

The important differences associated with mast years were mainly seed production, which is perhaps a little disappointing, but not surprising. I suggest that the figures and the results lead with seed production, as all the other significant differences follow from this one (if you add other fluxes to the seed production flux, the sums are highest in years with high seed production, which is easy to understand).

We understand the reviewer's argument that reproductive biomass production should be presented first, as it is the main distinguishing feature of mast years. However, we chose to present the results from the most integrative level (total aboveground biomass production) before describing the contribution of each biomass compartment (wood, total litterfall, leaves, reproductive organs and others).

This organization was intended to provide a neutral and comprehensive presentation of the results before discussing the mechanisms underlying the observed patterns. Importantly, the absence of significant differences in the other biomass compartments during mast years is also a key finding of this study. This result is central to our interpretation of ecosystem functioning and is discussed extensively in the Discussion, as it provides important insights into biomass allocation strategies during mast years.

For these reasons, we have retained the current organization of the Results section, which we believe best reflects the overall objectives and findings of the study.

Importantly, failure to detect an effect (e.g. of mast years on growth, resorption, etc.) does not mean that the effect size is small (Amrhein et al. 2019) <https://doi.org/10.1038/d41586-019-00857-9> You can calculate how big an effect you are ruling out; i.e., given the variability in your data, how big an effect would be needed to achieve statistical significance? When you cite other studies that did find effects, were these of larger or smaller magnitude than what you can rule out?

We thank the reviewer for this important methodological comment. We agree that the absence of statistical significance should not be interpreted as evidence of the absence of an effect. Accordingly, throughout the manuscript, statements indicating that mast years had "no effect" have been replaced with wording such as "no statistically significant effect" or "no statistically detectable effect", where appropriate. These changes better reflect the limitations of statistical inference and avoid overinterpreting non-significant results.

I was confused about the number of replicates in each of the three ecosystems, which varies by the type of measurement. It's important to specify n, or we don't understand the standard error (Figures and Tables).

Accordingly to this suggestion, we added precisions on the number of replicate at the beginning of the section 2.2. : « *In each plot (S1, S2 and S3), three out of the four replicates (i.e. subplots of 2500m²) were identically equipped for below canopy water collection and biomass sampling. Consequently, unless otherwise specified, all measurements were performed on three replicates per plot.* », and in **sections 2.2.1** : « *In addition, atmospheric bulk deposition was sampled, for chemical analysis, using three collectors (0.24 m² opening ; i.e., three replicates for the whole site) connected to storage containers (50 L) and installed on the flux tower, located near S1.* » and **section 2.2.2**. : « *Green leaves were sampled annually in mid-August by rifle shooting from five beech trees per plot (i.e., five replicates per plot).* » where it was needed.

We added the number of replicates for each type of measurement in **Table 2** (Statistical analyses section).

I was surprised that dead wood production was not included in the budgets. Well, it's rarely reported, because it's hard to measure, but I don't think there is a justification to ignore it. What did you do with tree mortality? I think it would be better to admit that you are omitted this flux than to claim that it is zero.

This comment revealed that our method description was not sufficiently clear. In fact, the objective of this study is to quantify annual aboveground biomass production and the related nutrient content. Consequently, dead branches collected in the litter traps were not considered because they do not represent newly produced annual biomass, unlike leaves, reproductive organs and the other annual litter components (see concept described in Fig.1). Moreover, the branch compartment annually produced is included in the annual wood production estimates through the allometric equations described in Section 2.4.6. To avoid any ambiguity, we simplified the sampling method by deleting the sentence referring to dead wood, as this compartment (i.e. perennial biomass returning to the forest floor) was not considered in our study.

The results are difficult to read because they recite lists of numbers that probably do not belong in the text. We can see these values, relatively speaking, in your figures, and I don't think it's important for a reader to know them to 3 digits. Your message will be more clear if you focus the Results section on what we are supposed to see in your results; the numbers could be in supplemental tables, if you

think they are so important, and your raw data should be published in data packages, if they aren't already. When I got to the Discussion, which is much more readable, I found many passages that would be excellent if moved to the Results. See markup on the scanned ms. printout (to be sent by email). The parts that relate to other studies and to speculation about mechanisms belong in the Discussion, obviously.

We acknowledge that the Results section contains a substantial amount of numerical information, which may affect readability. However, this is inherent to a study that simultaneously investigates multiple nutrients across several compartments, on 3 different plots. We decided to give the absolute values in the text, as we believe that they complement the information provided in the figures and may be useful for readers who wish to directly access and reuse these quantitative values. In addition, the Results section was considered clear and well structured by the other reviewers. Regarding Figures 9 and 10 and Table 4, as well as the associated text, we consider that these elements provide a broader synthesis and integration of the different biomass and nutrient flux components. These paragraphs and figures involve interpretation and discussion of processes rather than just description of individual results. Therefore, we believe that they are more appropriate in the Discussion section, where these integrative aspects can be discussed in relation to ecosystem functioning.

Detailed comments

23. This conclusion seems not to be justified by your results. Can you make this more clear in the abstract? If not, drop it.

We believe that this conclusion is supported by our results, particularly by Fig. 9, which shows that, depending on the nutrient, canopy leaching and resorption can together represent a substantial part of nutrient budgets in aboveground biomass production (up to 50% for K for example). To make this point clearer in the abstract, we have revised the sentence as follows: "*Overall, our results showed that canopy leaching and resorption, which remain understudied, accounted for a substantial proportion of the nutrient budget associated with aboveground biomass production.*"

28 what is the novel indicator? Clarify or omit.

