Response to Reviewers

A gridded dataset of European Forest Types to support forest monitoring, modelling and reporting

Integrated replies with manuscript line references

Line numbers refer to the revised manuscript with tracked changes supplied for this response.

Reviewer 1

We sincerely thank the reviewer for carefully reading our manuscript and for the constructive and insightful comments. We greatly appreciate the recognition of the effort involved in developing a high-resolution (100 m) European Forest Type (EFT) dataset covering 39 countries and based on the EEA classification framework.

Overall, we believe the reviewer's comments have significantly improved the manuscript's clarity, transparency, and scientific robustness. We are grateful for the time and expertise invested in evaluating our work and hope that the revisions satisfactorily address all concerns raised.

Comment 1

> *1.The core input data (JRC RPP maps) has a native resolution of 1 km, yet the output product is presented at 100 m. The manuscript does not provide a scientifically rigorous justification for this downscaling. Simply resampling a 1-km probability layer to 100 m does not add ecological information; it merely creates a smoother visual. This discrepancy raises concerns about "false precision," where users might assume the map captures stand-level heterogeneity that the underlying data simply cannot support.*

Reply: We thank the reviewer for raising this important point. We agree that the native spatial resolution of the JRC Relative Probability of Presence (RPP) maps is 1 km and that a simple resampling to 100 m would not add ecological information and could indeed create a misleading impression of increased precision. However, for the sake of clarity, our approach does not aim to increase the spatial precision of the original JRC probabilities. The 100 m grid is adopted to ensure consistency with the Copernicus Dominant Leaf Type product, which is available at 100 m resolution and distinguishes broadleaved, coniferous, and mixed forests. This thematic information is used as an ancillary constraint during the spatial allocation process rather than as a means of inferring new probability information.

Specifically, the JRC probabilities remain the sole source of information regarding species-group occurrence, while the Copernicus layer is used to constrain the allocation of these probabilities according to the locally observed forest type. For example, the probability of broadleaved species is set to zero within pixels classified as purely coniferous forest, and conversely, the probability of coniferous species is set to zero within pixels classified as purely broadleaved forest. Pixels classified as mixed forest retain both components. This procedure ensures thematic consistency between the RPP information and the forest-type classification.

The choice of the 100 m Copernicus product is intentional. Compared with the 10 m forest layer, the 100 m product explicitly includes a mixed-forest class, also broadleaves/coniferous, that is not represented in the 10 m products. This mixed class is particularly important in many European forest landscapes where broadleaved and coniferous species coexist within the same stand or landscape unit. The use of the 100 m layer therefore improves thematic consistency without implying an increase in the intrinsic spatial accuracy of the original JRC RPP data.

To avoid any misunderstanding, we revised Section 2.4.2 to better clarify that the resulting 100 m product should be interpreted as a spatially disaggregated representation constrained by higher-resolution forest-type information, rather than as a true enhancement of the native 1 km resolution of the JRC RPP maps. We are grateful to the reviewer for highlighting this issue, as it prompted us to clarify an aspect of the methodology that was not sufficiently explained in the original manuscript.

> **Changes made in the manuscript (revised version):** Lines 186–205, 270–319, 390–425, and 445–463. We clarified that the product is generated on a 100 m output grid for interoperability with the Copernicus Forest Type layer, while the native 1 km RPP information is not enhanced to stand-level accuracy. We also described

the harmonisation procedure with the broadleaved, coniferous, and mixed-forest classes and explicitly limited the intended scale of interpretation.

Comment 2

2. The validation relies heavily on the ICP BIOSOIL dataset, which is relatively sparse compared to the vast heterogeneity of European forests. To be truly "fatal," the absence of validation against independent, plot-level National Forest Inventory (NFI) data—which is the gold standard for forest type reporting in Europe—severely limits the credibility of the accuracy assessment. Without NFI-based cross-validation, the reported accuracy levels may be overly optimistic.

Reply: We thank the reviewer for highlighting the importance of independent validation datasets.

We fully agree that National Forest Inventories (NFIs) represent one of the most reliable sources of forest information and that NFI-based validation would provide valuable additional evidence regarding the accuracy of the proposed EFT maps. However, the implementation of such a validation at the European scale is currently constrained by data availability and harmonization issues.

