined transport of freight and passengers on sea or coastal waters, whether scheduled or not.

Purchase, financing, renting and operation of vessels required for port operations and auxiliary activities, such as tugboats, mooring vessels, pilot vessels, salvage vessels and ice-breakers.

The economic activities in this category could be associated with several NACE codes, in particular H50.2, H52.22 and N77.34 ~~and N77.34~~ in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. Where an economic activity in this category does not fulfil the substantial contribution criterion specified in point 1 (a) of this Section, the activity is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852, provided it complies with the remaining technical screening criteria set out in this Section.

| Substantial contribution to climate change mitigation |
| --- |
| 1. The activity complies with one or more of the following ***criteria***[209]:<br>***(a)*** the vessels have zero direct (tailpipe) $CO_2$ emissions; |

[209] *The criteria refer to operational requirements. The requirements are covenanted in the financial and contractual agreements between financial institutions/asset and owners/operators and reported ex post minimum annually. Fulfilling of the operational criteria will be evidenced via relevant policies and procedures by vessels operators, or via relevant contractual obligations on the vessels charters/ operators posed by vessel owners.*

***(b)*** until 31 December 2025, hybrid and dual fuel vessels derive at least 25 % of their energy from zero direct (tailpipe) CO2 emission fuels or plug-in power for their normal operation at sea and in ports;

***(c)*** where technologically and economically not feasible to comply with the criterion in point (a), until 31 December 2025, and only where it can be proved that the vessels are used exclusively for operating coastal and short sea services designed to enable modal shift of freight currently transported by land to sea, the vessels have direct (tailpipe) CO2 emissions, calculated using the International Maritime Organization (IMO) Energy Efficiency Design Index (EEDI)[246], 50 % lower than the average reference CO2 emissions value defined for heavy duty vehicles (vehicle sub group 5- LH) in accordance with Article 11 of Regulation 2019/1242;

***(d)*** where technologically and economically not feasible to comply with the criterion in point (a), until 31 December 2025, the vessels have an attained Energy Efficiency Design Index (EEDI) value 10 % below the EEDI requirements applicable on 1 April 2022[247] if the vessels are able to run on zero direct (tailpipe) CO2 emission fuels or on fuels from renewable sources[248].

***(e – new) The yearly average greenhouse gas intensity of the energy used on-board by a ship or a company's fleet during a reporting period[210] shall not exceed the limits set below:***

***- 76.4 gCO2e/MJ from 1 January 2025;***

***- 61.1 gCO2e/MJ from 1 January 2030;***

***- 45.8gCO2e/MJ from 1 January 2035;***

***- 30.6 gCO2e/MJ from 1 January 2040;***

***- 15.3 $gCO^2e$/MJ from 1 January 2045;***

***- XgCO2e/MJ from 1 January 2050.***

***(f – new) Vessels derive 100% of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis***

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210 *The greenhouse gas intensity of the energy used on-board by a ship shall be calculated as the amount of greenhouse gas emissions per unit of energy according to the methodology and default values specified in Annexes I and II below. From the date of entry into force of the FuelEU Maritime Regulation, these Annexes should be updated accordingly.*

***2)*** Vessels are not dedicated to the transport of fossil fuels.

## ANNEX I

### METHODOLOGY FOR ESTABLISHING THE GREENHOUSE GAS INTENSITY LIMIT ON THE ENERGY USED ON-BOARD BY A SHIP

For the purpose of calculating the greenhouse gas intensity limit of the energy used on-board a ship, the following formula, referred to as Equation (1) shall apply:

| GHG intensity index | WtT | TtW |
|---|---|---|
| $GHG\ intensity\ index\left[\frac{gCO2eq}{MJ}\right] =$ | $\frac{\sum_i^{n\,fuel} M_i \times CO_{2eq\,WtT,i} \times LCV_i + \sum_k^c E_k \times CO_{2eq\,electricity,k}}{\sum_i^{n\,fuel} M_i \times LCV_i + \sum_k^c E_k}$ | $+\frac{\sum_i^{n\,fuel}\sum_j^{m\,engine} M_{i,j} \times \left[\left(1-\frac{1}{100}C_{engine\,slip\,j}\right)\times\left(CO_{2eq,TtW,j}\right)+\left(\frac{1}{100}C_{engine\,slip\,j} \times CO_{2eq\,TtW,slippage,j}\right)\right]}{\sum_i^{n\,fuel} M_i \times LCV_i + \sum_k^l E_k}$ |

Equation (1)

where the following formula is referred to as Equation (2):

$$CO_{2eq,TtW,j} = \left(C_{f\,CO_2,j} \times GWP_{CO_2} + C_{f\,CH_4,j} \times GWP_{CH_4} + C_{f\,N_2O,j} \times GWP_{N_2O}\right)_i$$ Equation (2)

| Term | Explanation |
|---|---|
| $i$ | Index corresponding to the fuels delivered to the ship in the reference period |
| $j$ | Index corresponding to the fuel combustion units on board the ship. For the purpose of this Regulation the units considered are the main engine(s), auxiliary engine(s) and fired oil boilers |
| $k$ | Index corresponding to the connection points ($c$) where electricity is supplied per connection point. |
| $c$ | Index corresponding to the number of electrical charging points |
| $m$ | Index corresponding to the number of energy consumers |
| $M_{i,j}$ | Mass of the specific fuel $i$ oxidised in consumer $j$ [gFuel] |
| $E_k$ | Electricity delivered to the ship *per* connection point $k$ if more than one [MJ] |
| $CO_{2eq\ WtT,i}$ | WtT GHG emission factor of fuel $i$ [g$CO_{2eq}$/MJ] |
| $CO_{2eq\ electricity,k}$ | WtT GHG emission factor associated to the electricity delivered to the ship at berth *per* connection point $k$ [g$CO_{2eq}$/MJ] |
| $LCV_i$ | Lower Calorific Value of fuel $i$ [MJ/gFuel] |
| $C_{engine\ slip\ j}$ | Engine fuel slippage (non-combusted fuel) coefficient as a percentage of the mass of the fuel $i$ used by combustion unit $j$ [%] |
| $C_{f\ CO_2,j}, C_{f\ CH_4,j}, C_{f\ N_2O,j}$ | TtW GHG emission factors by combusted fuel in combustion unit $j$ [gGHG/gFuel] |
| $CO_{2eq,TtW,j}$ | TtW $CO_2$ equivalent emissions of combusted fuel $i$ in combustion unit $j$ [g$CO_2$eq/gFuel] $$CO_{2eq,TtW,j} = \left(C_{cf\ CO_2,j} \times GWP_{CO_2} + C_{cf\ CH_4,j} \times GWP_{CH_4} + C_{cf\ N_2O,j} \times GWP_{N_2O}\right)_i$$ |
| $C_{sf\ CO_2,j}, C_{sf\ CH_4,j}, C_{sf\ N_2O,j}$ | TtW GHG emissions factors by slipped fuel towards combustion unit $j$ [gGHG/gFuel] |
| $CO_{2eq,TtWslippage,j}$ | TtW $CO_2$ equivalent emissions of slipped fuel $i$ towards combustion unit $j$ [g$CO_2$eq/gFuel] $$CO_{2eq,TtW\ slippage,j} = \left(C_{sf\ CO_2,j} \times GWP_{CO_2} + C_{sf\ CH_4,j} \times GWP_{CH_4} + C_{sf\ N_2O,j} \times GWP_{N_2O}\right)_i$$ |
| $GWP_{CO_2}, GWP_{CH_4}, GWP_{N_2O}$ | $CO_2$, $CH_4$, $N_2O$ Global Warming Potential over 100 years |

In the case of fossil fuels, the default values in Annex II shall be used.

For the purpose of this regulation the term $\sum_k^c E_k \times CO_{2eq\ electricity,k}$ in the numerator of Equation (1) shall be set to zero.

**Method for determining [$M_i$]**

The [$M_i$] mass of fuel shall be determined using the amount reported in accordance with the framework of the reporting under Regulation (EU) 2015/757 for voyages falling within the scope of this Regulation based on the chosen monitoring methodology by the company.

**Method for determining WtT GHG factors**

For non-fossil fuels, wherever values different from the default values in Annex II are used, these shall be based on relevant Bunker Delivery Notes (BDNs), for the fuels delivered to the ship in the reference period, for at least equal quantities of fuels as the one determined as being consumed in scope of the regulated journey in accordance with point A.

The WtT GHG ($CO_{2eq\ WtT,i}$) of the fuels (which are not fossils fuels) are established in Directive (EU) 2018/2001. The actual values, contained in the Directive that shall be used for the purpose of this Regulation, in accordance with the methodology, are those without combustion[1]. For those fuels for which pathways are not included in the Directive and for fossil fuels, the WtT GHG emission factors ($CO_{2eq\ WtT,i}$) default values are contained in Annex II.

**Fuel Bunker Delivery Note (BDN)**

For the purposes of this regulation, relevant BDNs of fuels used on board shall contain at least the following information:

- product identification
- fuel mass [t]
- fuel volume [$m^3$]
- fuel density [$kg/m^3$]
- WtT GHG emission factor for $CO_2$ (carbon factor) [$gCO_2/gFuel$] and for $CO_{2eq}$ [$gCO_{2eq}/gFuel$] and related certificate[2]
- Lower Calorific Value [MJ/g]

**BDN Electricity**

For the purposes of this regulation, relevant BDNs for electricity delivered to the ship shall contain at least the following information:

– supplier: name, address, telephone, email, representative

– receiving ship: IMO number (MMSI), ship name, ship type, flag, ship representative

– port: name, location (LOCODE), terminal/ berth

– connection point: OPS-SSE connection point, connection point details

1 Reference is made to Directive (EU) 2018/2001, Annex V.C.1.(a) to the term $e_u$ 'emissions from the fuel in use'

2 This value is not required in case of fossil fuels referred to in Annex II. For all other fuels, including blends of fossil fuels, this value should be made available together with a separate certificate identifying the fuel production pathway.

– connection time: date/time of commencement/finalisation

– energy supplied: power fraction allocated to supply point (if applicable) [kW], electricity consumption (kWh) for the billing period, peak power information (if available)

– metering

**Method for determining TtW GHG factors**

The TtW emissions are determined on the basis of the methodology contained in this Annex as provided in Equation (1) and Equation (2)

For the purpose of this Regulation, the TtW GHG emission factors ( $CO_{2eq,TtW,j}$ ) that shall be used to determine the GHG emissions are contained in Annex II. The $CO_2$ $C_f$ factors shall be the ones established in Regulation (EU) 2015/757 and are reported in the Table for easy reference. For fuels whose factors are not included in the said regulation, default factors as contained in Annex II shall be used.

In accordance with its compliance plan referred to in Article 6 and upon assessment by the verifier, other methods, such as direct $CO_{2eq}$ measurement, laboratory testing, may be used if it enhances the overall accuracy of the calculation.

**Method for determining TtW fugitive emissions**

Fugitive emissions are emissions caused by the amount of fuel that does not reach the combustion chamber of the combustion unit or that is not consumed by the energy converter because they are uncombusted, vented, or leaked from the system. For the purpose of this Regulation, fugitive emissions are taken into account as a percentage of the mass of the fuel used by the engine. The default values are contained in Annex II.

**Methods for determining the reward factors linked to substitute sources of energy**

In case substitute sources of energy are installed on board, a reward factor for substitut sources of energy can be applied. In case of wind power such reward factor is determined a follow:

| Reward factor for substitute sources of energy- WIND ($f_{wind}$) | $\frac{P_{Wind}}{P_{Tot}}$ |
|---|---|
| 0,99 | 0,1 |
| 0,97 | 0,2 |
| 0,95 | $\geqslant$ 0,3 |

The ship GHG intensity index is then calculated by multiplying the result of Equation (1) b the reward factor.

**Verification and Certification**

| **Fuel Class** | **WtT** | **TtW** |
|---|---|---|
| Fossil | Default values shall be used as provided in Table 1 of this Regulation | MRV Regulation $CO_2$ carbon factors shall be used for fuels for which such factor is provided |

| | | |
|---|---|---|
| | | For all other emissions factors, default values can be used as provided in Table 1 of this Regulation, alternatively<br><br>Certified values by mean of laboratory testing or direct emissions measurements |
| Sustainable Renewable Fuels<br><br>(Bio Liquids, Bio Gases, e-Fuels) | $CO_{2eq}$ values as provided in RED II (without combustion) can be used for all fuels whose pathways are included in RED II, alternatively<br><br>RED II approved certification scheme can be used | Emissions factors, default values can be used as provided in Table 1 of this Regulation, alternatively<br><br>Certified values by mean of laboratory testing or direct emissions measurements. |
| Others (including electricity) | $CO_{2eq}$ values as provided in RED II (without combustion) can be used for all fuels whose pathways are included in RED II, alternatively<br><br>RED II approved certification scheme can be used | Emissions factors, default values can be used as provided in Table 1 of this Regulation, alternatively<br><br>Certified values by mean of laboratory testing or direct emissions measurements. |

# ANNEX II

The emissions factors for fossils fuels contained in this Annex shall be used for the determination of the greenhouse gas intensity index referred to in Annex I of this Regulation.

The emissions factors of biofuels, biogas, renewable fuels of non-biological origin and recycled carbon fuels shall be determined according to the methodologies set out in Annex 5 part C of Directive (EU) 2018/2001.

In the table:

– TBM stands for To Be Measured
– N/A stands for Not Available
– The dash means not applicable

## Table 1 – Default factors

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| | WtT | | | TtW | | | | |
| **Class / Feedstock** | **Pathway name** | $LCV$ $\left[\frac{MJ}{g}\right]$ | $CO_{2eq\,WtT}$ $\left[\frac{gCO2eq}{MJ}\right]$ | **Energy Converter Class** | $C_{f\,CO_2}$ $\left[\frac{gCO2}{gFuel}\right]$ | $C_{f\,CH_4}$ $\left[\frac{gCH_4}{gFuel}\right]$ | $C_{f\,N_2O}$ $\left[\frac{gN_2O}{gFuel}\right]$ | $C_{slip}$ As % of the mass of the fuel used by the engine |
| Fossil | HFO ISO 8217 Grades RME to RMK | 0,0405 | 13,5 | ALL ICEs | 3,114 MEPC245 (66) Regulation (EU) 2015/757 | 0,00005 | 0,00018 | - |
| | | | | Gas Turbine | | | | |
| | | | | Steam Turbines and Boilers | | | | |
| | | | | Aux Engines | | | | |
| | LSFO | 0,0405 | 13,2, crude 13,7 blend | ALL ICEs | 3,114 | 0,00005 | 0,00018 | - |
| | | | | Gas Turbine | | | | |
| | | | | Steam Turbines and Boilers | | | | |
| | | | | Aux Engines | | | | |
| | ULSFO | 0,0405 | 13,2 | ALL ICEs | 3,114 | 0,00005 | 0,00018 | - |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| | WtT | | | TtW | | | | |
| | VLSFO | 0,041 | 13,2 | ALL ICEs | 3,206<br>MEPC245 (66)<br>MRV Regulation | 0,00005 | 0,00018 | - |
| | LFO<br>ISO 8217 Grades RMA to RMD | 0,041 | 13,2 | ALL ICEs | 3,151<br>MEPC245 (66)<br>Regulation (EU) 2015/757 | 0,00005 | 0,00018 | - |
| | MDO<br>MGO<br>ISO 8217 Grades DMX to DMB | 0,0427 | 14,4 | ALL ICEs | 3,206<br>MEPC245 (66)<br>Regulation (EU) 2015/757 | 0,00005 | 0,00018 | - |
| | LNG | 0,0491 | 18,5 | LNG Otto (dual fuel medium speed) | 2,755<br>MEPC245 (66)<br>Regulation (EU) 2015/757 | 0 | 0,00011 | 3,1 |
| | | | | LNG Otto (dual fuel slow speed) | | | | 1,7 |
| | | | | LNG Diesel (dual fuel slow speed) | | | | 0.2 |
| | | | | LBSI | | | | N/A |
| | LPG | 0,046 | 7,8 | All ICEs | 3,03 Buthane<br>3,00 Propane<br>MEPC245 (66)<br>Regulation (EU) 2015/757 | TBM | TBM | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| | WtT | | | TtW | | | | |
| | H2 (natural gas) | 0,12 | 132 | Fuel Cells | 0 | 0 | - | - |
| | | | | ICE | 0 | 0 | TBM | |
| | NH3 (natural gas) | 0,0186 | 121 | No engine | 0 | 0 | TBM | - |
| | Methanol (natural gas) | 0,0199 | 31,3 | All ICEs | 1,375 MEPC245 (66) Regulation (EU) 2015/757 | TBM | TBM | - |
| **Liquid biofuels** | Ethanol E100 | 0,0268 | Ref. to Directive (EU) 2018/2001 | All ICEs | 1,913 MEPC245 (66) Regulation (EU) 2015/757 | TBM | TBM | - |
| | Bio-diesel Main products / wastes / Feedstock mix | 0,0372 | Ref. to Directive (EU) 2018/2001 | ALL ICEs | 2,834 | 0,00005 TBM | 0,00018 TBM | - |
| | HVO Main products / wastes / Feedstock mix | 0,044 | Ref. to Directive (EU) 2018/2001 | ALL ICEs | 3,115 | 0,00005 | 0,00018 | - |
| | Bio-LNG Main products / wastes / Feedstock mix | 0,05 | Ref. to Directive (EU) 2018/2001 | LNC Otto (dual fuel medium speed) | 2,755 MEPC245 (66), Regulation (EU) 2015/757 | 0,00005 | 0,00018 | 3,1 |
| | | | | LNG Otto (dual fuel slow speed) | | | | 1,7 |
| | | | | LNG Diesel (dual fuels) | | | | 0.2 |
| | | | | LBSI | | | | N/A |
| **Gas biofuels** | Bio-H2 Main products / wastes / Feedstock mix | 0,12 | N/A | Fuel Cells | 0 | 0 | 0 | - |
| | | | | ICE | 0 | 0 | TBM | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Renewable Fuels of non-Biological Origin (RFNBO) - (e- fuels)** | e-diesel | 0,0427 | Ref. to Directive (EU) 2018/2001) | ALL ICEs | 3,206 MEPC245 (66) Regulation (EU) 2015/757 | 0,00005 | 0,00018 | - |
| | e-methanol | 0,0199 | Ref. to Directive (EU) 2018/2001 | All ICEs | 1,375 MEPC245 (66) Regulation (EU) 2015/757 | 0,00005 | 0,00018 | - |
| | e-LNG | 0,0491 | Ref. to Directive (EU) 2018/2001 | LNG Otto (dual fuel medium speed) | 2,755 MEPC245 (66) Regulation (EU) 2015/757 | 0 | 0,00011 | 3.1 |
| | | | | LNG Otto (dual fuel slow speed) | | | | 1,7 |
| | | | | LNG Diesel (dual fuels) | | | | 0.2 |
| | | | | LBSI | | | | N/A |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| | WtT | | | TtW | | | | |
| | e-H2 | 0,12 | 3,6 | Fuel Cells | 0 | 0 | 0 | - |
| | | | | ICE | 0 | 0 | TBM | |
| | e-NH3 | 0,0186 | 0 | No engine | 0 | N/A | TBM | N/A |
| **Others** | Electricity | - | 106,3 EU MIX 2020 72 EU MIX 2030 | OPS | - | - | - | - |

Column 1 identifies the class of the fuels namely Fossils, Liquid Biofuels, Gaseous Biofuels, e-Fuels;

Column 2 identifies the name or the pathway of the relevant fuels within the class. For the Liquid Biofuels, Gaseous Biofuels, RFNBO (e-Fuels) the values for the WtT section shall be taken from Directive (EU) 2018/2001 (without combustion[3]); for fossils fuels only the default values in the table shall be used.

Column 3 contains the Lower Calorific Value of the fuels expressed in [MJ/g].

Column 4 contains the $CO_{2eq}$ emissions values in [$gCO_{2eq}/MJ$]. For fossils fuels only the default values in the table shall be used. For all other fuels, (except were expressly indicated), values shall be calculated by using the methodology or the default values as per in Directive (EU) 2018/2001 deducted of the combustion emissions considering full oxidation of the fuel[4].

Column 5 identifies the main types/classes of energy converters such as 2 and 4 strokes Internal Combustion Engines (ICE) Diesel or Otto cycle, gas turbines, fuels cells etc.

Column 6 contains the emission factor $C_f$ for $CO_2$ in [$gCO_2$/gfuel]. Emissions factors values as specified in the Regulation (EU) 2015/757 (or IMO MEPC245 (66) as amended) shall be used. For all those fuels not contained in Regulation (EU) 2015/757, the default values contained in the table should be used. Values certified by a by a trusted certifier (under the relevant provisions made in Directive (EU) 2018/2001) can be used in place of the default values.

Column 7 contains the emission factor $C_f$ for methane in [$gCH_4$/gfuel]. Default values as contained in the table shall be used. Values certified by mean of testing can be used in place of the default values. For LNG fuels $C_f$ for methane are set to zero.

[3] Reference is made to Directive (EU) 2018/2001, Annex V.C.1.(a) to the term $e_u$ 'emissions from the fuel in use'.

[4] Reference is made to Directive (EU) 2018/2001, Annex V.C.1.(a) to the term $e_u$ 'emissions from the fuel in use'

Column 8 contains the emission factor $C_f$ for nitrous oxide in [$gN_2O$/gfuel]. Default values as contained in the table shall be used. Values certified by mean of testing can be used in place of the default values.

Column 9 identifies the part of fuel lost as fugitive emissions ($C_{slip}$) measure as % of mass of fuel used by the specific energy converter. Default values as contained in the table shall be used. Values certified by mean of testing can be used in place of the default values. For fuels such as LNG for which the fugitive emissions (slip) exists, the amount of fugitive emissions as presented in Table 1 is expressed in % of the mass of fuel used (Column 9). The values contained in Column 9 shall be used, in accordance with equation (1). The values of $C_{slip}$ in Table (1) are calculated at 50% of the engine load.

## 6.11 Sea and coastal passenger water transport

***Note,*** *this activity is already covered by the Climate Delegated Act (Activity 6.11* Sea and coastal passenger water transport) *and the recommendations made here are for inclusion of amendments to those criteria to bring it in line with the developed thinking around pollution prevention and control and how this relates to the climate mitigation objective.*

*Description of the activity*

Purchase, financing, chartering (with or without crew) and operation of vessels designed and equipped for performing passenger transport, on sea or coastal waters, whether scheduled or not. The economic activities in this category include operation of ferries, water taxies and excursions, cruise or sightseeing boats. The activity could be associated with several NACE codes, in particular H50.10, N77.21 and N77.34 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. Where an economic activity in this category does not fulfil the substantial contribution criterion specified in point (a) of this Section, the activity is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852, provided it complies with the remaining technical screening criteria set out in this Section.

| Substantial contribution to Climate change mitigation |
| --- |
| 1. The activity complies with one or more of the following ***criteria***[211]:<br><br>(a) the vessels have zero direct (tailpipe) CO2 emissions;<br><br>(b) where technologically and economically not feasible to comply with the criterion in point (a), until 31 December 2025, hybrid and dual fuel vessels derive at least 25% of their energy from zero direct (tailpipe) CO2 emission fuels or plug-in power for their normal operation at sea and in ports; |

[211] The criteria include operational requirements. The requirements are covenanted in the financial and contractual agreements between financial institutions/asset and owners/operators and reported ex post minimum annually. Fulfilling of the operational criteria will be evidenced via relevant policies and procedures by vessels operators, or via relevant contractual obligations on the vessels charters/ operators posed by vessel owners.

(c) where technologically and economically not feasible to comply with the criterion in point (a), until 31 December 2025, the vessels have an attained Energy Efficiency Design Index (EEDI)[260] value 10% below the EEDI requirements applicable on 1 April 2022[261], if the vessels are able to run on zero direct (tailpipe) emission fuels or on fuels from renewable sources[262].

(d – new) The yearly average greenhouse gas intensity of the energy used on-board by a ship or a company's fleet during a reporting period[212] shall not exceed the limits set below:

- 76.4 gCO2e/MJ from 1 January 2025;
- 61.1 gCO2e/MJ from 1 January 2030;
- 45.8gCO2e/MJ from 1 January 2035;
- 30.6 gCO2e/MJ from 1 January 2040;
- 15.3 gCO$^2$e/MJ from 1 January 2045;
- XgCO2e/MJ from 1 January 2050.

(e – new) Vessels derive 100% of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis

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[212] *The greenhouse gas intensity of the energy used on-board by a ship shall be calculated as the amount of greenhouse gas emissions per unit of energy according to the methodology and default values specified in Annexes I and II below. From the date of entry into force of the FuelEU Maritime Regulation, these Annexes should be updated accordingly.*

## 6.12 Retrofitting of sea and coastal freight and passenger water transport

***Note,** this activity is already covered by the Climate Delegated Act (Activity 6.12. Retrofitting of sea and coastal freight and passenger water transport) and the recommendations made here are for inclusion of amendments to those criteria to bring it in line with the developed thinking around pollution prevention and control and how this relates to the climate mitigation objective.*

*Description of the activity*

Retrofit and upgrade of vessels designed and equipped for the transport of freight or passengers on sea or coastal waters, and of vessels required for port operations and auxiliary activities, such as tugboats, mooring vessels, pilot vessels, salvage vessels and ice-breakers.

The economic activities in this category could be associated with NACE codes H50.10, H50.2, H52.22, C33.15, N77.21 and N.77.34 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

An economic activity in this category is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to climate change mitigation |
| --- |
| 1. The activity complies with **one or more** of the following criteria:<br><br>The retrofitting activity reduces fuel consumption of the vessel by at least **15%** expressed in grams of fuel per deadweight tons per nautical mile **for freight vessels, or per gross tonnage per nautical mile for passenger vessels**, as demonstrated by computational fluid dynamics (CFD), tank tests or similar engineering calculations.<br><br>1 a) (new) enables the vessels to attain Energy Efficiency Design Index (EEDI) value at least 10% below the EEDI requirements applicable on 1 April 2022 and enables vessels to derive 100 % of the energy used onboard from fuels or other energy carriers which achieve at least 80% greenhouse gas emission savings compared to their fossil fuel equivalent on a Well-To-Wake basis, have the ability to plug-in at berth and are equipped with plug-in power technology; |

| |
|---|
| 2. Vessels are not dedicated to the transport of fossil fuels. |

# 8. Restoration, remediation

## 8.5 Hotels, holiday, camping grounds and similar accommodation

*Description of the activity*

The provision of short-term accommodation with or without associated services (e.g. cleaning, food and beverage services, parking, laundry services, swimming pools and exercise rooms, recreational facilities as well as conference and convention facilities etc.).

This includes accommodation provided by:

- hotels and motels of all kinds
- holiday homes
- visitor flats, bungalows, cottages and cabins
- youth hostels and mountain refuges
- campgrounds and trailer parks
- space and facilities for recreational vehicles
- recreational camps and fishing and hunting camps
- protective shelters or plain bivouac facilities for placing tents and/or sleeping bags

This category excludes:

- provision of homes and furnished or unfurnished flats or apartments for more permanent use, typically on a monthly or annual basis (NACE code L6820)

- cruise ships (NACE code H5010)

This activity is classified as part of 3 separate NACE codes (I5510, I5520 and I5530) according to the statistical classification of economic activities established by Regulation (EC) No.1893/2006.

| Substantial contribution to protection and restoration of biodiversity and ecosystems |
| --- |

The activity fulfils simultaneously:

- All criteria under 1A or 1B
- All criteria under 2 and 3

Two options are, therefore, possible:

| | Criteria | | | |
|---|---|---|---|---|
| | **1A** | **1B** | **2** | **3** |
| **Option 1** | √ | | √ | √ |
| **Option 2** | | √ | √ | √ |

**1A. Contribution to conservation and/or restoration management activities**

1A.1 - The activity is contributing to conservation and/or restoration measures undertaken by separate management entity(ies) in clearly identified areas[213], within or in the proximity of the same tourist destination[214], in any of the following forms:

a) Offer and/or organise visits to dedicated conservation areas where entrance or permit/user fees are applied;

b) Operation of concessions and leases for services directly related to the conservation area (issued by the management entity);

c) Operation of tourist accommodation establishments within the conservation area but not subject to concession (in agreement with the management entity);

d) Offer and/or manage volunteers for activities directly related to conservation (in accordance to the conservation management entity's provisions);

[213] Legally protected areas (PAs) or other effective area-based conservation measures (OECMs) with active management. The CBD defines OECM as ´*a geographically defined area other than a protected area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in-situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other relevant values*´. Protected areas and other effective area-based conservation measures (cbd.int)

[214] Tourism destination is defined in this context as a geographic area consisting of a set of resources and attractions that is promoted by the same Regional Tourism Organisation.

e) Offer and/or manage educational opportunities directly related to conservation and appropriate behaviour (in accordance to the conservation management entity's provisions);

f) Purchase of products of any kind (e.g. food, drinks, handcrafts etc.) for re-selling or for direct use derived from sustainable practices in the conservation area accredited by the management entity or other credible institution[215].

g) Purchase of merchandise from the conservation area for re-selling (or other commercial arrangement that guarantees revenue from selling of merchandise accrues to the conservation area);

h) Payment of copyrights (images, name etc.) directly to conservation areas management entity(ies);

i) Collect tourists voluntary donations to the conservation area management entity to be transferred to a dedicated fund/account set up by the conservation management entity on a regular basis;

j) Other direct or indirect forms of contribution to be defined in the contractual agreement (see below).

1A.2 - The contributing activities are defined in a specific **contractual agreement(s) (or equivalent)** between the operator of the activity and the conservation and/or restoration management entity. The agreement covers a minimum of **5 years** and is reviewed every year. It defines clearly time-bound targets for contribution to the conservation/ restoration area financial self-reliance with one or more of the forms described under criterion 1A.1. The activities' contributions are estimated in monetary terms and defined as the % of contributions estimated value over the total yearly operating cost of the conservation/restoration area (*Value of contributing activities per year / Total yearly operating costs of the conservation area x 100*). The % contribution so estimated and defined in the contractual agreement is equivalent to:

[215] In the case of Natura 2000 sites, the Natura 2000 logo can be used to certify goods and services. Vista - Search (cc.cec)

- **at least 1%** of the annual turnover of an individual tourist accommodation establishment, if the contractual agreement includes only **one** establishment.

- **at least 0.7%** of the annual turnover of an individual tourist accommodation establishment, if the contractual agreement or equivalent is collective and includes a group of **two to ten** establishments.

- **at least 0.5%** of the annual turnover of an individual tourist accommodation establishment, if the contractual agreement or equivalent is collective and includes a group of **over ten** establishments.

1A.3 - Additional requirements under Criterion 1A:

a) Mandatory financial contributions applied to the tourism activity in the context of the national/local regulatory framework (eco-taxes, tariffs etc.) are not considered making substantial contributions.

b) Conservation/Restoration offsets of impacts defined at the stage of formal authorisation of the tourism activity are not considered making substantial contributions.

c) Eligible conservation/restoration activities are aligned with the respective taxonomy TECHNICAL SCREENING CRITERIA for both SC and DNSH.

OR

**1B. Biodiversity Management Plan**

1B.1 - The activity has developed a **Biodiversity Management Plan** (or equivalent)[216] specific to the tourism service/offer provided, including all of the following conservation and/or restoration measures:

[216] CBD Guidance on protected areas and other effective areas-based conservation measures

a) An analysis of Carrying Capacity or Limit of Acceptable Change of the area or equivalent[217] developed in coordination with the conservation management entity and approved by the management entity itself or, where applicable, by the competent authority;

b) A clear set of objectives and activities aimed at avoiding and/or minimising direct negative impacts to remain within the carrying capacity or limits of acceptable change identified under point a) and including one or more of the following as defined by the GSTC criteria[218]:

   1. Visits to natural sites: Direct damage on ecosystems/habitats through management of tourist flows and movements

   2. Wildlife interaction:

      i. Direct disturbance through detrimental actions: animal feeding, destruction or damaging eggs and nests, destruction of plants, etc.

      ii. Indirect disturbance on species (tourists local movements, littering, noise or light pollution)

      iii. Invasive species: Prevention of introduction of invasive species and use only local species for landscaping and restoration[219].

[217] The UN World Tourism Organisation (UNWTO) proposes the following definition of the carrying capacity *«The maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction. »* (UNEP/MAP/PAP, 1997).

[218] GSTC Industry Criteria for Hotels and Accommodations (www.gstcouncil.org)

[219] The introduction of invasive alien species is prevented and/or their spread is managed in accordance with Regulation (EU) No 1143/2014. Outside of the EU reference is made to the national legislation and to the CBD Supplementary Voluntary Guidance for Avoiding Unintentional Introductions of Invasive Alien Species Associated with Trade in Live Organisms - 14/11. Invasive alien species (cbd.int)

3. Wildlife harvesting and trade[220]: Protected wildlife species are not harvested, consumed, sold.

c) A clear breakdown of the funds and resources the establishment commits towards specific biodiversity management measures (recurrent management, infrastructure, equipment, etc.);

d) Where applicable, a description of partnership agreements with conservation management entities, local NGOs or communities to contribute to common conservation goals;

e) Where applicable, indication of how the management plan fits into existing conservation efforts at the level of the entire tourist destination[221], including research activities.

f) A biodiversity information and awareness plan linked to the specific impacts arising from tourism activities[222]

g) A clear framework for the continuous monitoring and measuring of performance and evaluation of effectiveness including an adaptive approach allowing for the identification of corrective actions where necessary[223].

The activity may adopt a Biodiversity Management Plan existing at destination level, if appropriate, as long as all the elements mentioned above are included[224].

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[220] As defined and governed by Council Regulation (EC) 338/97 and Commission Regulation (EC) 865/2006 implemneting the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) within the EU. Outside of the EU reference is made to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

[221] See note 2 on definition of Tourism Destination.

[222] In line with the EU Ecolabel for tourist accommodation services Criterion 2a: The tourist accommodation shall provide environmental communication and education notices on local biodiversity, landscape and nature conservation measures to guests.

[223] Guiding principles for laid out in Chapter V (Monitoring) of the EU Better Regulation Guidelines can be used as a reference.

[224] A destination level BMP not covering all elements listed in criterion 1B.1 is integrated and adapted to fulfill the criterion in full.

1B.2 - At the beginning of the activity and **every two years** thereafter, the compliance with the biodiversity management plan or equivalent instrument, is controlled by either the relevant national competent authorities or by an independent third-party certifier such as a dedicated certification/accreditation scheme, at the request of national authorities or the operator of the activity. The independent third-party certifier may not have any conflict of interest with the owner or the funder, and may not be involved in the development or operation of the activity. In order to reduce costs, audits may be performed together with any forest certification, climate certification or other audit.

**AND**

**2. Sustainable Supply Chain & Environmental Management System**

For all categories of accommodation establishments:

2.1 – The establishment has at least 40% of food and drink, wood (including furniture), paper and/or cardboard products, by procurement value, certified according to environmental standards[225]. The establishment commits to a continuous improvement of at least 10% every 3 years to reach a minimum of 80% as proven by a third party verified certification.

AND, only for accommodation establishments with over 50 employees:

2.2 - The establishment has an environmental management system (EMS) requiring third party certification (EMAS, ISO 14001 or equivalent) aligned with best environmental management practice and benchmark performances (EMAS Reference Document for the Tourism Sector[226] or equivalent national/international standard); OR

[225] Commission Decision (EU) 2016/611 on best environmental management in the tourism sector indicates 60% of food and drink products by procurement value should be environmentally certified (Section 3.7.1 Green sourcing of food and drink products); and over 97% of all wood, paper and cardboard purchased by accommodations and restaurants are recycled or environmentally certified (ecolabelled, FSC, PEFC) (Section 3.1.2 Supply chain management). Nevertheless, it seems appropriate to lower the entry level and require a continuous improvement over time.

[226] Commission Decision (EU) 2016/611

The establishment was awarded with an EN ISO 14024 type I ecolabel (such as the EU Ecolabel for Tourist Accommodation services) or an equivalent voluntary label meeting equivalent requirements[227].

**3. Minimum requirements**

3.1 If applicable, for any accommodation establishment or associated facility an Environmental Impact Assessment (EIA) or screening has been completed in accordance with Directive 2011/92/EU[228]. Where an EIA has been carried out, the required mitigation and compensation measures for protecting the environment are implemented.

3.2 For sites/operations located in or near biodiversity-sensitive areas (including the Natura 2000 network of protected areas, UNESCO World Heritage sites and Key Biodiversity Areas, as well as other protected areas), an appropriate assessment[229], where applicable, has been conducted and based on its conclusions the necessary mitigation measures[230] are implemented.

3.3 Recreational hunting and fishing activities are allowed only if explicitly included as part of the conservation/management plan of the conservation area as established by the management entity and fishing activities are aligned with the relevant taxonomy Technical Screening Criteria for both SC and DNSH.

[227] In particular requirements include: following a multi-criteria approach; criteria are developed through an independent science-based process, are publicly available and go beyond what is required by legislation; it is based on impartial control procedure through third party verification.