To the best of our knowledge, there is no publicly available, pan-European NFI dataset that provides plot-level information consistently classified according to the European Forest Types (EFT) framework. While individual countries maintain high-quality NFIs, access conditions, sampling protocols, classification systems, spatial precision, and data availability vary substantially among countries. As a result, assembling a harmonized European validation dataset based on national inventories is, unfortunately, currently not feasible within the scope of this study.

For this reason, we relied on the ICP Forests BIOSOIL dataset which represents one of the few harmonized and transnational forest monitoring datasets available across Europe. Although we acknowledge that BIOSOIL does not fully capture the diversity and spatial heterogeneity of European forests, it provides a consistent validation framework across multiple countries and biogeographical regions.

We agree that validation against harmonized NFI-derived EFT classifications would be highly valuable and should be considered as a future research direction whenever suitable datasets become available. We will clarify this limitation in the revised manuscript and further discuss the implications of the current validation framework in the Discussion section

Changes made in the manuscript (revised version): Lines 795–799. We added a dedicated paragraph explaining that no publicly available pan-European NFI dataset currently provides harmonised plot-level EFT labels with consistent access, definitions, sampling design, and spatial precision. We also clarified that the comparison with FOREST EUROPE statistics is a consistency check rather than a formal accuracy assessment, and identified harmonised NFI-derived EFT labels as a priority for future validation.

Comment 3

3. The EFT classification rules (e.g., defining a forest as "Beech forest") are based on basal area or crown cover dominance. However, the input RPP data represents the relative probability of occurrence. A species might have a high probability of being present in a pixel without being the dominant species in terms of biomass or structure. The paper fails to bridge this conceptual gap, leading to potential systematic misclassification in mixed-species regions.

Reply: We thank the reviewer for raising this important conceptual point. We agree that the JRC Relative Probability of Presence (RPP) dataset does not directly represent species dominance in terms of basal area, crown cover, biomass, or stand structure. Rather, it provides spatially explicit estimates of the relative likelihood of occurrence of tree species.

To clarify, our approach neither assumes nor seeks to establish a direct equivalence between species occurrence probability and structural dominance. Instead, RPP information is used as an indicator of species composition within an expert-based classification framework designed to identify European Forest Types (EFTs) rather than detailed forest types based on stand structure or species dominance.

This distinction is important. The objective of the present study is limited to the EFT category level, which represents a broader ecological classification. We do not attempt to map more specific forest types defined by quantitative dominance thresholds. Such an approach was explored in our previous work (Giannetti et al., 2018), where species-specific basal area information was explicitly considered. In contrast, the present study focuses on producing a harmonized pan-European EFT map using datasets that are consistently available across Europe.

To better represent mixed-species conditions and reduce the influence of single-species occurrences, the classification rules were not based on the most probable species alone. Instead, we considered the two species with the highest probability of occurrence within each pixel, allowing the expert system to account for species mixtures that are common across European forests.

Furthermore, the EFT assignment is not based solely on species occurrence probabilities. The classification combines RPP information with additional constraints, including biogeographical distributions, forest-type information derived from Copernicus products, and environmental masks for specific habitat types. These complementary datasets help improve the ecological consistency of the resulting EFT classes.

However, we acknowledge that occurrence probability cannot fully substitute for direct measurements of structural dominance. Therefore, we clarified this distinction in the revised manuscript and emphasize that the resulting maps should be interpreted as a probabilistic and expert-based representation of EFT categories at the continental scale, rather than as a direct mapping of stand-level dominance patterns

> **Changes made in the manuscript (revised version):** Lines 294–319 and 449–463. We explicitly stated that RPP values represent relative likelihood of occurrence and must not be interpreted as abundance, basal-area share, crown cover, biomass, or structural dominance. We further clarified that the algorithm uses the two top-ranked RPP species as indicators of likely species-association patterns within a sequential expert system, not as direct measurements of stand dominance.

Comment 4

> *Category 14 is ecologically and economically vital but notoriously difficult to map. The current methodology relies on tree species lists that often overlap with native ranges or historical naturalizations. If the RPP data cannot distinguish between a natural stand and a plantation (e.g., Pseudotsuga menziesii native conifers in certain contexts), the 4.2% coverage reported for Category 14 may be significantly under- or over-estimated. A more robust spatial "masking" for plantations is needed.*

Reply: We thank the reviewer for this valuable comment and agree that distinguishing plantation forests from naturally occurring stands would improve the characterization of Category 14.

However, to the best of our knowledge, no harmonized and spatially explicit dataset currently exists that consistently maps forest plantations across the entire European Union. Consequently, a robust plantation mask could not be implemented within the present framework.

To minimize potential misclassification, our methodology adopts a conservative approach. Category 14 is currently identified using only tree species that are considered non-native to Europe. Therefore, the classification does not rely solely on the occurrence probabilities provided by the RPP dataset but also on the biogeographical status of the species considered. This reduces the likelihood of confusing naturally occurring European forest types with plantation forests composed of introduced species.

We acknowledge that some uncertainty remains, particularly in cases where non-native species may occur outside managed plantations or where plantation forests are composed of species that are native within parts of Europe. As noted by the reviewer, the availability of a harmonized European plantation dataset would substantially improve the delineation of this category.

The workflow was intentionally designed to be modular, allowing future integration of improved plantation-specific datasets as they become available. In the revised manuscript, we further emphasized this limitation, particularly in the Discussion section, where we explicitly addressed the potential uncertainty associated with Category 14 and highlight how future European-scale plantation datasets could improve the robustness of the classification.

Changes made in the manuscript (revised version): Lines 229–232 and 814–818. We clarified that Category 14 represents forests dominated by introduced tree species included in the RPP dataset and is not a comprehensive plantation map. We added the limitations concerning naturalised stands, plantations composed of species native elsewhere in Europe, and omitted introduced taxa, and noted that the modular workflow can incorporate a future harmonised plantation layer.

Comment 5

5. The Mediterranean forest types (Categories 8 and 9) are characterized by high horizontal and vertical complexity. The expert system approach used here appears too rigid for these "soft" ecotones. The manuscript lacks a sensitivity analysis on how the 14 rules perform in transition zones where multiple species have similar RPP values, likely leading to high "pixel-flipping" instability.

Reply: We agree that ecotonal areas inherently represent challenging environments for any rule-based classification approach, as transitions between forest types are rarely abrupt. However, in the specific case of Mediterranean EFTs 8 (Thermophilous deciduous forest) and 9 (Broadleaved evergreen forest), we believe that the potential instability is more limited than suggested.

Although both forest types occur within the Mediterranean region and may be spatially adjacent, their floristic composition differs substantially according to the European Forest Types definition and the species affinity matrix proposed by Pividori et al. EFT 8 is primarily characterized by thermophilous deciduous species such as Quercus pubescens, Acer, Ostrya, Fraxinus, Carpinus, and locally Castanea sativa, whereas EFT 9 is dominated by evergreen sclerophyllous species, particularly Quercus ilex and Quercus suber. Consequently, the Relative Probability of Presence (RPP) maps generally show low probabilities of these dominant species co-occurring within the same pixels, reducing the likelihood that small variations in RPP values would trigger frequent rule switching between these two EFTs.

We acknowledge that local misclassifications may still occur because forest structure and composition are influenced by multiple ecological factors beyond species occurrence alone. This is an intrinsic limitation of any large-scale mapping approach based on probabilistic species distributions. As also discussed in the manuscript, the expert system proposed here is intended for wall-to-wall mapping at continental scale and does not aim to replace plot-based classifications, where detailed field observations allow substantially higher thematic accuracy. The latter remains the most appropriate approach whenever stand-level characterization is required.

We will clarify this aspect in the Discussion to better explain the expected behaviour of the expert system in Mediterranean transition zones and the limitations associated with ecotonal forests.

Changes made in the manuscript (revised version): Lines 724–740 and 805–809. We expanded the interpretation of Mediterranean Categories 8 and 9 and added an explicit discussion of ecotonal instability. The revised text explains that their diagnostic deciduous and evergreen species are generally distinct, while acknowledging that local mixtures and small differences between similarly ranked taxa may change the selected rule and require a dedicated sensitivity analysis.

Comment 6

6. Mire/Peatland forests (Cat 11) and Floodplain forests (Cat 12) are determined by edaphic/hydrological conditions, not just species presence. While the authors mention "environmental masks," the resolution and accuracy of these masks (e.g., soil moisture, peatland maps) are not sufficiently detailed. If the mask is inaccurate, the model will default to a zonal forest type (like Beech or Spruce), leading to a significant loss of rare and protected habitat data.