[228] For activities in third countries, in accordance with equivalent applicable national law or international standards requiring the completion of an EIA or screening, for example, IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks

[229] In accordance with Directives 2009/147/EC and 92/43/EEC. For activities located in third countries, in accordance with equivalent applicable national law or international standards, that aim at the conservation of natural habitats, wild fauna and wild flora, and that require to carry out (1) a screening procedure to determine whether, for a given activity, an appropriate assessment of the possible impacts on protected habitats and species is needed; (2) such an appropriate assessment where the screening determines that it is needed, for example IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

[230] Those measures have been identified to ensure that the project, plan or activity will not have any significant effects on the conservation objectives of the protected area.

| Do no significant harm ('DNSH') | |
|---|---|
| (1) Climate change mitigation | For buildings built before 31 December 2020, the building has at least an Energy Performance Certificate (EPC) class C. As an alternative, the building is within the top 30% of the national or regional building stock expressed as operational Primary Energy Demand (PED) and demonstrated by adequate evidence, which at least compares the performance of the relevant asset to the performance of the national or regional stock built before 31 December 2020 and at least distinguishes between residential and non-residential buildings.<br><br>For buildings built after 31 December 2020, the Primary Energy Demand (PED)[231] defining the energy performance of the building resulting from the construction does not exceed the threshold set for the nearly zero-energy building (NZEB) requirements in national regulation implementing Directive 2010/31/EU. The energy performance is certified by an Energy Performance Certificate (EPC). |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) …/… supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) …/…supplementing Regulation (EU) 2020/852.<br><br>Environmental degradation risks related to preserving marine environment, in particular the risks of hampering the achievement of good environmental status of marine waters or the risks of deteriorating marine waters that are already in good environmental status as defined |

The calculated amount of energy needed to meet the energy demand associated with the typical uses of a building expressed by a numeric indicator of total primary energy use in kWh/m2 per year and based on the relevant national calculation methodology and as displayed on the Energy Performance Certificate (EPC).

| | |
|---|---|
| | in the Marine Strategy Framework Directive (Directive 2008/56/EC), shall be identified and addressed. |
| (4) Transition to a circular economy | The accommodation establishment:<br><br>1. Does not make any use or offers to its guests any of the items listed in Part B of Annex I to Directive (EU) 2019/904 on Single-use plastics[232].<br><br>2. Separates at source paper, metal, plastic, glass and biowaste where separate collection for these materials is available in the area[233].<br><br>Has a food waste prevention plan with a specific time-bound quantitative target of reduction of food waste[234]. |
| (5) Pollution prevention and control | DNSH as set out in Appendix C of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852<br><br>The activity is in line with the Medium Combustion Plant Directive (2015/2193/EU). |

| |
|---|
| Rationale |
| **Rationale**: Tourism, sports and leisure activities (tourism activities or sector in short) cover a very wide spectrum of activities in their value chain that range across very different sectors. EUROSTAT identifies 15 NACE codes as relevant to the Tourism industry[235]. In addition, several other NACE codes cover leisure activities and sports in various ways. All activities in |

[232] Annex I, Part B on Single-use plastic products covered by Article 5 on restrictions on placing on the market

[233] Only the materials for which the separate collection exists need to be separated at source by the establishment.

[234] Food waste is defined under Art. 3 of the Directive (EU) 2018/851 amending Directive 2008/98/EC on waste

[235] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Tourism_industries

the NACE classification related to tourism, sports and leisure activities that could lead to a direct impact on biodiversity have been identified and grouped in sub-categories in the definition provided below. The result of this analysis is the following list of NACE codes classifies by sub-activity in the tourism sector:

**1. Hotels, holiday, camping grounds and similar accommodation**

This activity is classified as part of 3 separate NACE codes (I5510, I5520 and I5530) according to the statistical classification of economic activities established by Regulation (EC) No.1893/2006

**2. Food and beverage services**

This activity is classified as part of 2 separate NACE codes (I5610 and I5630) according to the statistical classification of economic activities established by Regulation (EC) No.1893/2006

**3. Renting and leasing of vehicles and goods used for recreational and sport purposes**

This activity is classified as part of 3 separate NACE codes (I7711, I7712 and I7721) according to the statistical classification of economic activities established by Regulation (EC) No.1893/2006.

**4. Tourism, sports and leisure activities management**

This activity is classified as part of 7 separate NACE codes (79.12, 91.02, 91.03, 93.11, 93.19, 93.21 and 93.29) according to the statistical classification of economic activities established by Regulation (EC) No.1893/2006

Out of these 4 sub-groups the first was considered the most relevant in terms of potential biodiversity impact based on life-cycle considerations and was given priority. Technical Screening Criteria for the other sub-groups will have to be developed at a later stage, if appropriate.

**Substantial Contribution**: Tourism, sport and leisure activities are closely dependent on the condition of the natural/landscape assets that constitute the attraction for the final users. For most types of tourism, biodiversity contributes significantly to the attractiveness and quality of destinations, and therefore to their competitiveness. There is significant geographical overlap between tourism development (and growth) and biodiversity hotspots, as well as areas of low human development, as illustrated in a study by UNEP and Conservation International (CI)[236]. The value of biodiversity and the associated services provided by healthy ecosystems is extremely large for tourism. Market surveys have shown that 42% of European travellers, surveyed in 2000, included a visit to natural parks as part of their vacation activities. In England, tourism based on high quality natural environments is estimated to be worth £5 billion each year[237]. As a result, tourism sport and leisure activities have a vested interest and should have a more active and concrete role in maintaining the natural/landscape assets in good status (if not improving them). The relationship between sustainable tourism and biodiversity is simple: sustainable tourism should contribute to conservation of biodiversity[238]. Some tourism businesses are making important contributions by establishing commercial operations that are directly linked to conservation. Some others have developed tourism products that are specifically designed to support conservation, for example, by providing a share of income to specific conservation projects, and by maintaining a flow of tourists, and therefore income, to areas where income from tourism is a vital source of funding for conservation.

This is perfectly aligned with the Biodiversity Strategy 2030 and the proposed Nature Restoration Law[239] indicating that at least €20 billion a year should be unlocked for spending on nature to be able to finance all the proposed targets. This will require mobilising private and public funding at national and EU level, but the private sector needs to scale up its support and the tourism sector is ideally positioned to do this because of the mentioned dependency from natural assets.

In addition, the Technical Screening Criteria have been developed in alignment with the Global Sustainable Tourism Council (GSTC) criteria for biodiversity. The GSTC establishes and manages global standards for sustainable travel and tourism, known as the GSTC Criteria. These are the guiding principles and minimum requirements that any tourism business or destination should aspire to reach in order to protect and sustain the world's natural and

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[236] United Nations Environment Programme and Conservation International (2003), Tourism and Biodiversity – Mapping Tourism's Global Footprint, CI, Washington.

[237] Tourism and Biodiversity – Achieving Common Goals Towards Sustainability, UNWTO 2010

[238] Secretariat of the Convention on Biological Diversity (2007), Managing Tourism and Biodiversity, User's Manual on the CBD Guidelines on Biodiversity and Tourism Development, Secretariat of the CBD, Montreal, p.12.

[239] https://environment.ec.europa.eu/publications/nature-restoration-law_en

cultural resources, while ensuring tourism meets its potential as a tool for conservation and poverty alleviation. The GSTC criteria for biodiversity include:

a) The organization demonstrates awareness of natural protected areas and areas of high biodiversity value.
b) The organization provides and records monetary support for biodiversity conservation in the local area.
c) The organization provides and records in-kind or other support for biodiversity conservation in the local area.
d) The property is actively managed to support biodiversity conservation.
e) The organization is aware of, and mitigates, activity with potential to disturb wildlife and habitats.
f) Compensation is made where any disturbance has occurred.
g) Action is taken to encourage visitors to support biodiversity conservation.
h) The organization engages with local conservation NGOs.

As a result of the rationale above, Technical Screening Criteria have been developed based on the principle that the connection between tourism/sport/leisure activities and the natural/landscape assets representing the tourist attraction to an area should be symbiotic. In other words, there should be a mutual sharing of benefits and not a one directional exploitation of natural/landscape assets for profit making. This can happen at different levels depending on the type of economic activity:

1. **Contribution to conservation and/or restoration management activities (Criterion 1A)**: The activity contributes to conservation/restoration activities implemented by separated management entities (e.g. protected areas)

2. **Biodiversity Management Plan (Criterion 1B)**: The activity plays an active role in reducing the pressure linked to tourists interaction with biodiversity and ecosystems (e.g. trampling, littering, harvesting etc.)

3. **Environmental Management System (Criterion 2)**:

    1. The activity plays an active role in reducing the pressure on biodiversity and ecosystems directly or indirectly linked to tourism facilities (e.g. water consumption, waste disposal, use of chemicals)

2. The activity indirectly contributes to conservation by choosing to source its products from sustainable sources (e.g. organic products, EU Ecolabel certified furniture etc.)

All these elements are captured in the proposed Technical Screening Criteria in a way that they can be applied to fit the different profiles of an economic activity from the large hotel chain to the small family operation.

The contribution under criterion 1A is described in qualitative terms but quantified financially in proportion to the turnover of the tourist accommodation establishment and a threshold is indicated to determine substantial contribution. Based on the EUROSTAT data for the period 2015-2018 the average turnover of tourist accommodation establishments (NACE code I55) is presented in the table below. The simple application of a 1% SC threshold on the annual turnover has the potential to generate substantial direct or indirect financial support to the conservation area management entity. Most of the activities listed under criterion 1A are in reality in-kind contributions and make use of the tourist establishment as a catalyst in support of the revenue generating mechanisms of the conservation area management entity itself.

The SC threshold is relatively low per individual establishment (1%) but an incentive is provided for establishments to coordinate their efforts. The higher the number of establishments under the same agreement, the lower the individual contributions of each establishment (0.7% between 2 and 10; 0.5% over 10 establishments). This is a key feature of the Technical Screening Criteria as the real contribution to conservation can only emerge from an aggregation of individual establishments at destination level. Based on a conservative estimate, a group of 10 establishments can generate an average 138 000 Euros per year (3 SMEs of each size class x their respective 0.5% contribution = 138 000 Euros).

| **Business Size** | **Average Annual Turnover (MEuro)** | **1% contribution (Euro)** ***Single Est.*** | **0.7% contribution (Euro)** ***2-10 Est.*** | **0.5% contribution (Euro)** ***>10 Est.*** |
|---|---|---|---|---|
| **Large Enterprise*** - 250 persons employed or more | 50 | 500 000 | 350 000 | 250 000 |
| **Macro SME** - From 50 to 249 persons employed | 7 | 70 000 | 49 000 | 35 000 |

| | | | | |
|---|---|---|---|---|
| **Medium-size SME** - From 20 to 49 persons employed | 2 | 20 000 | 14 000 | 10 000 |
| **Micro SME** - From 2 to 9 persons employed | 0.2 | 2 000 | 1 400 | 1 000 |

*Source: Elaborated from EUROSTAT - Accommodation and food service statistics - NACE Rev. 2 - Statistics Explained (europa.eu)*

***Note**: Figures provided for Large Enterprises are likely to be overestimated in the table, because Large Enterprises more likely to own and/or operate several accommodation establishments in the same or in different locations. In this case, only the turnover of the individual establishment of relevance to the conservation area will be used as a basis for the estimate in the contractual agreement with the conservation management entity.

**In relation to the requirements in art. 19 of the Taxonomy Regulation (EU) 2020/852 (:**

- **Policy coherence**: The logic of the Technical Screening Criteria proposed is aligned with the Biodiversity Strategy 2030 indicating that the private sector needs to scale up its financial support and the tourism sector is ideally positioned to do so because of the mentioned dependency from natural assets. Moreover, tourism accommodation operators should sensitize their guests to the value of biodiversity and the need to protect/restore ecosystems. Best practice guidance and criteria related to the environmental performance of tourism emphasise the important role that tourism should play in biodiversity protection, both et EU level (EU Ecolabel for Tourism accommodation[240] and Best Environmental Management Practise in the Tourism Sector[241]) and at international level (Global Sustainable Tourism Council criteria).

- **Environmental ambition and integrity**: The different criteria required to determine a substantial contribution can be combined in two ways but both require concrete

[240] Commission Decision (EU) 2017/175 on establishing EU Ecolabel criteria for tourist accommodation indicates several criteria related to biodiversity, notably:

- Criterion 26.a - The tourist accommodation shall provide environmental communication and education notices on local biodiversity, landscape and nature conservation measures to guests
- Criterion 50 - Native or non-invasive alien species used in outdoor planting

[241] Commission Decision (EU) 2016/611 on the reference document on best environmental management practice, sector environmental performance indicators and benchmarks of excellence for the tourism sector indicates that best environmental management practice is to monitor the state of biodiversity within the destination, and to implement a biodiversity conservation and management plan that protects and enhances total biodiversity within the destination and at individual establishment level.

contributions to conservation/restoration activities, the presence of an environmental management system to ensure indirect impacts on biodiversity (water use, waste production, use of chemicals) are minimised and a greening of the supply chain of food and other products used in large quantities by accommodation establishments. Both combinations are considered to require a considerable effort to the establishments and sufficient to determine that the activity is making a substantial contribution. The quantitative threshold proposed for supply chain environmentally certified products are in line with existing practice and have generally been kept lower than the existing benchmark values for best environmental practice (Commission Decision (EU) 2016/611 on best environmental management in the tourism) as it seems appropriate to lower the entry level and require a continuous improvement over time.

- **Level playing field**: All the elements are captured in the proposed Technical Screening Criteria in a way that they can be combined to fit the different profiles of an economic activity from the large hotel chain to the small family operation. As indicated above, criterion 1A is proportional to the size of the establishment by design. Criterion 1B is more suited to large enterprises that manage directly tourist flows and are in close proximity to natural assets. Criterion 2 approaches increasingly used on a voluntary basis by many tourist establishments as part of their CSR strategy. The size-based approach used in Criterion 2 is justified because an EMS is resource intensive and is not an easy option to implement for micro or medium-size SMEs, while supply chain considerations can be easily made at any scale. Clearly accommodation establishments that are in proximity of a conservation/restoration area (e.g. Protected Area) have more to benefit from the natural assets that attract the tourists and have greater opportunity for contribution. But even establishments in a urban/semi-urban context have opportunities that can be exploited (e.g. support to city parks). This simply reflects the different level of dependency of the establishment from natural assets that underpins the logic of the Technical Screening Criteria.

- **Usability of the criteria**: Criteria are applicable to any context and type of tourist accommodation establishment. The fulfilment of the criteria is easily verified on the basis of specific documents that have to be produced by the establishment or a third party certification entity.

**DNSH:** The criteria used reflect the standard wording used in the Appendixes to the Annex I to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852, with the exception of Climate Change Mitigation, Water, Circular Economy and Pollution prevention and control.

- Climate Change Mitigation: energy efficiency in buildings is particularly relevant for the tourism accommodation sector and criteria used in the DA are reproposed here;
- Water: reference is added to the Marine Strategy Framework Directive and the need to maintain Good Environmental Status with the same wording used for the WFD.
- Circular Economy: Use of disposable items and food waste are important elements to be considered in the tourism sector. The most relevant legal framework in these areas is included in two recent Directives which are currently entering into force (Directive (EU) 2019/904 on Single-use plastics and the Directive (EU) 2018/851on waste).
- Pollution prevention and control: A reference to compliance with the Medium Combustion Plants Directive was added as particularly relevant for tourist accommodation establishments in relation to air pollution control.

# 9. Water supply

## 9.2 Desalination

*Description of the activity*

The activity covers the construction and operation of desalination plants where the desalination process takes place in order to produce water to be distributed in drinking water supply systems where the water resources are or will be impacted by the effects of climate change, thus enabling the activity '*Water Supply*'.

Desalination plants usually include abstraction, pre-treatment (e.g. designed to remove contaminants, scale formation or membrane fouling), treatment (e.g. reverse osmosis, or 'RO'), post-treatment (disinfection and conditioning) and storage of processed water. Finally, the activity covers the disposal of brine (reject water), which usually is accomplished by means of deep sea pipes or outflows providing sufficient dilution. For plants located on more inland sites (such as for brackish water desalination), brine discharge techniques may differ.

Increasingly, desalination plants are complemented with facilities for renewable energy generation such as photovoltaic plants or wind turbines, in order to attenuate the energy demand from the grid thus lowing the carbon footprint of the activity.  However, their contribution to the total energy consumption still remains low. These facilities are also considered part of the activity when the purpose of power generation is to supply the plant.

The activity is not classified under any NACE code, however could be associated with E36.00 and F42.9

The distribution of the desalinated water is excluded in this activity as it is covered by the activity '*Water Supply*'.

Desalination may be applied to waters with varying levels of salinity. Currently, the most common process applied is RO (reverse osmosis using membrane technology).

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Substantial contribution to Climate change adaptation.

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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 the Annex II of the first Climate 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 the Annex II of the first 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 the referred Annex, 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[242] 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

[242] Future scenarios include Intergovernmental Panel on Climate Change representative concentration pathways RCP2.6, RCP4.5, RCP6.0 and RCP8.5

and related methodologies in line with the most recent Intergovernmental Panel on Climate Change reports[243], scientific peer-reviewed publications and open source[244] 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[245] or rely on blue or green infrastructure[246] 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,

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[243] Assessments Reports on Climate Change: Impacts, Adaptation and Vulnerability, published periodically by the Intergovernmental Panel on Climate Change (IPCC), the United Nations body for assessing the science related to climate change produces, https://www.ipcc.ch/reports/.

[244] Such as Copernicus services managed by the European Commission.

[245] Nature-based solutions are defined as 'solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions'. Therefore, nature-based solutions benefit biodiversity and support the delivery of a range of ecosystem services (version of [adoption date]: https://ec.europa.eu/info/research-and-innovation/researcharea/environment/nature-based-solutions_en/).

[246] See Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Green Infrastructure (GI) –Enhancing Europe´s Natural Capital (COM/2013/0249 final)

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.

Do no significant harm ('DNSH')

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| (1) Climate change mitigation | The desalination plant will have a high performance in terms of greenhouse gas emissions:<br>• Less than 1080 gCO2e/m3 of freshwater produced.<br>This value is obtained from the average consumption of desalination plants (World Bank 2019[247] and 2021 EC Blue Economy Report[248]) in terms of net energy consumption (4 kwh/m3) and the indirect emission threshold included in the delegated act for DNSH mitigation (270 gCO2e/kwh) in manufacturing activities. The value covers all the desalination process (even the discharge of brine) but not the distribution of the product water.<br>Net energy consumption may take into account measures decreasing energy consumption such as energy generation (hydraulic, solar and wind energy, for example). |
| (3) Sustainable use and protection of | The desalination plant is included in a water management plan and/or drought management plan at river basin scale, validated by the relevant Competent Authority in relation to Water Management. The Plan must |

[247] The Role of Desalination in an Increasingly Water Scarce World. March 2019. World Bank Document

[248] The EU Blue Economy report 2021 (europa.eu)

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| water and marine resources | demonstrate that all efficiency and demand management measures, including measures to improve water efficiency, reduce per capita consumption, reduce network losses and other non-revenue water, have been fully considered and found to be insufficient to address the gap between supply and demand, and that no environmentally better alternatives (such as water reuse) are available.<br><br>Environmental degradation risks related to preserving water quality and avoiding water stress are identified and addressed with the aim of achieving good water status (including marine water) and good ecological potential as defined in Article 2, points (22) and (23), of Regulation (EU) 2020/852, in accordance with Directive 2000/60/EC of the European Parliament and of the Council[249] and a water use and protection management plan, developed thereunder for the potentially affected water body or bodies, in consultation with relevant stakeholders.<br><br>An Environmental Impact Assessment or screening is carried out in accordance with national legislation, and includes an assessment of the impact on water and marine water in accordance with Directive 2000/60/EC, and to the EU Marine Strategy Framework Directive (2008/56/EC). The required mitigation and compensation measures for protecting the environment are implemented.<br><br>The EIA will include a site-specific assessment of impacts relative to brine marine disposal based on:<br><br>(i) description and understanding of the local baseline conditions (e.g. seawater quality, topography, hydrodynamic characteristics, and marine |

[249] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1). For activities in third countries, in accordance with applicable national law or international standards which pursue equivalent objectives of good water status and good ecological potential, through equivalent procedural and substantive rules, i.e. a water use and protection management plan developed in consultation with relevant stakeholders which ensures that 1) the impact of the activities on the identified status or ecological potential of potentially affected water body or bodies is assessed and 2) deterioration or prevention of good status/ecological potential is avoided or, where this is not possible, 3) justified by the lack of better environmental alternatives which are not disproportionately costly/technically unfeasible, and all practicable steps are taken to mitigate the adverse impact on the status of the body of water

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| | ecosystems based on field measurements and surveys), (ii) dispersion modelling of the brine discharge and (iii) laboratory toxicity testing.<br><br>The level of detail required in the assessment must be appropriate to the size, process and recovery rates of the desalination plant, as well as its location since potential adverse impacts are site-specific. |
| (4) Transition to a circular economy | N/A |
| (5) Pollution prevention and control | N/A |
| (6) Protection and restoration of biodiversity and ecosystems | An Environmental Impact Assessment (EIA) or screening has been completed in accordance with relevant EIA national legislation. Where an EIA has been carried out, cumulative impacts have to be addressed from existing and planned projects and the required mitigation, restoration and/or compensation measures for protecting the environment are implemented. For sites/operations located in or near biodiversity-sensitive areas (including the Natura 2000 network of protected areas, UNESCO World Heritage sites, Marine Protected Areas, and Key Biodiversity Areas, as well as other protected areas), an appropriate assessment[250], where applicable, has been conducted and |

[250] In accordance with Directives 2009/147/EC and 92/43/EEC. For activities located in third countries, in accordance with equivalent applicable national law or international standards, that aim at the conservation of natural habitats, wild fauna and wild flora, and that require to carry out (1) a screening procedure to determine whether, for a given activity, an assessment on the likely significant effects on protected habitats and species is needed; (2) such an assessment where the screening determines that it is needed, for example IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

| | |
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| | based on its conclusions the necessary mitigation measures[251] are implemented.<br><br>It will be ensured as well that the activity will:<br><br>1. Comply with Articles 16 and 6.3 and 6.4 of the Habitats Directive and Article 3 and 4 of the Birds Directive, Article 4 of the Water Framework Directive, the Invasive Alien Species Regulation (Regulation (EU) No 1143/2014) and the respective national environmental law.<br><br>2. Be consistent with national, regional or local river basin management strategies and plans.<br><br>3. Comply with the EU Marine Strategy Framework Directive (2008/56/EC)[252] and Maritime Spatial Planning directive (2014/89/EU)[253]<br><br>4. Include a site-specific minimum brine dilution objectives (taking into account salt concentration, total alkalinity, temperature and toxic metals) based on an appropriate characterization of local water conditions and ecosystems and species, in order to mitigate the possible adverse effects of brine disposal so as not to adversely impact on the good environmental status of the marine environment. |

Rationale

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[251] Those measures have been identified to ensure that the project, plan or activity will not have any significant effects on the conservation objectives of the protected area.

[252] Law - EU Coastal and Marine Policy - Environment - European Commission. https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

[253] EUR-Lex - 32014L0089 - EN - EUR-Lex. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0089

**Rationale for the Technical Screening Criteria:**

According to the *2021 EU Strategy on Adaptation to Climate Change*, “Due to the changing climate, many European regions are already facing more frequent, severe, and longer lasting droughts”. In addition, the EU Strategy recognizes that *“Climate change also threatens water quality**.** A stable and secure supply of drinking water is of highest importance and it must be guaranteed. Climate change will increase the risk of contamination and acute pollution of freshwater due to impacts such as low river flows, increased water temperatures, flooding, and forest loss”.*

**Climate change is endangering water resources**. Water scarce countries[254] are suffering the effects of climate change, such as increased evapotranspiration, and extended and more frequent droughts. These effects can amplify the scarcity of water thus jeopardising water supply and leading to an overexploitation of and increased competition for groundwater and surface water resources.

To date, about 20,000 desalination plants in more than 150 countries supply fresh water to more than 300 million people. By January 2021, there were 2,309 operational desalination plants in the EU producing about 9.2 million cubic meters per day (m3/day, 3,352 million m3/year) of fresh water, mainly from seawater and brackish water[255].

This technology allows fresh water to be obtained from the sea, estuaries, or brackish deep wells by passing the raw water through a process (e.g. RO), thereby obtaining freshwater and reject water (brine) — the latter is usually discharged back into the raw water source (such as the sea or deep wells). Desalination plants are a reliable water source that are usually energy-intensive procedure in order to produce freshwater.

The construction and operation of desalination plants can make a substantial contribution to the objective ‘Climate change adaptation’ by helping the countries/areas to increase their water resources, thus enabling the activity related to water supply by increasing the level of resilience

[254] Countries suffering from water stress, water scarcity and frequent droughts. This can be measured by means of water stress indexes such as WSI, from the World Resource Index.

[255] The EU Blue Economy report 2021 (europa.eu)

to the system, when their existing ones are jeopardized by the effects of climate change (e.g. increased droughts and evapotranspiration).

As desalination plants are a reliable water source, they will avoid the overexploitation of existing water resources by creating a new resource. This alternative water supply is more costly in production than water abstraction but provides a stabilising buffer for the vicissitudes of freshwater supply (increased by climate change).

The Activity has SC to Climate change Adaptation as enabling the activity '*Water Supply*' since it increases the level of resilience of this activity. In order to achieve this, the activity relies on the Technical Screening Criteria included in the first delegated act in relation to substantial contribution to Climate Change Adaptation since are considered valid for the activity.

**Rationale for the Do No Significant Harm criteria:**

As desalination is energy-intensive with risks of other environmental impacts, it should be carefully considered in an option analysis with the aim of avoiding overexploitation of the existing water resources, which should also include demand management and water reuse as possible options. The *2007 Commission Communication on Water Scarcity and Droughts*[256] and the 2012 Commission Communication *A Blueprint to Safeguard Europe's Water Resources*[257] proposed a water hierarchy whereby additional water supply options such as desalination are only considered after all other improvements in efficiency on the demand side are exhausted.

The desalination option will be the last solution or the only feasible solution as an outcome of the water management plans and/or drought management plans where climate change scenarios are included in the risk analyses. All efficiency and demand management measures (including measures to improve water efficiency, reduce per capita consumption, reduce network losses and other non-revenue water) should have been fully considered and found to be insufficient to address the gap between supply and demand, and that no environmentally better alternatives (such as demand management) are available. This is incorporated in the DNHS for water as a condition to be fulfilled.

[256] EUR-Lex - 52007DC0414 - EN - EUR-Lex (europa.eu)

[257] EUR-Lex - 52012DC0673 - EN - EUR-Lex (europa.eu)

DNSH to water, pollution and Biodiversity are addressed by sufficient EIAs according to **all EU legislation** (not only the EIA Directive), and the impact of the brine discharge must be assessed and mitigated. Desalination plants are not regulated by the IED (Industrial Emissions Directive). To be noted that to prevent causing Significant Harm to Biodiversity, compliance with the EIA Directive (which is used as a DNSH criterion in the first climate Delegated Act) is not considered sufficient enough mainly due to the following reasons:

- It does not necessarily capture the landscape (ecosystem) based scale. This can be achieved via compliance with the SEA directive. The WFD (Water Framework Directive) also applies the river basin scale, which is a more integrated approach.

- It does not apply to all size projects whereas the Habitats Directive and Birds Directive do.

- It does not include guidelines applicable to the marine ecosystems whereas the Marine Strategy Directive (2008/56/EC) currently does.

In relation to pollution, Desalination plants are not regulated by the IED (Industrial Emissions Directive). The possible harmful effects of pollution are addressed by the fulfilment of **all EU legislation** including the EU Marine Strategy Framework Directive (2008/56/EC) and Maritime Spatial Planning directive (2014/89/EU).

The DNSH to **mitigation** is studied in terms of maximum emissions per produced m3 of water (in line with the first Climate Delegated Act that evaluates the Substantial Harm criteria in terms of gCO2e), using average energy consumption for RO plants , which is the technique that demands less energy (if compared with Multi Effect Distillation of Multi Flash Distillation). For defining the average consumption the following scientific base was utilized: World Bank Report 2019: RO consumption range (3-7 Kwh/m3). EC, Blue Economy Report 2021: RO consumption range (3-5 Kwh/m3). In order to calculate the maximum emissions per produced m3, the emission threshold included in the first Climate Delegated Act supplementing Regulation (EU) 2020/852 for 'manufacturing' activities (270 gCO2e/kwh) is utilized since desalination plants can be considered as industries for producing drinking water. The value covers all the desalination process (even the discharge of brine) but not the distribution of the product water. The distribution of the desalinated water is excluded in this value as it is covered by the activity '*Water Supply*'.

No additional Screening Criteria are proposed for the construction part of the activity since the effect of 'enabling' is achieved by the operation of the desalination plants. However, the operation cannot be achieved without the construction of the facilities. It is also understood that the DNSH criteria described above include all the necessary mitigation measures for the possible impacts during the construction phase.

# E. Enabling activities

## E.1 Marketplace for the trade of second-hand goods for reuse

*Description of the activity*

Development and operation of marketplaces and classifieds[258] for the trade (sale or exchange) of second-hand products, materials or components for reuse. This activity is restricted to marketplaces and classifieds, that act as an intermediary to match buyers seeking a service or product with sellers or providers of those products or services. This activity does not include the wholesale or retail trade of second-hand goods, it covers only related services (such as buyer-seller linking, payment, delivery service, etc.). Marketplaces and classifieds supporting B2B, B2C and C2C sales are included.

The economic activities in this category could be associated with several NACE codes, in particular J58.29, J61, J62 and J63.1 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

The activity is limited to the enabling of trade in goods originally produced by the following activities classified under NACE codes:

- C10 Manufacture of food products
- C11 Manufacture of beverages
- C13 Manufacture of textiles
- C14 Manufacture of wearing apparel
- C15 Manufacture of leather and related products
- C16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials

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[258] Classifieds are platforms that connect buyers and sellers. Marketplaces are platforms that connect buyers and sellers and facilitate transaction via technology enablement or services (such as payment gateway or logistics services).

- C17 Manufacture of paper and paper products
- C18 Printing and reproduction of recorded media
- C22 Manufacture of rubber and plastic products
- C23.3 Manufacture of clay building materials
- C23.4 Manufacture of other porcelain and ceramic products
- C24 Manufacture of basic metals
- C25.1 Manufacture of structural metal products
- C25.2 Manufacture of tanks, reservoirs and containers of metal
- C25.7 Manufacture of cutlery, tools and general hardware
- C25.9 Manufacture of other fabricated metal products
- C26 Manufacture of computer, electronic and optical products
- C27 Manufacture of electrical equipment
- C28.22 Manufacture of lifting and handling equipment
- C28.23 Manufacture of office machinery and equipment (except computers and peripheral equipment)
- C28.24 Manufacture of power-driven hand tools
- C28.25 Manufacture of non-domestic cooling and ventilation equipment
- C28.93 Manufacture of machinery for food, beverage and tobacco processing, excluding machinery for tobacco processing
- C28.94 Manufacture of machinery for textile, apparel and leather production
- C28.95 Manufacture of machinery for paper and paperboard production
- C28.96 Manufacture of plastic and rubber machinery
- C31 Manufacture of furniture

- C32 Other manufacturing

An activity in this category is an enabling activity in accordance with Article 13(1), point (l), of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to transition to a circular economy |
|---|
| The economic activity consists of developing and operating marketplaces or classified to support the sale or reuse of second-hand products, components or materials. This is restricted to:<br>• the trade (sale or exchange) for reuse of second-hand goods that have already been used for their intended purpose before by a household or an organisation, with or without repair.<br>The trade of new products, that have not been sold to a household or an organisation before, is excluded.<br>The trade of products made from recycled materials, but not used in its current form by a household or an organisation before, is excluded.<br>• the trade (sale or exchange) of goods that were originally produced by activities listed in the Description<br>Only the share of the economic activity derived from activities listed above is included. This means that revenues, investment or expenditure must be allocated to eligible products, components or materials. Revenues, investment or expenditure that cannot be allocated are not in scope. If an allocation rule is needed to allocate revenues, investment or expenditure to eligible products, components or materials (such as for non-transactional revenues), this allocation rule must be verified by an independent third party. The allocation rule must be based on the actual share of activities listed above for operating the marketplaces, and the predicted share of these activities for developing marketplaces. The simple ability of a market place to be used for the activities listed above is not sufficient to fulfil the criteria. |

| Do no significant harm ('DNSH') | |
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| (1) Climate change mitigation | If data centers are owned and operated, the activity has demonstrated best efforts to implement the relevant practices listed as "expected practices" in the most recent version of the European Code of Conduct |

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| | on Data Centre Energy Efficiency, or in CEN-CENELEC document CLC TR50600-99-1 “Data centre facilities and infrastructures - Part 99-1: Recommended practices for energy management” and has implemented all expected practices that have been assigned the maximum value of 5 according to the most recent version of the European Code of Conduct on Data Centre Energy Efficiency. |
| (2) Climate change adaptation | DNSH as set out in Appending A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| (4) Transition to a circular economy | If servers and data storage products are owned, the equipment used meets the requirements set in accordance with Directive 2009/125/EC for servers and data storage products.<br><br>If servers and data storage products are owned, the equipment used does not contain the restricted substances listed in Annex II to Directive 2011/65/EU, except where the concentration values by weight in homogeneous materials do not exceed those listed in that Annex.<br><br>If servers and data storage products are owned, a waste management plan is in place to favour reuse (as a priority) and recycling at the end of life of electrical and electronic equipment, such as contractual agreements with recycling partners.<br><br>If servers and data storage products are owner, at its end of life, equipment undergo preparation for reuse, recovery or recycling operations, or proper treatment, including the removal of all fluids and a selective treatment in accordance with Annex VII to Directive 2012/19/EU. |

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|---|---|
| (5) Pollution prevention and control | DNSH as set out in Appendix C of Annex 1 to the Commission Delegated Regulation (EU) …/… supplementing Regulation (EU) 2020/852] |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) …/… supplementing Regulation (EU) 2020/852 |

| Rationale |
|---|

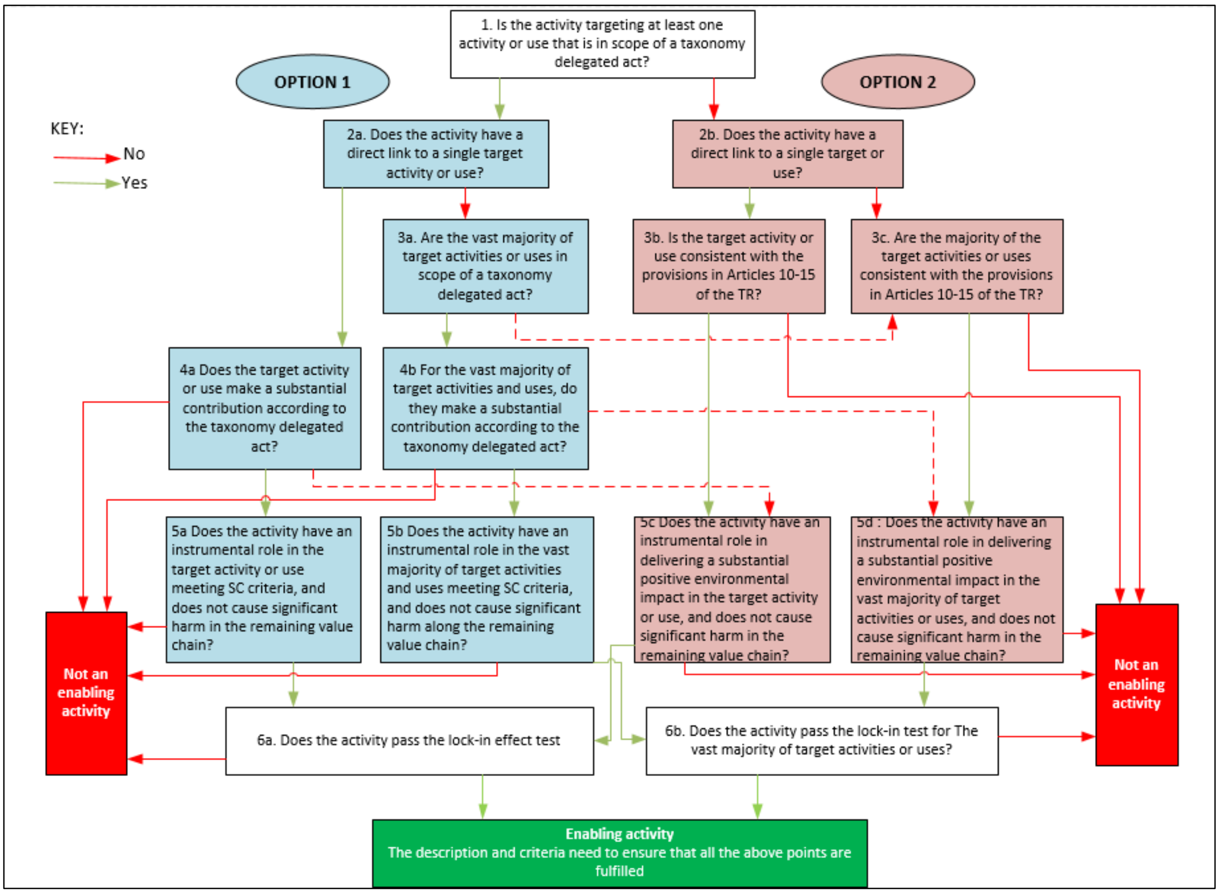
Substantial contribution of the activity to the transition to a circular economy

Article 13(1)(l) of the Taxonomy Regulation provides that an activity contributes substantially to the transition to a circular economy, including waste prevention, re-use and recycling, where that activity 'enables any of the activities listed in points (a) to (k) (…) in accordance with Article 16'.