Reply: We agree with the reviewer that mire/peatland forests (Category 11) and floodplain forests (Category 12) are primarily determined by hydrological and edaphic conditions rather than by tree species composition alone.

For this reason, the classification of these categories does not rely exclusively on species occurrence probabilities derived from the RPP dataset. To ensure consistency across Europe and to explicitly account for the environmental conditions characterizing these habitats, we incorporated dedicated environmental masks derived from Copernicus High Resolution Layers that are available in a harmonized form across the entire European Union.

We acknowledge that these datasets are not free from uncertainty and that local inaccuracies in the underlying environmental layers may affect the delineation of Categories 11 and 12. However, the use of harmonized Copernicus products provides a consistent and reproducible framework at the continental scale, which is essential for a pan-European mapping exercise.

Importantly, these environmental constraints are applied at an early stage of the expert-based classification workflow. This design choice was made specifically to identify mire/peatland and floodplain forests before the assignment of more widespread zonal forest types. Since these habitats are often spatially limited, fragmented, and underrepresented in species-based occurrence datasets, prioritizing their identification reduces the risk that they are subsequently classified as dominant zonal forest categories such as beech-, oak-, or spruce-dominated forests.

To clarify this aspect, we revised the manuscript and further emphasize both the role of the Copernicus environmental masks and the rationale for their priority within the decision-tree structure. We will also expand the discussion of the uncertainties associated with these layers and their potential implications for Categories 11 and 12

> **Changes made in the manuscript (revised version):** Lines 345–425, 455–463, 700–723, and 810–813. We described the source, role, and limitations of the wetland and floodplain masks; clarified that these hydrological constraints are evaluated before the zonal rules; and added a specific warning that inaccuracies in the Copernicus wetness layer or river-buffer representation may cause local omission or overextension. We also stated that Categories 11 and 12 should not replace detailed habitat inventories.

Comment 7

> *7. For a dataset intended for "modelling and reporting," providing a single categorical map is insufficient. Users need an Uncertainty Map (e.g., Shannon Entropy or probability margins between the first and second most likely EFT). Without this, the dataset acts as a "black box," where a pixel classified as "Category 1" with 51% certainty is treated the same as one with 99% certainty.*

Reply: This is a very important aspect and a valuable suggestion, and we agree with the reviewer that information on classification uncertainty can be highly beneficial for users interested in modelling and reporting applications.

The proposed workflow is based on an expert-rule system that integrates multiple data sources, including species occurrence probabilities (RPP), forest-type constraints derived from Copernicus products, biogeographical information, and environmental masks. As a result, the final EFT assignment is not derived from a single probabilistic classification model and therefore does not directly provide a pixel-level probability associated with each EFT category.

While the underlying RPP dataset contains probabilistic information at the species level, the subsequent expert-based classification process transforms these probabilities into categorical EFT assignments through a sequence of ecological decision rules. Consequently, deriving a statistically rigorous uncertainty metric for the final EFT classes is not straightforward.

We nevertheless acknowledge the importance of communicating classification confidence and uncertainty to end users. Therefore, we expanded the Discussion section to explicitly address this limitation and to identify uncertainty mapping as an important direction for future developments of the dataset. Potential approaches could include the use of probability margins among the most likely species, entropy-based metrics derived from the underlying RPP information, or ensemble evaluations of the classification rules.

> **Changes made in the manuscript (revised version):** Lines 800–804. We added a dedicated uncertainty paragraph clarifying why the categorical output cannot be interpreted as a posterior probability. We also identified feasible diagnostics for a future uncertainty product, including first-versus-second RPP margins, entropy of normalised RPP distributions, rule-specific sensitivity, and ensemble stability under alternative masks and thresholds.

Comment 8

> *8. The Copernicus Forest Type (FTY) product already provides a 10m/20m Broadleaved/Coniferous split. This study must demonstrate that its 100m EFT product is consistent with the established Copernicus products. If the aggregated EFTs (e.g., all needle-leaf categories) show major spatial disagreements with the Copernicus*

HRL, the validity of the expert system rules or the RPP inputs must be questioned. A formal "agreement analysis" with Copernicus is missing.