As highlighted in the report from the Platform on Sustainable Finance released in March, as far as the circular economy objective is concerned, enabling activities can be those which 'intervene at the interface between different activities. Indeed, as a material-stream-oriented objective, the circular economy requires better handling of the transfer of material between different operators, particularly when the waste of one operator can be a resource for another. Examples may include digital marketplaces for second-hand products'. In such case, marketplaces for the trading of second-hand goods enable to prolongs the use of products, including through reuse as stated in Article 13(1)(e).

The sale of certain second-hand products is already listed as an activity eligible to making a substantial contribution to the transition to a circular economy. This activity targets the development of marketplaces enabling the former activity to be performed.

Fit with the enabling activity framework:




1: This activity is targeting at least one activity or use that is in scope of what the Platform recommended to be in a taxonomy delegated act (sale of "sale of second-hand goods", (activity 2.12, Annex to the March Platform report). → **Move to 2a**

2a: The activity does not have a direct link to a single target activity or use: the enabling activity actually targets activity 2.12 of the Platform report. This activity however is limited the sale of second-hand goods from business to business or business to consumers. Consumer to consumer sale of second-hand items is not covered under the platform report, however, the marketplaces covered under the enabling activities are. For instance, while some online marketplaces for second-hand goods only allow for trade from professionals (such as Backmarket), other well known, generalists online classifieds marketplaces such as Marktplaats, leboncoin, 2ememain or specialized classifieds marketplaces such as Vinted both contain ads from professionals as well as non-professionals. → M**ove to 3a**

3a: The vast majority of the target activities or uses are not in scope of a taxonomy delegated act. In fact, the origin of online classifieds lies in the resale and reuse of goods and still today, the majority of trade via these platforms is in second-hand goods between private individuals.

The main reason for C2C (consumer to consumer) trade of second-hand goods is not listed as a recommended activity in the Platform report is that consumers are not subject to the Taxonomy Regulation. → **Move to 3c**

3c: The majority of the target activities or uses are consistent with the provisions in articles 10-15 of the Taxonomy Regulation. Indeed, marketplaces selling second hand goods allow for the lifetime/use intensity of products to increase. Importantly, for this activity, we worked under the assumption that prolonging the lifetime of goods though reuse would have a displacement effect on consumption and on production – second-hand items are bought instead of new items. This assumption is corroborated by several market surveys, e.g. those carried out by Vestiaire Collective,or Farfetch showing that a substantial proportion (in the range of 60-70%) of the respondants bought second-hand instead of new goods. By offering platforms where consumers can buy and sell second-hand items, the need for newly produced goods is reduced. This activity makes a substantial contribution to the transition to a circular economy by enabling Art.13(1)(e) to be fulfilled (enable to prolongs the use of products, including through reuse). → **Move to 5d**

5d: Regarding instrumentality: Without marketplaces, the target activity would not be performed (at least, not in such scale). By connecting buyers/users with sellers of second-hand goods, the enabling activity can be seen as instrumental for the target activity.

Regarding overall positive environment impact: Several studies have shown that overall, buying and selling of second-hand products had a positive environmental impact overall. Studies focus on clothes (for instance WRAP, 2017, Valuing our clothes: the cost of UK fashion), electronics (Hampus et al, 2019, Resource and environmental impacts of using second-hand laptop computers: A case study of commercial reuse), or on the environmental impacts of any second-hand good trades (see Adevinta, 2020, the second-hand effect). All the studies we have seen show for an overall positive environmental for the trade of second hand good.

Most studies we found focus on fast moving consumer goods which tend to be bought new.

For other goods, second-hand market is already very developed because of important economic value of the assets (such as real estate, or art). In those cases, selling second-hand is not about prolonging the lifetime of the asset. This is why, this activity does not cover marketplaces for any goods but those for which prolonging the lifetime. In the scope of the activity, we provide a closed list of NACE codes originally producing the goods in scope.

→ **Move to 6b**

6b: The activity passes the lock in test overall, with the exception of second-hand cars. The climate and pollution performance of cars are improving fast. Norway committed to limit the placing on the market to electric cars by 2025, the EU by 2035. An activity that enables to prolong the lifetime of assets which are soon not to be placed on the market any longer does not pass the lock in test. For usability reasons, we have decided not to include cars in the scope of this activity and would recommend to deal with this issue in a separate activity. Alternatively, enabling the sale of electric cars could be included in this activity, but it would imply that marketplaces can make a distinction between revenues generated and investments for the sale of electric versus combustion engine cars.

Other important considerations reflected in the criteria:

Certain online marketplaces selling second-hand goods are generalist sites.

Revenues of platforms are split between transactional (linked to a specific product and transaction sale) and non-transactional revenues (not linked to a specific transaction, such as revenues from advertisement or subscription fees from professional sellers). A limitation of useability of this activity, is the capacity to allocate revenues/investments/expenditures to specific products/transactions. However, revenues of platforms progressively evolve towards a larger share of transactional revenues. This means that the useability of activity will improve in time. This is why, it is important to include an explicit requirement for a verified allocation key.

Varied comments :

Both digital and physical (ex: fair for 2$^{nd}$ hand goods resale) marketplaces qualify.

The resale activity itself is not included and is already covered by activity “2.12 Sale of second-hand goods” published by the platform in March 2022. In this activity we only focus on activities which act as an intermediary to enable to sale of 2$^{nd}$ hand goods, but are neither the buyer or the seller. It is therefore important to keep in the future a good alignment between this activity and activity “2.12 Sale of second-hand goods” to ensure consistency of criteria (notably on the scope of eligible products, described through NACE codes), while making sure the responsibility of each eligibility criteria is put on the right economic actor. For instance, marketplaces are not responsible for the guarantee that is provided for a 2$^{nd}$ hand good, the responsibility is with the seller.

No scope exclusion is defined for fossil-related products: the group assessed that this use case was probably extremely rare. Fossil infrastructure have very long lifetime , and it is doubtful there is a significant market for 2nd hand goods.

Proposed DNSH criteria for climate : There is no well-established label/standard for GHG management that would be used consistently across geographies, sectors or company size (large vs medium/small companies). Therefore, it is not possible to refer a specific standard or level of expectation. Nevertheless, the group believes it is important to define on a transversal DNSH criteria for climate change mitigation.

In this text, relevance of proposed DNSH criteria on climate will be limited : in most cases, marketplace players do not own nor operate data centers. This should be reworked, and it would be useful to define a transversal DNSH for climate change mitigation.

Classifieds and marketplaces are different, both words should be kept in the description of the activity. See here : https://medium.com/@bryanwester/classifieds-vs-marketplaces-whats-the-difference-650985eec9ed

Marketplaces for the trading of secondary raw materials for recycling are not included in this activity. Such marketplaces should be considered as part of enabling activities to be prioritized in future taxonomy development work. This should be done at the same time as other enabling technologies for waste management (IT/OT solutions for waste management, etc.).

Platforms that are seeking to reduce food waste (linked to C10 and C11) are not well covered in this activity. Indeed, for food products, product have not necessarily been sold to a customer before, the objective is also to avoid stock scraping. This activity should be prioritized future taxonomy development work, with other enabling activities that favor circular economy in agriculture.

The resale of cars should be managed in a dedicated activity, and with consistent criteria no matter whether the trade is made online or in a physical car dealership. The sale and resale of vehicles, vessels, etc. that are eligible/aligned in the Taxonomy (such as electric cars) should be considered by future taxonomy development work.

## E.2 Provision of IT/OT data-driven solutions and software that provide a substantial contribution to circular economy

*Description of the activity*

Manufacturing, development, installation or deployment, and maintenance of

a) Software and IT/OT systems built for the purpose of remote monitoring and predictive maintenance, including

    (i) remotely collecting, processing, transferring, and storing data from equipment, products or infrastructure during their use or operation, and

    (ii) analysing the data and generating insights about the operational performance and condition of the equipment, product or infrastructure, and

    (iii) providing remote maintenance and recommendations about measures required to avoid operational failure and maintain the equipment / product / infrastructure in a optimal operating condition and prolong their useful life and reduce resource use and waste.

Included in this activity are also AI based solutions, e.g. for automated machine learning.

b) Tracking & tracing software and IT/OT systems built for the purpose of providing identification, tracking and tracing of materials, products and assets through their respective value chains (incl. material passport) with the predominant objective to support the circularity of material flow or other objectives outlined in EU regulation 2020/852.

c) Lifecycle assessment software supporting the lifecycle assessment and related reporting for products, equipment or infrastructures.

d) Design and engineering software supporting the eco-design of products, equipment, and infrastructure

e) Supplier management software supporting green procurement of material, products and services with low environmental impact (but excluding the operation of market places supporting the trading of such goods)

f) Lifecycle performance management software supporting the monitoring and assessment of the circularity performance of products, equipment, or infrastructures during their lifecycle,

where those technologies are not already explicitly covered in other activities substantially contributing to the transition to the circular economy.

IT/OT systems include connectable products, sensors, analytics and other software, and ICT technologies for the transmission, storage and display of data. Software includes on-premise and cloud-based software.

The economic activities in this category could be associated with several NACE codes, in particular C26.3, C26.52, C27.12, C27.9, J58.29, J61, J62 and J63.1 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

An economic activity in this category is an enabling activity in accordance with Article 13(1), point (l), of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to transition to a circular economy |
| --- |
| The economic activity as outlined in the description provides users and operators with capabilities as listed below. Only listed capabilities are included in this activity. If these capabilities are part of a broader software or IT/OT offering, only specific software add-ons implementing these capabilities qualify (not the full software offering), or only the share of the economic activity derived from the software or IT/OT system that can be allocated to these capabilities by means of an established methodology, such as relating the cost (or functional size as per IEC 20926) of implemented capabilities to overall cost (or functional size). The determination of this share needs to be verifiable by 3rd parties.<br>Where multiple capabilities are listed under a single bullet point below, all capabilities should be met for the system or software to qualify.<br>a) For remote monitoring and predictive maintenance systems, the following capabilities qualify:<br>• Capturing sensor data from sensors (such as power, temperature, vibration, video, sound, viscosity) built into a product, equipment, or infrastructure; collecting and transmitting such data to a data repository (edge or cloud) for the purpose of data analysis; alerting the user to abnormal sensor values; and |

assessing the status of the product, equipment, or infrastructure, detecting wear and tear or electrical issues, or drawing conclusions about the exact nature of abnormal operating conditions by means of advanced analytical methods

- Predicting the expected remaining lifetime of a product, equipment, or infrastructure, and recommending measures to extend the remaining lifetime
- Predicting an upcoming product / equipment / infrastructure failure and recommending measures to prevent such failure
- Providing recommendations about the highest value next use cycle, such as reuse, recovering components through parts harvesting for remanufacture, or recycling, taking into consideration a combination of factors regarding the product's condition.

Excluded from this activity are IT/OT systems aimed at (i) monitoring for the replacement of consumables (e. g. printer ink); (ii) remote monitoring and remote maintenance of power generation plants that are more greenhouse gas intensive than 100 gCO2e/kWh, (iii) Monitoring and remote management of any type of fossil fuel engine.

b) For tracking & tracing software and IT/OT systems, the following capabilities qualify:

- Providing identification, tracking and tracing of materials, products and assets through value chains in order to make accessible structured data (such as material content, substances, environmental information) required for lifecycle assessments or material declarations according to relevant standards, such as Commission Recommendation 2013/179/EU96[259], ISO 14067[260] or ISO 14040[261], and sharing of such data with value chain partners, consumers, and other economic actors in compliance with relevant standards regarding data modelling, interoperability, data privacy and data security.
- Provisioning and sharing of documents and data directly supporting the repair and maintenance of products and equipment, such as repair instruction, test

[259] Commission Recommendation 2013/179/EU of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (OJ L 124, 4.5.2013, p. 1).

[260] ISO standard 14067: Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification (version of [adoption date]: https://www.iso.org/standard/71206.html).

[261] ISO standard 14040 : Environmental management — Life cycle assessment — Principles and framework

equipment, wiring and connection diagrams, diagnostic fault and error codes, disassembly instructions

- Supporting the take-back of products for remanufacturing, refurbishment or recycling, by managing steps and transactions in the take-back process (such as pick-up order placement, tracking of sales transaction data, decomposition of product into materials to be re-injected into circular material flows) and by optimising decisions to prevent downcycling and maximise resource recovery.

c) For lifecycle assessment software, the following capabilities qualify:

- Supporting the life cycle assessment of products, equipment or infrastructure with SW-implemented methods and algorithms according to relevant standards such as Commission Recommendation 2013/179/EU96[259], ISO 14067[260] or ISO 14040261
- Providing data required for lifecycle analysis, such as standard carbon emission values and other environmental impacts for frequently used products and materials or production steps.
- Providing recommendations for improving the design of a product, equipment, or infrastructure so as to minimize their material and carbon footprint.

d) For design and engineering software, the following capabilities qualify:

- Supporting users to formulate, document and manage product[262]-specific circularity and other environmental design goals and requirements, such as design-for-remanufaturability, design-for-serviceability, minimal environmental impact from using or operating the product, minimal waste during production or construction, etc.
- Supporting users to explore product designs for the purpose of assessing and optimizing product designs against specified circular or other environmental objectives, or finding the best trade-off between conflicting design goals (e.g. robustness vs. material use, greener material vs. costing or installing schedule or cost of downstream reuse and recycling systems)

[262] In this section d), the word “product” is used in a broad sense, including machines, equipment, infrastructures and other object designed with design and engineering software

- Validating a design through analysis and simulation against specified circularity and other environmental design goals and requirements
- Supporting the computer-aided product design process – including mechanical, electrical, electronic or recipe design – with data and information about the impact of design and construction decisions on circularity and environmental performance
- Supporting the selection of materials and components with a low environmental impact through the provision of data about market-available materials and components and their cost.
- Tracking the composition of a product over its life cycle with the predominant objective to manage its global level of circularity.

e) For supplier management software, the following capabilities qualify:

- Providing the user with information about suppliers of circular[263], eco-designed or otherwise eco-friendly material, products, and components, as well as the offering of such suppliers
- Supporting the management and tracking suppliers' compliance with standards and certifications related to the provision of such materials, products, and components.
- Supporting the exchange with suppliers of data required to verify the environmental performance of supplied materials, products, and components.
- Supporting the trading and matchmaking between suppliers and purchasers of circular, eco-designed or otherwise eco-friendly products, materials, and components.

f) For lifecycle performance management software, the following capabilities qualify:

- Supporting the monitoring and assessment of the circularity performance of a product, equipment or infrastructure during its lifecycle over time.
- Comparing circularity performance against original circularity design goals, analyzing deviations and their root causes.

[263] Circular materials, components and products are second-hand goods that have been used for their intended purpose before by a customer (household or organisation), possibly after repair, refurbishment and/or remanufacturing or goods with a significantly higher recycled content compared to industry average.

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| | • Supporting the planning and documentation of measures required to prolong the useful life of the product, equipment or infrastructure (such as maintenance, retrofit, or other services)<br>• Supporting the impact assessment of such measures on circularity performance<br>Providing the user with data required to take decisions on the future use of the product, equipment, or infrastructure (e.g. retrofit, change of use, decommissioning and recycling). |
| Do no significant harm ('DNSH') | |
| (1) Climate change mitigation | If data centers are owned and operated, the activity has demonstrated best efforts to implement the relevant practices listed as "expected practices" in the most recent version of the European Code of Conduct on Data Centre Energy Efficiency624, or in CEN-CENELEC document CLC TR50600-99-1 "Data centre facilities and infrastructures - Part 99-1: Recommended practices for energy management"625 and has implemented all expected practices that have been assigned the maximum value of 5 according to the most recent version of the European Code of Conduct on Data Centre Energy Efficiency. |
| (2) Climate change adaptation | DNSH as set out in Appending A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| (4) Transition to a circular economy | If data centers are owned and operated, the equipment used meets the requirements laid down in Directive 2009/125/EC for servers and data storage products. |

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| | The equipment used does not contain the restricted substances listed in Annex II to Directive 2011/65/EU, except where the concentration values by weight in homogeneous materials do not exceed the maximum values listed in that Annex.<br><br>A waste management plan is in place and ensures maximal recycling at end of life of electrical and electronic equipment, including through contractual agreements with recycling partners, reflection in financial projections or official project documentation.<br><br>At its end of life, the equipment undergoes preparation for re-use, recovery or recycling operations, or proper treatment, including the removal of all fluids and a selective treatment in accordance with Annex VII to Directive 2012/19/EU. |
| (5) Pollution prevention and control | DNSH as set out in Appendix C of Annex 1 to the Commission Delegated Regulation (EU) …/… supplementing Regulation (EU) 2020/852] |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |

| Rationale |
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This activity is based on Article 16 of Regulation (EU) 2020/852. It covers software and IT/OT systems that provide operators with essential capabilities required to manage the transition to a circular economy, from the design of a product or equipment to its tracking along their lifecycle.

The objective of this activity is to address the most obvious and widespread uses of ICT technologies in a circular economy, i.e. technologies contributing to map out and monitor products' functionality, effectiveness and efficiency in order to extend the product lifetime or material and/or product passport technologies which are absolutely crucial to enable all actors along the value chain to be provided with the right information to retain or recover all useful components and materials.

Following the Horizontal Framework for Enabling Activities, this activity falls into the "Option 2" category. It supports a generic objective "transition to a circular economy" in a broad range of target activities, which are mostly not in scope of the EU Taxonomy. For this reason, only very specific capabilities of software and IT/OT systems which are instrumental for the transition to a circular economy and have in most cases no other significant economic purpose are included in this activity.

In some cases, the environmental objectives addressed by included activities cannot be usefully limited to the transition to a circular economy. For instance, the tracking of the material content of a product is useful not only for recycling, but also for product carbon footprint assessment. In such cases, the scope of this activity has been expanded to cover other environmental objectives as well.

Scope exclusions have been applied to the specific case of remote monitoring and maintenance, e.g. to avoid lock-in of fossil-based equipment. For the other SW offerings, no risks of locking in environmentally harmful technologies have been identified.

## E.3 Provision of IT/OT data-driven solutions that provide a substantial contribution to the use and protection of water and marine resources

*Description of the activity*

The activity produces, installs or maintains IT/OT data driven solutions to control, manage and mitigate leakage that enable substantial contribution to sustainable use and protection of water and marine resources through leakage reduction in water supply systems (WSSs).

Data-driven IT/OT solutions include connectable products, analytics, software and ICT technologies for transmission, storage and display of data and management systems.