Reply: We agree that consistency with the Copernicus Forest Type (FTY) product is an important requirement for the credibility of the resulting EFT maps.

However, it is important to clarify that consistency with the Copernicus FTY product is already embedded within the methodology and is not evaluated only as a post-processing validation step. The Copernicus FTY layer constitutes a fundamental input of the expert-based workflow and is explicitly used to constrain the spatial allocation of EFT classes.

As described in Section 2.4.2, the JRC Relative Probability of Presence (RPP) maps provide information on species occurrence probabilities, while the Copernicus FTY product supplies the forest-type context (broadleaved, coniferous, or mixed forest). The assignment rules enforce consistency between these datasets by excluding ecologically incompatible combinations. For example, probabilities associated with broadleaved species are set to zero within pixels classified as purely coniferous forest, while probabilities associated with coniferous species are set to zero within pixels classified as purely broadleaved forest. Mixed forest pixels retain both components.

Therefore, the resulting EFT map is not generated independently from the Copernicus product and subsequently compared against it. Rather, agreement with the broadleaved/coniferous/mixed forest typology is explicitly enforced during the classification process itself. Any major disagreement between the aggregated EFT classes and the Copernicus FTY product would therefore be structurally prevented by the implemented rules.

To avoid possible misunderstandings, we revised the manuscript to better emphasize the role of the Copernicus FTY layer as a methodological constraint and to clarify that thematic consistency with this product is built into the classification workflow from the outset

Changes made in the manuscript (revised version): Lines 390–425 and 635–659. We clarified that the Copernicus Forest Type product is used directly as an ancillary constraint in the workflow and described the harmonisation rules for broadleaved, coniferous, and mixed pixels. Consequently, consistency with Copernicus is enforced during map production rather than assessed only after classification; the revised text also explains the remaining limitations associated with the different native resolutions of the input layers.

Reviewer 2

Comment 1

This study presents a pan-European gridded dataset with 14 European Forest Types (EFTs), generated by integrating multiple existing datasets and a rule-based expert system to identify forest types across Europe. The topic is important and timely, and I appreciate the significant effort invested in producing such a large-scale and harmonized map product. However, the manuscript currently suffers from issues related to readability and the clarity of several claims. More importantly, the paper lacks a sufficiently rigorous validation of the generated maps, as well as a deeper discussion of uncertainties and limitations. Given that the main contribution is the map product itself, a more concrete quantitative evaluation is necessary to support the reliability and usefulness of the dataset.

Reply: We sincerely thank the reviewer for the careful reading of our manuscript and for the constructive and thoughtful evaluation of our work. We greatly appreciate the positive recognition of the relevance and timeliness of developing a harmonized pan-European forest type dataset, as well as the acknowledgement of the substantial effort required to integrate multiple data sources into a consistent, rule-based mapping framework.

We are also grateful for the reviewer's critical remarks regarding readability, clarity of certain claims, and, in particular, the need for a more rigorous validation and a more explicit discussion of uncertainties and limitations. These comments are highly valuable and have helped us substantially improve the manuscript. In the revised version, we have worked to enhance the overall clarity of the text, streamline the presentation of key methodological choices, and strengthen both the validation framework and the discussion of uncertainty, with the aim of better supporting the robustness and usefulness of the proposed dataset.

We thank the reviewer again for these insightful suggestions, which have, we think (and we hope), significantly contributed to improving the quality and transparency of the manuscript.

Changes made in the manuscript (revised version): Lines 55–100, 152–205, 270–319, 635–659, and 785–823. Throughout the manuscript, we revised unclear and overly broad claims, clarified the spatial meaning of the 100 m grid, strengthened the description of the input data and validation framework, and added a structured discussion of uncertainties, limitations, and appropriate uses.

Comment 2

The readability of the introduction could be improved. Some sentences are difficult to follow, for example around line 65 ("break down data ... to a higher level of information"), which appears semantically unclear. There are also phrases: "such as for example..." and "it is important to highlighted that...". Consider revising the text for clarity and conciseness.

Reply: We thank the reviewer for this helpful comment. Upon re-reading the manuscript, we agree that some passages may not be sufficiently clear and could benefit from improved wording and structure. The examples highlighted by the reviewer are useful in identifying areas where the text can be made more concise and easier to follow.