The economic activities in this category could be associated with several NACE codes, in particular E 36 and F42.99 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

An economic activity in this category is an enabling activity in accordance with Article 12(1), point (e), of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to the use and protection of water and marine resources |
| --- |
| The economic activity manufactures, installs, maintains, repairs and provides professional (technical consulting for design and/or monitoring) services to one or more of the following IT/OT data-driven solutions:<br>a) **Monitoring systems** such as holistic IT/OT suites/tools, or add-ons/extensions to such tools that provide identification, tracking and tracing water leakage with the aim of supporting the plan/efforts of the utility/final users to reach the Leakage threshold value ILI[264] lower than or equal 2.0 for existing WWSs, 1.5 for new WSSs and 1.5 for the rehabilitation of WSSs. |

[264] The Infrastructure Leakage Index (ILI) is calculated as current annual real losses (CARL)/unavoidable annual real losses (UARL): The current annual real losses (CARL) represent the amount of water that is actually lost from the distribution network (i.e., not delivered to final users). The unavoidable annual real losses (UARL) take into consideration that there will always be some leakage in a water distribution network. The UARL is calculated based on factors such as the length of the network, the number of service connections and the pressure at which

b) **IT/OT solutions,** or add-ons / extensions to such tools, that provide controlling, managing and mitigating water leakage with the aim of supporting the plan/efforts of the utility/final users to reach the Leakage threshold value ILI[265] equals to or lower than 2.0 for existing WWSs, 1.5 for new WSSs and 1.5 for the rehabilitation of WSSs.

c) IT/OT solutions, or add-ons/extensions to such tools, that **ensure interoperability** of systems in water metering areas when new monitoring systems or IT/OT solutions are installed.

d) For all the solutions listed above in items a to c, only the specific software/add-ons, or only the share of the economic activity derived from the software/add-ons that has been installed to provide controlling, managing and mitigating water leakage with the aim of supporting the plan/efforts of the utility/final users to reach the Leakage threshold value ILI[266] equals to or lower than 2.0 for existing WWSs, 1.5 for new WSSs and 1.5 for the rehabilitation of WSSs can count as enablers. That may not cover complete software suites and tools.

Manufacturers of these IT/OT tools must be aligned with the latest performance requirements as soon as they enter in force in the European Union.

| Do no significant harm ('DNSH') | |
|---|---|
| (1) Climate change mitigation | |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |

the network is operating. Another appropriate method can be used. The threshold value is established in accordance with Article 4 of Directive (EU) 2020/2184 of the European Parliament and of the Council. That calculation is to be applied across the extent of a specified part of a water supply (distribution) network, i.e., at water supply zone level, district metered area(s) (DMAs) or pressure managed area(s) (PMAs

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| (3) Sustainable use and protection of water and marine resources | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |
| (4) Transition to a circular economy | |
| (5) Pollution prevention and control | The equipment used meets the requirements set in accordance with Directive 2009/125/EC for servers and data storage products.<br><br>The equipment used does not contain the restricted substances listed in Annex II to Directive 2011/65/EU, except where the concentration values by weight in homogeneous materials do not exceed those listed in that Annex.<br><br>A waste management plan is in place and ensures maximal recycling at end of life of electrical and electronic equipment, including through contractual agreements with recycling partners, reflection in financial projections or official project documentation.<br><br>At its end of life, the equipment undergoes preparation for reuse, recovery or recycling operations, or proper treatment, including the removal of all fluids and a selective treatment in accordance with Annex VII to Directive 2012/19/EU. |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |

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| Rationale |

This activity is based on Article 16 of Regulation (EU) 2020/852.

Activities enabling achieving a substantial contribution to the objective “sustainable use and protection of water and marine resources” differ in various characteristics and among WSSs with more and more IT/OT activities in use.

The IT/OT activity that runs *Leakage control equipment, including Smart pressure management areas* ***enables*** *achieving substantial contribution to sustainable use and protection of water and marine resources to the activity* 9.1 “Water Supply”, as published in the report from the Platform on Sustainable Finance: Technical Working Group Part B Technical Screening Criteria (March 2022).

Leakage control systems are mentioned in the JRC report “Best Environmental Management Practice for the Public Administration Sector” as the necessary system to reduce the losses (and the parameter ILI is specifically mentioned). IT/OT tools to identify the leak and manage the WSSs are often part of the IT/OT that is system-bound and tailor-made for the complete WSS.

The activity 9.1 “Water Supply”, achieves SC to the objective *sustainable use and protection of water and marine resources* only if the following

- For operating existing water supply systems, (i) Aligned to the Drinking Water Directive (and the recast Drinking Water Directive once applicable); (ii) Received the required permitting; (iii) ILI is equal or lower than 2.0 and (iv) includes metering at consumer level.
- For new and extension of water supply systems: (i) Aligned to the Drinking Water Directive (and the recast Drinking Water Directive once applicable); (ii) Received the required permitting; (iii) ILI is equal or lower than 1.5 and (iv) includes metering at consumer level.
- For renewal of water supply systems: (i) closing the gap to a leakage level as described above by at least 20% either between the current leakage level averaged over three years, calculated using the Infrastructure Leakage Index (ILI) rating method and an ILI of 1.5 and (ii) A plan with goals and timelines for implementing metering at consumer level.

Each activity that is considered as enabling is required to follow and to be aligned with the Horizontal Framework for Enabling Activities. This Framework is based and develops the Article 16 of the Regulation (EU) 2020/852.

The activity is consistent with the Horizontal Framework for Enabling Activities, as it is proven by the following decision tree:

1. The activity is targeting at least one activity or use that is in the scope of a taxonomy delegated act (Activity 9.1. Water supply); OPTION 1 of the decision tree.

2. The activity as described in the scope description, has a direct link to a single target activity or use. The activity has a direct link to the activity **9.1. Water supply**[267]. The direct link is that without this system, the activity 9.1 Water supply cannot achieve the criteria of the Infrastructure Leakage Indexes (ILI) (equals to or is lower than 2.0, or 1.5).

3. The activity is instrumental to achieve substantial contribution (cannot be achieved without it), however its contribution does not assure that the threshold is met. OPTION 2 is used.

4. The activity has an instrumental role in delivering a substantial positive environmental impact in the target activity or use, and does not cause significant harm in the remaining value chain. The instrumental role can be assumed since without the Leakage control measures as described, the activity cannot achieve SC (ILI of 2.0 or 1.5, depending on the case) but in exceptional cases.

5. The activity passes the lock-in test since these systems can be easily replaced and improved in the future (e.g. improved pumping systems).

The activity is broad and technology neutral in the sense that the technology simply must showing a direct and causal link with the enabled activity.

[267] To be noted that this activity could also be considered as enabling the activities included in the First Delegated Act “5.1 Construction, extension and operation of water collection, treatment and supply systems” and “5.2. Renewal of water collection, treatment and supply systems”. IT/OT data-driven solutions may be instrumental to achieve Climate Action Mitigation objective in these activities. This is to be developed in the future.

## E.4 Manufacture and installation of, and associated services for leakage control systems enabling a substantial contribution to sustainable use and protection of water and marine resources

*Description of the activity*

The activity produces, installs and provides associated services for leakage control systems, including **Smart pressure management areas**, that enable substantial contribution to sustainable use and protection of water and marine resources through leakage reduction and prevention in water supply systems (WSSs).

The economic activities in this category could be associated with several NACE codes, in particular E 36, F42.99 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

An economic activity in this category is an enabling activity in accordance with Article 12(1), point (e), of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to sustainable use and protection of water and marine resources |
| --- |
| The activity manufactures, installs, provides maintenance and repair and professional (technical consulting for design and/or monitoring) services essential to the functioning over the lifetime of the following technology:<br>• **Smart pressure management for water systems installed aiming at reaching the Leakage threshold value ILI[268] lower than or equal to 2.0 for existing WWSs, 1.5 for new WSSs and 1.5 for the rehabilitation of WSSs**. These systems are aimed to control the pressure in District Metering Areas (DMAs) of the water supply system to a minimum pressure without affecting the supply to the consumers and eventually |

[268] The Infrastructure Leakage Index (ILI) is calculated as current annual real losses (CARL)/unavoidable annual real losses (UARL): The current annual real losses (CARL) represent the amount of water that is actually lost from the distribution network (i.e., not delivered to final users). The unavoidable annual real losses (UARL) take into consideration that there will always be some leakage in a water distribution network. The UARL is calculated based on factors such as the length of the network, the number of service connections and the pressure at which the network is operating. Another appropriate method can be used. The threshold value is established in accordance with Article 4 of Directive (EU) 2020/2184 of the European Parliament and of the Council. That calculation is to be applied across the extent of a specified part of a water supply (distribution) network, i.e., at water supply zone level, district metered area(s) (DMAs) or pressure managed area(s) (PMAs

avoiding damage in the pipes thus reducing leakages. In order to be declared “smart”, the system must include pressure control valves, pressure transmitters, flow meters and communication devices and special civil works (such as manholes to maintain the pressure control valves).

Manufacturers of this technology must be aligned with the latest performance requirements as soon as they enter in force in the European Union.

For the products, activities and technologies listed above, installation, maintenance and consultancy services for design and monitoring are included only if they are directly related leakage control systems.

Do no significant harm (‘DNSH’)

| | |
|---|---|
| (1) Climate change mitigation | |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of water and marine resources | |
| (4) Transition to a circular economy | The activity assesses the availability of and, where feasible, adopts techniques that support:<br><br>(a)reuse and use of secondary raw materials and reused components in products manufactured;<br><br>(b)design for high durability, recyclability, easy disassembly and adaptability of products manufactured;<br><br>(c)waste management that prioritises recycling over disposal, in the manufacturing process; |

| | |
|---|---|
| | (d)information on and traceability of substances of concern throughout the life cycle of the manufactured products. |
| (5) Pollution prevention and control | DNSH as set out in Appendix C of Annex 1 to the Commission Delegated Regulation (EU) …/… supplementing Regulation (EU) 2020/852] |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |

| |
|---|
| Rationale |

It is not possible to draft a general activity for enabling achieving a substantial contribution to the objective “sustainable use and protection of water and marine resources” . The variety of activities that influence this objective is vast, with different levels of contribution making impossible or at least not usable a general activity.

Leakage control systems are mentioned in the JRC report “Best Environmental Management Practice for the Public Administration Sector” as the necessary system to reduce the losses (and the parameter ILI is specifically mentioned).

Controlling the pressure is a critical method for reducing the leakage level. The working pressure in the drinking water distribution systems is one of the factors for calculating the unavoidable annual real losses (UARL), which is one of the factors for estimating the ILI. Pipe burst happens in many cases due to pressure fluctuations (which stresses the infrastructure) and also due to high pressures. By means of smart pressure management for water systems, the pressure is adjusted to the optimum to the demanded flow by the consumers.

The activity that manufactures, installs, maintains and provides lifecycle of *Leakage control equipment, including Smart pressure management areas* ***enables*** *achieving substantial contribution to sustainable use and protection of water and marine resources to the activity* 9.1 “Water Supply”, as published in the report from the Platform on Sustainable Finance: Technical Working Group Part B Technical Screening Criteria (March 2022).

The activity 9.1 “Water Supply”, achieves SC to the objective *sustainable use and protection of water and marine resources* only if the following criteria are met:

- For operating existing water supply systems, (i) Aligned to the Drinking Water Directive (and the recast Drinking Water Directive once applicable); (ii) Received the required permitting; (iii) ILI is equal or lower than 2.0 and (iv) includes metering at consumer level.

- For new and extension of water supply systems: (i) Aligned to the Drinking Water Directive (and the recast Drinking Water Directive once applicable); (ii) Received the required permitting; (iii) ILI is equal or lower than 1.5 and (iv) includes metering at consumer level.

- For renewal of water supply systems: (i) closing the gap to a leakage level as described above by at least 20% either between the current leakage level averaged over three years, calculated using the Infrastructure Leakage Index (ILI) rating method and an ILI of 1.5 and (ii) A plan with goals and timelines for implementing metering at consumer level.

Each activity that is considered as enabling is required to follow and to be aligned with the Horizontal Framework for Enabling Activities[269]. This Framework is based and develops the Article 16 of the Regulation (EU) 2020/852.

The activity are “aimed at reaching leakage thresholds” and will be implemented as follows:

[269] Link

- The final user (usually a water utility) aspires to reduce the leakage levels (measured as ILI)
- The final user includes in its strategy this activity and engages one manufacturer
- The manufacturer designs the system, aiming at a feasible ILI reduction
- The manufacturer installs the system and tests it
- The final user operates it and achieves a reduction in ILI
- The services maintaining and repairing these systems are usually provided by the manufacturer of by the final user once trained by the manufacturer.

The activity is consistent with the Horizontal Framework for Enabling Activities, as it is proven by the following decision tree:

a. 1a. The activity is targeting at least one activity or use that is in the scope of a taxonomy delegated act (Activity 9.1. Water supply); OPTION 1 of the decision tree.

b. 2a. The activity as described in the scope description, has a direct link to a single target activity or use. The activity has a direct link to the activity **9.1. Water supply**[270]. The direct link is that without this system, the activity 9.1 Water supply cannot achieve the criteria of the Infrastructure Leakage Indexes (ILI) (equals to or is lower than 2.0, or 1.5).

c. 4.a The activity is instrumental to achieve substantial contribution (cannot be achieved without it), however its contribution does not assure that the threshold is met. OPTION 2 is used

[270] To be noted that this activity could also be considered as enabling the activities included in the First Delegated Act "5.1 Construction, extension and operation of water collection, treatment and supply systems" and "5.2. Renewal of water collection, treatment and supply systems". Leakage control equipment may be instrumental to achieve Climate Action Mitigation objective in these activities. This is to be developed in the future.

d. 5c. The activity has an instrumental role in delivering a substantial positive environmental impact in the target activity or use, and does not cause significant harm in the remaining value chain. The instrumental role can be assumed since without the Leakage control measures as described, the activity cannot achieve SC (ILI of 2.0 or 1.5, depending on the case) but in exceptional cases.

e. 6c. The activity passes the lock-in test since these systems can be easily replaced and improved in the future (e.g. improved pumping systems).

The DNSH criteria are generally aligned with those included in the First Delegated Act. In relation to Mitigation, to be noted that the purpose of the activity is reducing leakage thus reducing the energy consumption of the water supply system. Therefore the mitigation concept in a co-benefit of the activity, and no DNSH to mitigation is required.

## E.5 Manufacture, installation, and servicing of high, medium and low voltage electrical equipment for electrical transmission and distribution that result in or enable substantial contribution to climate change mitigation

*Description of the activity*

The activity develops, manufactures, installs, maintains or services electrical products, equipment, systems, software that result in or enable substantial contribution to climate change mitigation in high, medium and low voltage electrical distribution systems through electrification, energy efficiency, integration of renewable energy or efficient power conversion. The activity includes systems to integrate renewable sources of energy in the electric grid, increase grid automation, flexibility and stability, manage demand-side response, develop low carbon transport or heat, deploy smart metering technologies for substantial improvement of energy efficiency.

Heat and power generating equipment and electrical appliances are excluded.

The activity could be associated with several NACE codes, such as C26.51, C.27.1, C.27.3, C.27.9, 33.13, 33.14 and 33.2

The activity is an enabling activity in accordance with Article 10(1), point (i), and Article 16 of Regulation (EU) 2020/852 where it complies with the technical screening criteria set out in this Section.

| Substantial contribution to climate change mitigation |
| --- |
| The activity complies with all of the following criteria 1 to 5:<br>1. The activity manufactures, installs, maintains or provides maintenance, repair and technical consulting services essential to the functioning over the lifetime of one or more of the technologies listed below :<br>a) Electric vehicle (EV) charging stations and supporting electric infrastructure for the electrification of transport. The manufacturer must prove that supporting electric infrastructure is installed primarily to enable electric vehicle charging. Economic activities that are an integral element of the 'Installation, maintenance and repair of charging stations for electric vehicles in buildings (and parking spaces attached to buildings)' as referred to in Section 7.6 of Annex I to Regulation (EU) 2021/2139" are excluded. |

b) Transmission and distribution transformers that comply with the Tier 2 (1 July 2021) requirements set out in Annex I to the Commission Regulation (EU) No 2019/1783[271] and, for medium power transformers with highest voltage for equipment not exceeding 36 kV, with AA0 level requirements on no-load losses set out in standard EN 50708 series*.

**new Commission regulation has been adopted in 2019 on transformers. The elements on transformers that are proposed in the section 4.9 on transmission and distribution should be updated to reflect this recent update. The equivalent is IEC TS 60076-20: POWER TRANSFORMERS –PART 20: ENERGY EFFICIENCY*

c) Low voltage electrical products, equipment and systems to increase the controllability of the electricity system, integrate renewable energy and generate energy efficiency:

- Low voltage circuit breakers, switchgears, switchboards, panelboards or control centers. All equipment must be connectable or automated or equipped with power or energy metering devices. Equipment must be compliant with IEC TR 63196 Low-Voltage Switchgear and Controlgear and their assemblies - Energy efficiency.
- Home Building Electronic Systems (HBES), as defined in IEC 63044 Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS), restricted to products and systems that are needed to measure, control and reduce energy consumption.
- Technologies that enable to increase the energy efficiency of low voltage installations, recognized under IEC 60364-8-1: Low-voltage electrical installations – Part 8-1: Energy efficiency - IEC 60364-8-2: Low-voltage electrical installations - Part 8-2: Prosumer's low-voltage electrical installations. This includes energy and power meters, external customer display, power compensation, phase compensation and filtering and efficient electric motor-driven systems.

Equipment must be compliant with IEC 61557-12: Equipment for testing, measuring or monitoring of protective measures - Part 12: Power metering and monitoring devices (PMD) - Part 1: Device requirements ; and with IEC 62974-1: Monitoring and measuring systems used for data collection, gathering and analysis - ISO 50001 Energy Management Systems.

d) High and medium voltage transmission and distribution equipment, systems and services, excluding transformers (for transformers refer to point b). The end user of the equipment manufactured is not part of the following industries: primary steel, non-ferrous metals, metal

[271] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2019.272.01.0107.01.ENG

transformation, cement, ceramic and glass. Equipment must be compliant with IEC62271 1 High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear ; IEC62271- 200 High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.

e) High, medium and low voltage electrical products, equipment, systems and software that enable a reduction of greenhouse gas emissions through the electrification of energy usage or the integration of renewable energy in the electricity grid. The manufacturer must prove that the equipment, system or software is installed to enable one of the applications listed below:

- Integration of renewable energy sources in the electrical grid, as defined in section 3.1 of the Delegated Act for climate change mitigation
- Storage technologies for the electricity grid, as defined in Section 4.10 of the Delegated Act for climate change mitigation.
- Infrastructure for rail transport, as defined in Section 6.14 of of the Delegated Act for climate change mitigation.
- Electrification of infrastructure for low carbon road transport and public transport, as defined in Section 6.15 of the Delegated Act for climate change mitigation.
- Electrification of Infrastructure enabling low carbon water transport, as defined in Section 6.16 of the Delegated Act for climate change mitigation.