In the revised version of the manuscript, we carefully reviewed the Introduction and the manuscript as a whole to improve readability, clarify potentially ambiguous statements, and remove redundant and useless expressions. We expect these revisions to substantially improve the overall clarity, readability and flow of the paper.

Changes made in the manuscript (revised version): Lines 55–59, 77–83, 86–100, and 152–164. We rewrote the cited passages and adjacent paragraphs to remove redundancy, correct unclear formulations, and improve the logical flow of the Introduction. The revised wording now describes the role of vegetation-based classifications and the disaggregation of monitoring indicators in ecologically meaningful terms.

Comment 3

In Section 2, when introducing the EFT classes, the authors should provide the actual forest type names (e.g., Boreal forest) rather than only referring to "Type 1–14". This would make the manuscript more self-contained and easier to follow.

Since the Copernicus Forest Types map is used in generating the final product, it should also be properly introduced in the data section. Currently, this dataset is missing from the dataset description.

Reply: We agree with the reviewer that referring only to the numerical EFT categories may reduce the readability of the manuscript and require readers to repeatedly consult external tables or references.

In the revised manuscript, we explicitly report the corresponding European Forest Type names when introducing the EFT classes in Section 2. We believe this modification will make the manuscript more self-contained and easier for readers to follow.

Changes made in the manuscript (revised version): Lines 220–232. We now provide the full names of all 14 EFT categories when the classification is introduced and explain which categories are zonal, azonal, or associated with introduced tree species.

Comment 4

It is unclear how the final product can reliably be considered a 100 m resolution map, as there are various layers with different resolution involved in the map generation pipeline.

Reply: We thank the reviewer for this important observation. We clarified the role of the different native resolutions and the interpretation of the 100 m output grid.

Changes made in the manuscript (revised version): Lines 270–319 and 390–425. We added the Copernicus Forest Type product to the data description, specified its thematic classes and role as an ancillary constraint, and clarified how layers with different native resolutions are harmonised. We explicitly state that the 100 m output grid does not increase the intrinsic ecological precision of the 1 km RPP data.

Comment 5

Figure 2 is not properlyreferred to or discussed in the main text. In addition, the labels are difficult to read, and the figure lacks a clear legend or explanation of the colored layers.

Reply: We agree that Figure 2 could be improved in terms of readability and interpretation.

In the revised version of the manuscript, we improved the figure layout by enhancing the readability of the labels and providing a clearer legend and description of the different colored layers. In addition, we revise the main text to ensure that Figure 2 is explicitly introduced, referenced, and discussed in greater detail, so that its purpose and content are more clearly explained to the reader.

Changes made in the manuscript (revised version): Lines 345–425 and 435–463; revised Figure 2 and its caption. We expanded the description of the environmental breakpoint masks, explicitly introduced and discussed Figure 2 in the main text, and improved the explanation of the coloured layers and their role in the classification workflow.

Comment 6

The manuscript lacks a thorough and high-quality validation of the final map product. In the results section, the new map is mainly compared with the FOREST EUROPE:
If FOREST EUROPE is used as the main reference dataset, it should be properly introduced, including information about its generation process, intended use, and known accuracy, so that the comparison can be better interpreted.
The current comparison appears more like a map consistency check rather than a proper accuracy assessment. Ideally, map validation should rely on high-quality independent reference data like NFI rather than comparison with another existing map product.

Reply: We thank the reviewer for these comments and agree that the role of the FOREST EUROPE dataset could be more clearly explained in the manuscript.

Although FOREST EUROPE is already introduced in the Introduction (see Lines 80-101), we recognize that additional information regarding its generation process, intended use, and limitations would help readers better interpret the comparison. In the revised manuscript, we therefore expanded the description of the FOREST EUROPE dataset and consider adding a dedicated subsection to provide a clearer methodological context.

We also agree that the comparison presented in the Results section should not be interpreted as a formal accuracy assessment. To clarify, the purpose of this analysis was not to validate the map against another spatial product, but rather to compare the country-level area estimates derived from our EFT map with the corresponding national statistics reported by FOREST EUROPE. We, therefore, will revise the manuscript to clarify that this analysis represents a consistency assessment between independent estimates rather than a pixel-level validation or accuracy evaluation.

Regarding the use of independent reference data, we fully agree that National Forest Inventories (NFIs) represent one of the most reliable sources of forest information and that NFI-based validation would provide valuable additional evidence regarding the accuracy of the proposed EFT maps. However, the implementation of such a validation at the European scale is currently constrained by data availability and harmonization issues.

To the best of our knowledge, there is no publicly available pan-European NFI dataset that provides plot-level information consistently classified according to the European Forest Types (EFT) framework. While individual countries maintain high-quality NFIs, access conditions, sampling protocols, classification systems, spatial precision, and data availability vary substantially among countries. As a result, assembling a harmonized European validation dataset based on national inventories is currently not feasible within the scope of this study.

For this reason, we relied on the ICP Forests BIOSOIL dataset, which represents one of the few harmonized and transnational forest monitoring datasets available across Europe. Although we acknowledge that BIOSOIL does not fully capture the diversity and spatial heterogeneity of European forests, it provides a consistent validation framework across multiple countries and biogeographical regions.

We agree that validation against harmonized NFI-derived EFT classifications would be highly valuable and should be considered as a future research direction whenever suitable datasets become available. However, we clarified these aspects in the revised manuscript and further discuss the strengths and limitations of the current validation framework in the Discussion section.

> **Changes made in the manuscript (revised version):** Lines 630–659, 645–740, and 795–799. We expanded the methodological context for the FOREST EUROPE comparison and now describe it as a country- and region-level consistency assessment between independently produced area estimates, not as pixel-level validation. We also added the limitations of BIOSOIL and the absence of a harmonised pan-European NFI reference dataset.

Comment 7

> *The readability and organization of the results section could also be improved.*

Reply: Thanks for this insightful comment. In the revised manuscript, we carefully reviewed the structure of the Results section with the aim of improving its clarity and flow. In particular, we will evaluate whether some of the more detailed analyses and supporting material could be moved to the Supplementary Materials/Appendices, allowing the main text to focus on the most relevant findings and key comparisons. We believed that these changes would make the Results section more concise, easier to follow, and more effective in communicating the main outcomes of the study.

> **Changes made in the manuscript (revised version):** Lines 635–740. We reorganised the Results around the principal continental and regional patterns, explained category-specific discrepancies, and linked them explicitly to species ranking and mask application. This makes the distinction between the principal findings and their interpretation clearer.

Comment 8

In the discussion section, the authors mention the usability of the map as one of the key points. This part could be strengthened by including more concrete application examples or user scenarios.

Reply: We agree that the discussion of the map's usability could be strengthened by providing more concrete examples of potential applications.

In the revised manuscript, we therefore expanded this section by including specific use cases and user-oriented scenarios that illustrate how the EFT map can support different activities, such as forest monitoring, biodiversity assessments, ecological modelling, conservation planning, reporting obligations, and other forest-related analyses at national and European scales.

At the same time, we maintained a balanced discussion of the dataset's limitations, uncertainties, and potential sources of inaccuracy. We believe that clearly communicating both the strengths and weaknesses of the product is essential for its appropriate use and interpretation.

Importantly, this work represents, to our knowledge, one of the first attempts to provide a spatially explicit and harmonized European map of European Forest Types (EFTs). While further improvements are certainly possible as new datasets become available, we believe that this should be regarded as a first step toward the broader operational use of EFTs in continental-scale analyses and European reporting frameworks, rather than as a reason to dismiss their potential applicability. We will further this perspective in the revised Discussion section.

Changes made in the manuscript (revised version): Lines 753–785 and 819–823. We strengthened the usability discussion with concrete scenarios, including stratification of forest and biodiversity indicators, disturbance-exposure comparisons, model initialisation and scenario analysis, and screening for conservation or restoration. We also listed inappropriate uses, including stand-level inventories, legal habitat delineation, operational harvesting decisions, and greenhouse-gas MRV without local data.

Comment 9

A comma appears to be missing around line 50: "ecosystem classification systems, those linked …" Table 1 is mentioned later in the manuscript than Table 2.

Reply: Thank you. We corrected these points in the revised manuscript.

Changes made in the manuscript (revised version): Lines 55–59 and 220–232. We corrected the punctuation and wording in the Introduction and reordered the presentation so that the EFT classification and category names are introduced before the detailed species-affinity table is discussed.