The manufacturer must prove that the equipment, system or software is installed in an infrastructure that is compliant with the Technical Screening Criteria of the relevant activity listed above, as defined in the Delegated Acts to the Regulation EU 2020/852. The manufacturer does not have to prove that the infrastructure is compliant with criteria defined under the Do Not Significant Harm section of the relevant activity.

f) Demand response and load shifting equipment, systems and services that increase the flexibility of the electricity system and support grid stability:

- Solutions to carry information to users for remotely acting on supply or consumption, including customer data hubs
- Automated control centers for load management and their core components (switchboards, contactors, relays, circuit breakers, automatic transfer switches). Core components must be installed as part of control centers

- Advanced software and analytics to maximize efficiency and automation of electricity networks or integration of decentralized energy resources, at the level of the electricity grid or an industry:
    - advanced control rooms, automation of electrical substations, voltage control capabilities
    - operation software enabling operators to simulate the operation of grids for the purpose of ensuring grid stability, managing Distributed Energy Resources (DERs) or improving grid performance. The software must support dynamic grid characteristics required for the transition towards renewable energy. It must be capable of processing data from near-real time grid measurements to observe how the power transmission, distribution and consumption really occur, and use this information to improve simulation studies and operation activities, including the avoidance of outages, back-outs, and wastes.
- Software supporting the design and planning of new grids or grid upgrades. The software must support dynamic grid characteristics required for the transition towards renewable energy, for instance volatile power generation at distribution level (“prosumers”), changing of power flow directions, and the use of grid storage units
- Meteorological sensors for forecasting renewable production
- Stand-alone or embedded connectable controllers and relays that enable an efficient use of electrical sources and loads amend
- Load-shedding and load-shifting equipment for load management and source-switching equipment (SSE). Equipment must be compliant with IEC 62962:2019 Particular requirements for load-shedding equipment (LSE)

g) Communication, software and control equipment, products, systems, and services for energy efficiency and integration of renewable energy:

- Equipment to allow for exchange of specifically renewable electricity between users
- Battery swapping technology or service, supporting the electrification of transport
- Microgrid Management System
- Energy or power management systems, energy or power controls systems and SCADA systems for Power management
- Contactors, Motor starters and motor controls that are connectable or automated and enable remote or automated control of electricity consumption and optimization of load variation

- Variable speed drives (excluding soft starters) that enable energy efficiency in electrical motor applications. Equipment must be compliant with IEC 61800-9-1 and IEC 61800-9-2 Ecodesign for power drive systems, motor starters, power electronics and their driven applications;
- Low-voltage Electrical motors with an energy efficiency class (according to IEC 60034-30: Efficiency classes for low-voltage motors) exceeding the requirements set by the EU Regulation 2019/1781 as of July1st, 2023, specifically:
  - Single-phase motors with a rated output of 0,12 kW or higher and an efficiency class of IE3 or higher
  - Ex eb increased safety motors with a rated output between 0,12 kW and 1 000 kW, with 2, 4, 6 or 8 poles and an efficiency class IE3 or higher
  - 3-phase motors with a rated output between 0,75 kW and 1000 kW, with 2, 4, 6 or 8 poles, which are not Ex eb increased safety motors and have (i) an efficiency class of IE5 for motors with 2,4 or 6 poles and a rated power between 75 kW and 200 kW, (ii) an efficiency class of IE 4 or higher for all other motors
  - 3-phase motors with a rated output between 0,12 kW and 0,75 kW, with 2, 4, 6 or 8 poles, which are not Ex eb increased safety motors and have an efficiency class of IE3 or higher
- Medium- and high-voltage motors with a rated power above 1000 kW and an energy efficiency class IE 4 or higher according to draft standard IEC 60034-30-3

2. Installation, repair, maintenance and technical consulting services are included only if they are directly related to products, equipment or systems in scope of this activity.

3. The following scope exclusions apply:

- Infrastructure dedicated to creating a direct connection or expanding an existing direct connection between a substation or network and a power production plant that is more greenhouse gas intensive than 100 gCO2e/kWh measured on a life cycle basis are not compliant. This scope exclusion only applies to equipment that is proven to be directly used to connect (or reinforce the connection to) a power production plant above 100gCO2e/kWh.

- Products, equipment, systems and software that are installed in an infrastructure dedicated to the extraction, transport, distribution, storage, manufacturing or transformation of fossil fuels are not compliant.

This scope exclusion does not exclude equipment installed to expand, reinforce or maintain energy transmission and distribution networks.

4. For switchgears with insulating or breaking medium using, or whose functioning relies upon, gases with a Global Warming Potential (GWP):

   - Below and equal to 145 kV and up to 50kA short circuit: equipment containing gas mixtures with a GWP above 10 are not compliant
   - Above 145kV or more than 50kA short circuit: equipment containing gas mixtures with a GWP above 675 are not compliant.

For all power ranges, switchgears containing $SF_6$ are not compliant.

5. All products, equipment and systems must comply with mandatory energy and material efficiency performance requirements defined in Ecodesign Directive 2009/125/EC. Manufacturers must refer to the latest performance requirements as soon as they enter in force in the European Union.

| Do no significant harm ('DNSH') | |
|---|---|
| (1) Climate change mitigation | |
| (2) Climate change adaptation | DNSH as set out in Appendix A of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852. |
| (3) Sustainable use and protection of | DNSH as set out in Appendix B of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |

| | |
|---|---|
| water and marine resources | |
| (4) Transition to a circular economy | The activity assesses the availability of and, where feasible, adopts techniques that support:<br><br>(a) reuse and use of secondary raw materials and reused components in products manufactured;<br><br>(b) design for high durability, recyclability, easy disassembly and adaptability of products manufactured;<br><br>(c) waste management that prioritises recycling over disposal, in the manufacturing process;<br><br>(d) information on and traceability of substances of concern throughout the life cycle of the manufactured products. |
| (5) Pollution prevention and control | DNSH as set out in Appendix C of Annex 1 to the Commission Delegated Regulation (EU) …/… supplementing Regulation (EU) 2020/852 |
| (6) Protection and restoration of biodiversity and ecosystems | DNSH as set out in Appendix D of Annex 1 to the Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2020/852 |

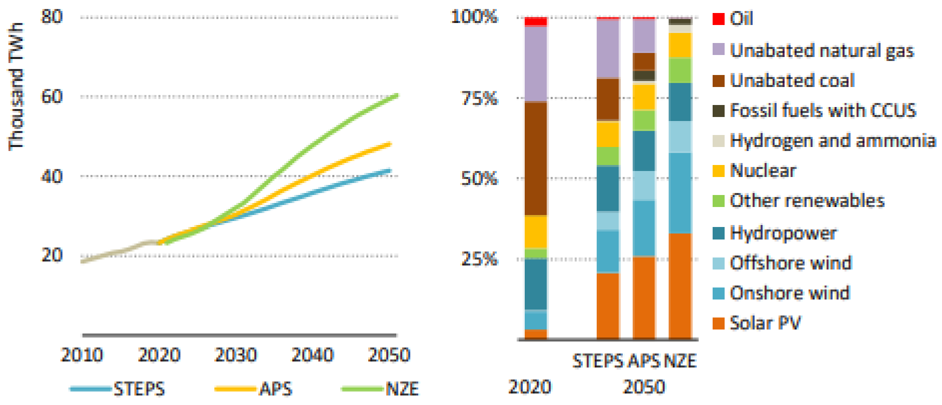
| |
|---|
| Rationale |

The Commission has mandated the Platform to develop TSC for this activity. The Commission made its intention to include electrical equipment as an additional enabling activity to the Climate Delegated Act - with or without recommendations from the Platform - clear in a recital of the Climate Delegated Act. Recital 23 of the Climate Delegated Act reads:

"The manufacturing of electrical equipment for electricity plays an important role for the upgrade, uptake and compensation of fluctuations of the electricity provided by the renewable sources of energy in the Union electric grids, the recharging of the zero emissions vehicles and deployment of smart, green house applications. At the same time, manufacturing of electrical equipment for electricity might enable the development of the smart housing concept with the objective of further promoting the use of renewable sources of energy and the good management of home equipment. It might therefore be necessary to complement the technical screening criteria in the manufacturing sector and to assess the potential of the manufacture of electrical equipment to make a substantial contribution to the climate change mitigation and climate change adaptation"

Electricity appears in climate scenarios as a key energy vector to achieve ambitious climate objectives. According to the International Energy Agency (IEA), in the Net Zero Emissions scenario (NZE), more than 70 000 terawatt-hours (TWh) are generated globally in 2050, which is almost three-times the current level, and the share of electricity in total final consumption reaches 50%. The higher level of ambition in the NZE (Net Zero Emissions scenario) would double electricity demand growth compared with in the STEPS (Stated Policies Scenario).

**Figure 4.20 ▷ Global electricity demand and generation mix by scenario**






*More electrification and clean electricity transitions lie ahead, and policy makers have the power to accelerate the pace of progress*

Source : https://iea.blob.core.windows.net/assets/88dec0c7-3a11-4d3b-99dc-8323ebfb388b/WorldEnergyOutlook2021.pdf

The driver for this shift towards electrical energy is the following : Among all methods to produce renewable energy, only wind and solar power have the potential to scale to a level compatible with global energy demand ; all other forms of renewable energy (bio gas, geo-thermal, tidal energy, etc.)

will make only a minor contribution. Wind, hydro and solar power generation (with the minor exception of solar thermal power) result in electrical energy – hence the strongly over-proportional growth of electrical energy in the overall energy mix. It follows that a massive expansion of grid capacity, in addition to the electrification of consumption (e. g. e-mobility), is an essential pre-condition for the transition from fossil to renewable energy sources.

In addition, future grids are quite different from their predecessors in multiple aspects :

Firstly, modern-day grids are necessarily bi-directional, integrating « prosumers » (who feed energy back into the grid) in addition to supplying power to consumers – whereas in the past electriciy grids followed a rigid top-down architecture, with power flowing one-way only from high / medium / low voltag grid levels to consumers.

Secondly, energy grids need to transform from local power generation and consumption to truly national or even continental grids. In the past, fossil power stations would simply be built next to the main consumer (e. g. a large city). Today, production and consumption are usually hundreds of kilometers apart (e. g. power generated from wind turbines in the North Sea supplied to urban conglomerates far away from the coast). Furthermore, the geographic distribution of power generation can vary significantly and at large scale ; one day, wind power from the North may dominate, the following day solar power from the South.

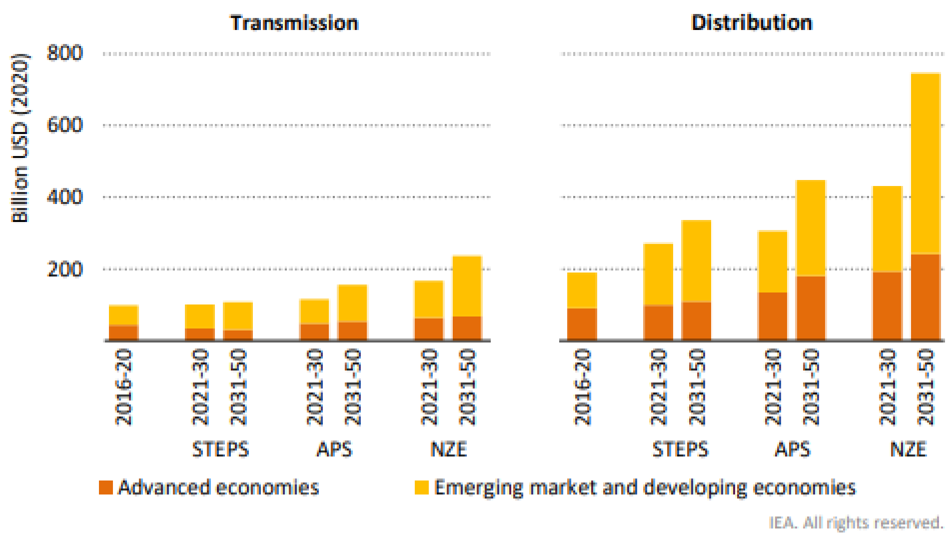
Finally, energy grids need to grow in their capability and intelligence to deal with intermittent power generation, by integrating storage at various levels (from short-term grid reserves to seasonal storage) as well as by actively interacting with consumers to manage supply vs. demand. The task to maintain grid stability, which was hitherto fulfilled by simply adjusting supply to demand at HV level, becomes a lot harder. Grids need to become transparent and intelligent at all grid levels, from national transmission grids to local substations.

As a consequence, investment in electricity networks needs to increase substantially over the next decade(s) in order to maintain and improve grid reliability, support clean energy transitions and provide access to electricity to all. According to IEA, an important acceleration of investment in T&D networks is needed to support the growth of electricity demand to limit global warming “well below 2°C” (SDS scenario) : x1.5 growth in 2021-2030, 2.3 growth in 2031-2040 and x2.7 growth in 2040-2050 compared to 2016-2020 period (and versus a growth limited to x1.6 in States Policies Scenario). The projection of investments shows the critical need to accelerate investments (versus 2016-2020 and versus STEPS scenario) already starting 2021-2030 decade.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PUBLICATION | World Energy Outlook 2021 | | | | | | |
| REGION | World | | | | | | |
| CATEGORY | Investment spending, annual average | | | | | | |
| FLOW | Transmission and distribution | | | | | | |
| | | | | | | | |
| **Somme de VALUE** | | **YEAR** | | | | | |
| **PRODUCT** | **SCENARIO** | **2016-2020** | **2021-2030** | **2031-2040** | **2041-2050** | | Evolution 2040/50 to 2016 |
| **Electricity** | Announced Pledges Scenario | 288,9 | 421,3 | 612 | 593,6 | | 2,1 |
| | Stated Policies Scenario | 288,9 | 371,6 | 422,4 | 463,3 | | 1,6 |
| | Sustainable Development Scenario | 288,9 | 447,1 | 681,8 | 785 | | 2,7 |

The growth of needed investment is impacts both Transmission networks (high voltage) and Distribution networks (medium and low voltage). On average over the 2021-2050 period, to achieve a Net Zero Emissions scenario, a doubling of investment is needed in Transmission network, and a tripling of investment in Distribution networks (see Figure 4.30).

**Figure 4.30 ▷ Average annual electricity network investment by scenario, 2016-2050**

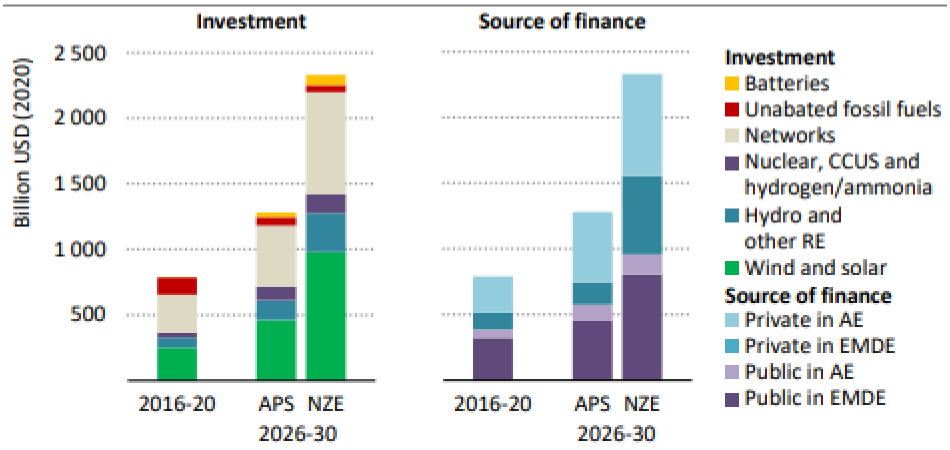



*Grid investment needs to scale up as electricity demand and variable renewables increase, making long-term visions for grids essential for energy transitions*

As a matter of comparison, in NZE scenario, the total investment needed in networks (grey color, see figure 3.15) is nearly equivalent to the investment needed in wind and solar (green color, see figure 3.15).

by about USD 1.1 trillion in 2030 (Figure 3.15).

**Figure 3.15 ▷ Average annual investment by type and source in the electricity sector, 2016-2020, and by scenario, 2026-2030**






*Investment in renewables and networks increases to fulfil announced pledges, but much more is needed to achieve the net zero emissions pathway, most of it from private capital*

Notes: AE = advanced economies; EMDE = emerging market and developing economies; Other RE = other renewables. Investment values represent annual averages for the indicated time periods.

In addition to the electrification of final energy demand (in industry, for heating in buildings, for mobility with electric vehicles, etc.), technologies will be needed to increase the flexibility of the electricity system. According to the IEA, electricity system flexibility is becoming increasingly central to electricity security, and systems are going to need greater flexibility from minute-to-minute, hour-to-hour and season-to-season over the coming decades. By 2050, global average flexibility needs to quadruple in the NZE scenario. This flexibility will be achieved with demand-side response, a strengthening of distribution lines (to enable more localized electricity usage and decreasing demand on main network), and smart grid technologies for dispatching and load balancing.

A reinforcement of large transmission lines is also needed : one key transformation of the energy grid is from local power generation and consumption to a truly national or even continental grid. Today, production and consumption are usually hundreds of kilometers apart (e. g. power generated from wind turbines in the North Sea supplied to urban conglomerates far away from the coast). Furthermore, the geographic distribution of power generation can vary significantly and at large scale ; one day, wind power from the North may dominate, the following day solar power from the South. Electricity networks pool the potential of flexibility sources and bolster overall system flexibility. Large transmission lines assist the balancing of electricity demand and supply within and between regions, for example by linking into hydro-rich systems to help manage the integration of wind and solar PV, thereby increasing system resiliency.

Strengthened distribution lines connect decentralised sources, including distributed solar PV and battery systems, enabling more localised electricity usage and decreasing demand on a main network. Smart grids add further resiliency by dispatching energy more accurately and rapidly relaying data on optimised load balancing.

Considering this context, the activity qualifies:

- High and medium voltage technologies, for the reinforcement of transmission and distribution lines and the CO2 benefits of electrification of specific energy-intensive industries (that are connected to the MV network, and not LV). Some industry applications are excluded because energy scenarios show a limited potential for the reduction of GHG emissions from electrification in the coming years specifically for these selected industrial sectors (see details below). This scope exclusion criteria should be reviewed periodically depending on the CO2 savings that could be achieved from potential of these energy-intensive industries.
- Regarding low voltage technologies, the activity focusses on technologies which favor energy efficiency, controllability and flexibility of the grid, integration of renewable energy. In particular, digitalization of low voltage electricity networks – combining data, analytics and connectivity – has the potential to make energy systems more efficient, flexible and resilient.

Following the "Do not Significant Harm" criteria, a scope exclusion is defined to exclude to connection – or connection reinforcement – of fossil-based electricity generation to the electricity network.

Following the "no lock-in effect" criteria, a scope exclusion is defined for the equipment of all fossil-based infrastructure.

Decision tree following the enabling horizontal framework:

| | 1 | 2a | 4a | 5a | 6a |
|---|---|---|---|---|---|
| a) Electric vehicle (EV) charging stations and supporting electric infrastructure for the electrification of transport. (...) | YES -> option 1 | YES : activity 4.9 | YES | YES | YES, lock-in test edited to add all fossil-related infrastructure |
| b) Transmission and distribution transformers that comply with the Tier 2 (1 July 2021) requirements set out in Annex I to the Commission Regulation (EU) No 2019/1783 (...) | YES -> option 1 | YES : activity 4.9 | YES | YES | YES, lock-in test edited to add all fossil-related infrastructure |
| e) High, medium and low voltage electrical equipment, systems and software that enable a reduction of greenhouse gas emissions (...) in compliance with the Technical Screening Criteria set out in the Delegated Acts to the Regulation EU 2020/852 : Section 3.1 ; Section 4.10 ; Section 3.3 ; Section 6.16 | YES -> option 1 | YES : activities 3.1 ; 4.10 ; 3.3 ; 6.16 | YES | YES | YES, managed in the referred activity in Climate DA |

| | 1 | 2b | 3b | 5c | 6a |
|---|---|---|---|---|---|
| c) Low voltage electrical equipment and systems to increase the controllability of the electricity system, integrate renewable energy and generate energy efficiency (...) | NO, not 100% coverage of electricity users in climate DA | YES : climate | YES | YES : focus only on "smart" technologies on LV that enable energy efficiency, demand-response/flexibility /controllability, integration of Renewable energy | YES, lock-in test edited to add all fossil-related infrastructure |

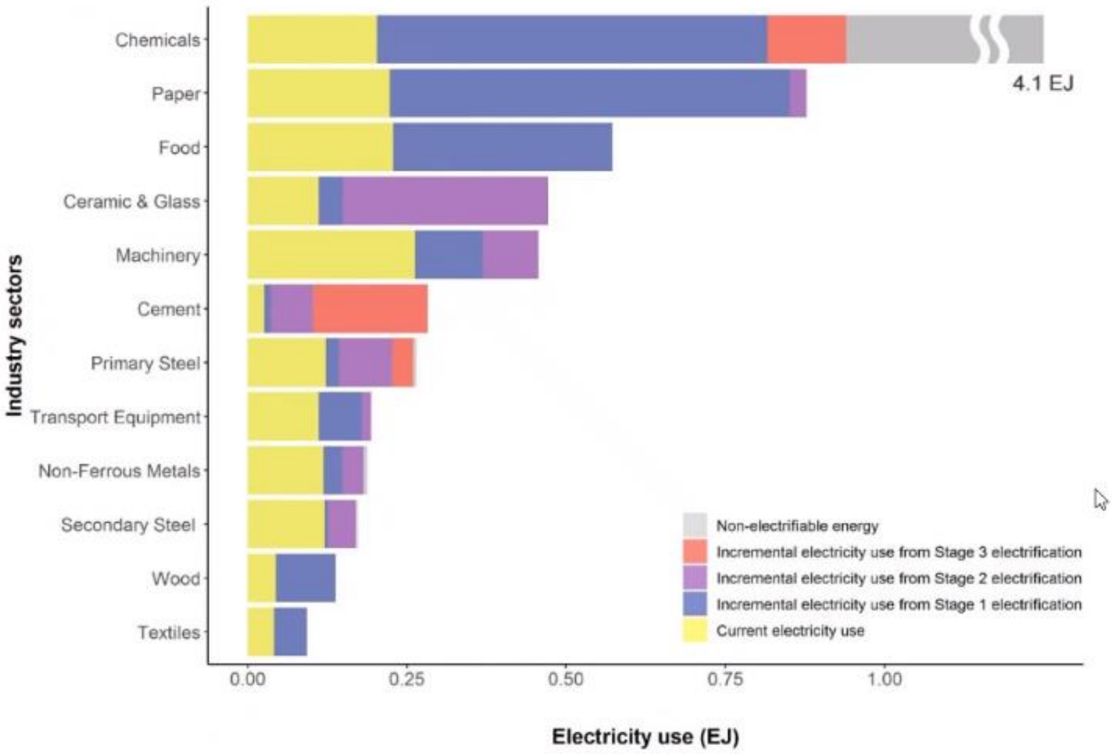
| | 1 | 2a | 3a | 3c | 5d | 6a |
|---|---|---|---|---|---|---|
| d) High and medium voltage transmission and distribution equipment, systems and services, excluding transformers (for transformers refer to point b). The end user of the equipment manufactured is not part of the following industries: primary steel, non-ferrous metals, metal transformation, cement, ceramic and glass. | YES -> T&D networks (activity 4.9 of Climate DA) + heavy industry and transport infrastructure | NO | NO | YES : scope exclusion has been defined to exclude specific energy-intensive industries, where the potential of electrification is bring CO2 savings is limited | YES : substancial role of MV+HV recognized in EU energy transition scenarios, by JRC | YES, lock-in test edited to add all fossil-related infrastructure |

| | 1 | 2b | 3b | 5c | 6a |
|---|---|---|---|---|---|
| f) Demand response and load shifting equipment, systems and services that increase the flexibility of the electricity system and support grid stability (...) | NO, not 100% coverage of electricity users in climate DA | YES : climate | YES | YES : focus only on "smart" technologies for grid flexibility and reliability | YES, lock-in test edited to add all fossil-related infrastructure |

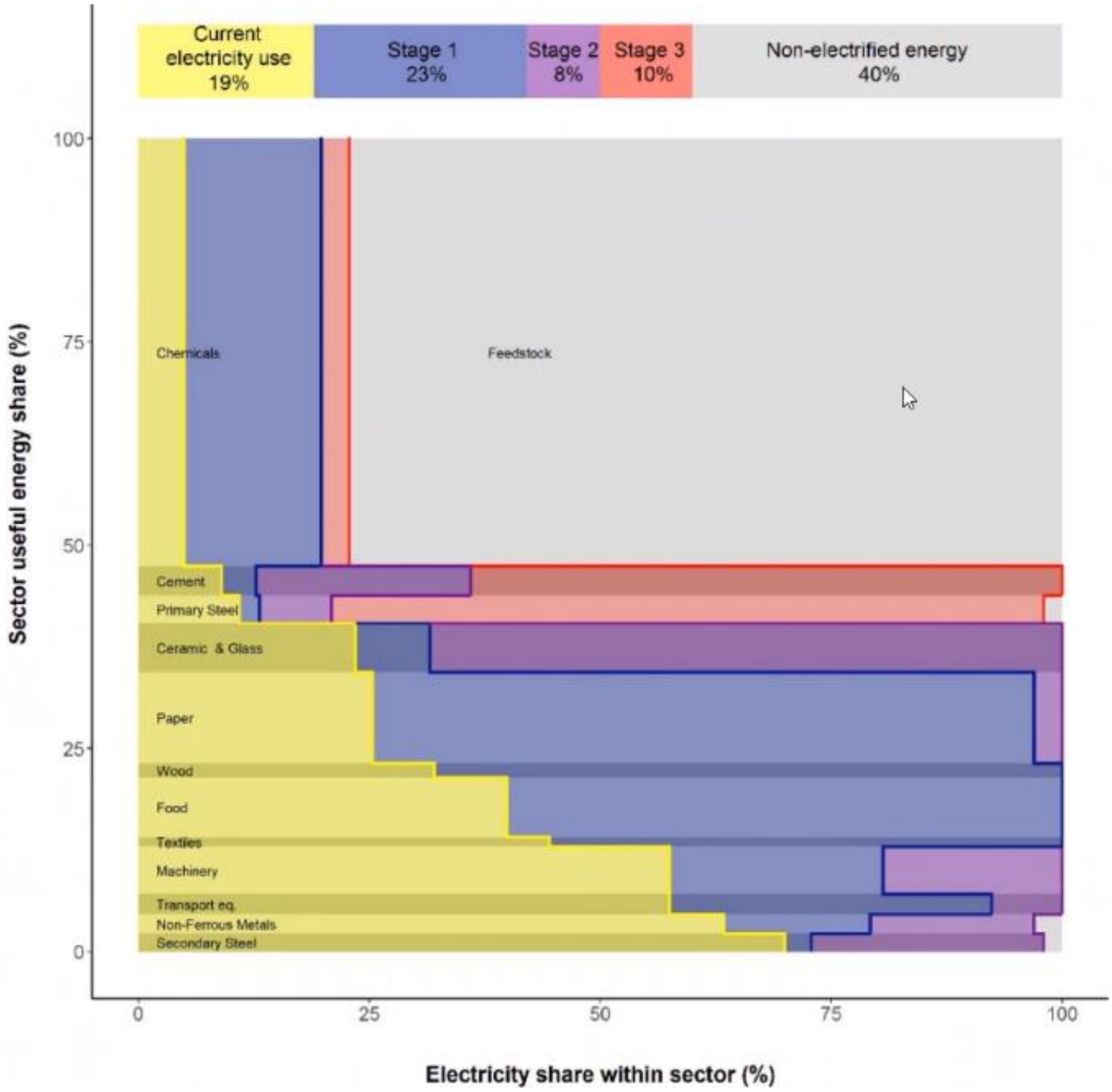
| | 1 | 2b | 3b | 5c | 6a |
|---|---|---|---|---|---|
| g) Communication, software and control equipment, systems and services for energy efficiency and integration of renewable energy (...) | NO, not 100% coverage of electricity users in climate DA | YES : climate | YES | YES : focus only on "smart" technologies for energy efficiency. For motors, Need to focus only on energy efficient motors that have the potential to bring significant energy savings | YES, lock-in test edited to add all fossil-related infrastructure |

Some comments related to specific criteria are available below :

- Justification of exclusion of specific industrial sectors for high and medium voltage technologies : Some industry applications are excluded because energy scenarios show a limited potential for the reduction of GHG emissions from electrification in the coming years specifically for these selected industrial sectors (see graph below). This scope exclusion criteria should be reviewed periodically depending on the CO2 savings that could be achieved from potential of these energy-intensive industries.



Chemicals
Paper
Food
Ceramic & Glass
Machinery
Cement
Primary Steel
Transport Equipment
Non-Ferrous Metals
Secondary Steel
Wood
Textiles
Industry sectors
4.1 EJ
Non-electrifiable energy
Incremental electricity use from Stage 3 electrification
Incremental electricity use from Stage 2 electrification
Incremental electricity use from Stage 1 electrification
Current electricity use
0.00
0.25
0.50
0.75
1.00
Electricity use (EJ)




<u>- Justification of inclusions of maintenance</u> activities : Depending on customers and asset type, maintenance contracts can be specific to an equipment, or large covering an entire building/infrastructure. This activity qualifies maintenance related to eligible technologies, to acknowledge that the maintenance of these equipment in optimal operating conditions is core to delivering the targeted CO2 savings. For instance, a digital monitoring and control systems require frequent (typically several times / year) maintenance and qualibration campaign to deliver energy savings. In this activity, the eligibility of the asset maintained has to proven. This means that the usability of this criteria will be limited for maintenance services which are not targeted to a specific asset, but rather to a full infrastructure. However, the expert group is in favor of keeping this criteria – despite known useability restriction – to recognize the importance of maintenance of digital/automated/efficient systems. As part of a FAQ published

by the Commission, it would be useful to include guidance for companies (and their auditors) and how to document the link between maintenance-related revenues or investments and eligible assets.

- Rationale for motors and drives (relevant sources in parantheses):

Electric motors and drive systems (EMDS) are the largest single-energy end use and account for more than 40% of global electricity consumption. There is a huge, untapped potential for energy efficiency in EMDS – around 25% of EMDS electricity use could be saved cost-effectively – which would reduce total global electricity demand by about 10%. However, the energy efficiency of EMDS has been relatively neglected in comparison with other sustainable energy opportunities (IEA, 2011).In the EU, there are about 8 billion electric motors in, consuming nearly 50% of the electricity EU produces (European Commission). It is estimated that electric motors converted 1 425 TWh of electricity into mechanical energy and heat in 2015, corresponding to 560 Mt of CO2-equivalent emissions. This value is expected to rise to around 1 470 TWh by 2020 and to about 1 500 TWh by 2030 (Commission Regulation 2019/1781)

Under the new Ecodesign regulation for motors, which make the efficiency classes IE2/IE3 the minimum standard for most motors, the European Commission estimates that annual savings will increase to 110 TWh by 2030, which is equivalent to the electricity consumption of the Netherlands. This means that 40 million tonnes of CO2 emissions per year will be avoided and that the annual energy bill of EU households and industry will be reduced by approximately €20 billion by 2030. (European Commission). As of today, the share of high-efficiency motors shipped to region EMEA is still fairly small: IE1 = 28%, IE2 =57%, IE3 = 14%, IE4 = 1%, IE5 = [negligible] (as measured in number of units, source = Omdia).

Comment: the expert group has agreed not to limit eligibility to the highest efficiency class as defined in IEC 60034-30 (= IE5). Current regulation differentiates between different power ranges and motor types : for instance, with current state of the art, IE5 motors need to be permanent-magnet motors and cannot run without an inverter. For most applications (e.g. pumps and fans), this is not needed.

- Justification of GWP for F-gas exclusion :

For switchgear <145kV and up to 50 kA short circuit, proposal on GWP are aligned with the proposal from the Commission :

See Annex IV - (23) => https://eur-lex.europa.eu/resource.html?uri=cellar:ecf2b875-b59f-11ec-b6f4-01aa75ed71a1.0001.02/DOC_2&format=PDF ).

For switchgear >145kV or more than 50kA short circuit, technical feasibility of switchgear with a GWP <10GWP is not yet proven, and no technological solution is available on the market. However, the limit of 2000 GWP seems high considering current R&D roadmap, this is why the expert group proposes a lower value of 675.

A study on alternatives to F-gases in switchgears is available here : https://ec.europa.eu/clima/system/files/2020-09/c_2020_6635_en.pdf

“Enabling activity” versus “own-performance activity” :

Two technologies listed in the activity as considered as enabling technologies, but also have a defined “own performance criteria”. The objective is to qualify as eligible only best in class offers from an energy efficiency and CO2 perspective. The 2 offers are : Electrical motors and SF6-free connectable switchgears. Recommendation of the expert group is to keep these technologies included in this activity :

- Same industry; integrated architectures and sales process (with other enabling technologies in this activity)
- No redundancy / Overlap with other activities already published in the Climate DA

Decision to separate electrical motors and/or SF6-free connectable switchgear to create a specific own performance activity should be taken by the European Commission.

Proposal to improve the DNSH criteria on circular economy :

Current wording is same as climate DA. This could be made stricter, see proposal below :

The activity shall adopt techniques that support:

(a) reuse and use of secondary raw materials and reused components in products manufactured;

(b) design for high durability, recyclability, easy disassembly and adaptability of products manufactured;

(c) waste management that prioritises recycling over disposal, in the manufacturing process;

(d) information on and traceability of substances of concern throughout the life cycle of the manufactured products.

Proposal on scope exclusions for activites related to fossil fuels:

The scope exclusion defined in this activity could be included in other activities of the climate DA. This would enable to avoid qualifying activities that generate a “lock-in effect” , and it would foster consistency across activities of the Climate DA (and avoid any risk of “criteria shopping”). Proposed criteria : Products, equipment, systems and software that are installed in an infrastructure dedicated to the extraction, transport, distribution, storage, manufacturing or transformation of fossil fuels are not compliant. Energy transmission and distribution networks, that are used to transport a mix of varied energy sources, are not excluded.

Comment : Energy (electricity, gas) networks do not create a lock-in effect, as these networks will still be needed (and require investment) in a 1.5°C scenario.

<u>Overlap with Activities 7.4 and 7.6 and 4.9 of Climate delegated act</u>

There is a risk of overlap between this activity, and activities 7.4 , 7.6 and 4.9 of climate DA. The expert group has chosen, for the sake of simplicity, usability, and consistency of the taxonomy, to include in scope all critical steps for the proper functioning of enabling technologies over their lifecycle: manufacturing, installation, maintenance and lifecycle (e.g. maintenance and repair) and professional (e.g. technical consulting) services essential to the functioning over the lifetime. However, activities 7.4 and 7.6 of the Climate DA already cover the installation of EV and of renewable capacities, but only the installation step is covered over the entire lifecycle of the product. Similarly, activity 4.9 includes the construction or installation of some equipment, but not with a full coverage and in an inconsistent manner (the wording “construction/installation” is only used for a few technologies). The expert group recommends keeping a “lifecycle approach” in this activity. Separating the lifecycle of a product into different steps in the Taxonomy will create :

- risks of inconsistencies between activities, and risk of criteria shopping

- limit usability: companies do not typically segregate revenues/CAPEX/OPEX according to these lifecycle steps, and reporting data detailed by activity will not be useable.

<u>Overlap with Activities 3.5  of Climate delegated act</u>

There is a potential overlap of “Home Building Electronic Systems (HBES), as defined in IEC 63044 Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS), restricted to products and systems that are needed to measure, control and reduce energy consumption.” with Activity 3.5 of climate DA : energy-efficient building automation and control systems for residential and nonresidential buildings.

However, the expert group proposes to keep this included, to avoid duplicating reporting efforts of companies to segregate revenues/CAPEX/OPEX between different activities. Companies providing “smart LV technologies” qualified in the activity would typically sell HBES systems.

Edit needed on the activity 3.6 of Climate delegated act : 3.6. Manufacture of other low carbon technologies

Including this new activity would require an amendment of the description of activity 3.6 in the Climate DA, which currently only excludes technologies covered in Sections 3.1 to 3.5.

Criteria c on transformers :

A change was made compared to Section 4.9 of Climate DA : for medium power transformers < 36 kV, reference to ”AAA0” was replaced by ”AA0”. The expert group believes this is a typo in the Section 4.9 of Climate DA, that should be corrected. In all cases, consistency and alignement of criteria between the 2 activities should be kept.

- The reference to AAA0 as A0-50% is only a reference for the best available technology by using amorphous core
- All medium transformers need by EU shall not be in Amorphous steel due to limitation of capacity available
- Switching to Amorphous, our medium power transformer manufacturer industry will be totally dependent and in case of crisis (imports from China, Japan and US and very limited volumes are available and an increase would require massive CAPEX investment by steel manufacturers), it will put our distribution network at risk.
- And a simple calculation of the CO2 saved by switching from tier 2 to AAA0 on a 1 MVA transformer (as a reminder average power of medium power transformer sold on the market is 500 KVA):
    - Tier 2 P0 = 770 W
    - AAA0 P0 = 390 W
    - Saving : 340 W (saving for 500 kVA transformer is 250 W)
    - Energy saved along the lifetime : 340*24*365*30/1000 : 7 560 kW
    - CO2 saved according average EU 27 value (0.285) = 2 154.6 kg EqCO2

 This saving is limited compared to lifecycle emissions of a transformer, and probably largely or even totally counter-compensated by the additional CO2 generated during production of the amorphous steel and emissions from import transport.

- EN 50588 is canceled and replace by the EN 50708-2-1 where AAA0 is not defined.