We have revised the sentence to explicitly state that this indicator consists of comparing the additional nutrient demand during mast years with the available nutrient reserves, making its definition clearer : *«This study highlights the importance of a multi-nutrient perspective and proposes a comparison between MY nutrient budgets and the available nutrient reserves to better assess nutritional constraints associated with masting.»*

33. I live in North America, and I don't agree that ecosystem fertility is driven by nutrient cycling efficiency. Perhaps this is true in Europe, if forests grow only on marginal lands? At a broad scale, differences in ecosystem fertility reflect differences in parent material; nitrogen accumulation depends on the supply of phosphorus from weathering.

We agree that this statement, particularly true for European forests, was too general. Ecosystem fertility is influenced by several factors, including parent material, climate, and soil development, while nutrient cycling efficiency is one of the processes controlling nutrient availability within forest ecosystems. We have therefore revised the sentence to make this distinction clearer : *« In forests, tree nutrition is tightly linked to ecosystem fertility, which is strongly influenced by nutrient cycling processes (Legout et al., 2020). Because many temperate forests develop on nutrient-poor, unfertilized soils, nutrient recycling processes between trees and soils are widely recognized as the primary drivers of forest ecosystem fertility (Ponette et al., 2001; Ranger et al., 2002).»*

38. Is this Yanai paper about nitrogen? Looks like it would be from my dissertation on phosphorus (1992).

Thank you for pointing this out. This was indeed a citation error resulting from an earlier version of the manuscript. We have removed the incorrect citation.

34, 38 is this a mistake? Maybe you need to define biological cycling, because I would have guessed that it included nutrient translocation within plants, but you were calling this the biochemical cycle.

39 how is translocation different from internal recycling?

43. I think you should avoid introducing concepts that we don't need understand your paper; you could describe what you need here without asking us to distinguish geochemical cycles from biochemical and biological.

I liked the conceptual diagram, but thought it could be better annotated to stand alone: the description of what the colors of the arrows means belongs in the figure legend, not in your text. You could improve the degree to which the background material in this paragraph corresponds to

the figure. Instead of biological cycling, biochemical, cycling, and geochemical cycling, we have internal tree recycling and biological recycling. I have never seen biological recycling defined this way; is it necessary? Now I'm doubting whether this diagram is warranted... Think about it and be sure it's justified.

We thank the reviewer for highlighting the potential ambiguity in the terminology used to describe nutrient cycling processes. To avoid confusion, we have simplified this section and removed the distinction between biological, biochemical and geochemical cycles, as these concepts were not necessary to understand the objectives of our study. We now focus directly on the processes relevant to our work, which are the tree internal nutrient recycling and nutrient recycling between trees and soil.

Following the reviewer's suggestion, we also revised Figure 1 and its caption to make the conceptual diagram more self-explanatory. In particular, we added the description of the meaning of the different arrow colors directly in the caption and modified the terminology used to describe recycling processes, distinguishing between "tree internal nutrient recycling" and "recycling between trees and soil". Accordingly, references to the arrow colors have been removed from the main text.

With these modifications, we believe that Figure 1 now provides a clearer conceptual framework and remains relevant in the Introduction by illustrating the processes investigated in this study.

On line 59 I question whether a mast event is defined at the stand level. Mysteriously, trees synchronize seed production across wide spatial scales.

We agree with this comment and we modified the text in consequence : « *Mast events are the synchronized production of fruits and seeds among individuals of the same species at the stand level and even across broader spatial scales (Lebourgeois et al., 2018).* »

103. I routinely tell students to describe their study site, not some bigger geographical area that happens to have a name or a funding source. I was editing the section accordingly (do your three stands cover an area of 73 ha?), but then I saw that you want to describe your funding source. You can decide how relevant that is, or whether it belongs in the acknowledgments.

We agree that the description of a study site should primarily focus on the characteristics of the studied area rather than a funding source. However, in this case, ANDRA is not only a financial partner but also an active collaborator involved in the long-term management and maintenance of the experimental site, field sampling activities, and the production of some of the environmental datasets. Therefore, we consider that mentioning ANDRA in the description of the study site is relevant because it reflects its role in the establishment, maintenance, and monitoring of the experimental infrastructure.

113 on my continent, even-aged management means that a single intensive harvest caused a single cohort of regeneration to dominate the current stand. Is that the case here? I am unfamiliar with harvesting every 7 to 8 years unless in a uneven-aged management system. If you want readers in America to understand your forest, avoid using terms that we define differently than you do. Maybe it's a translation issue.

We agree that « even-aged » have different meanings depending on the regional forestry context and could lead to confusion for readers unfamiliar with European forest management practices.

In our case, the term was used to indicate that the studied stands were relatively homogeneous in age across the whole site. The forest was managed using regular thinning operations aimed at promoting the growth of larger trees, which corresponds to the dominant management approach in many European beech forests. To avoid any misunderstanding, we have removed the term “even-aged” from the manuscript.

172 Will your data be archived, including the QC data? If not, it's important to give more detail here. 10% uncertainty is high for chemical analysis, but “at most” is not a good way to describe your QC data; we need some central tendencies, mean, median, or interquartile range? Ranges are sensitive to sample size, so I don't like “at most.”

We agree that the expression “at most 10%” may not be sufficiently informative. This value corresponds to the maximum deviation accepted between measured and expected concentrations of certified standard samples used for quality control. Because our analyses are multi-element (approximately fifteen elements analysed simultaneously or sequentially), if one or more elements in the certified standards deviated by more than 10% from the expected values, the instrument was systematically recalibrated. These calibration checks ensured that analytical deviations remained below this threshold.

We would like to clarify that this 10% acceptance threshold mainly concerns elements present at low concentrations, such as Fe or Na, whereas analytical deviations for the major elements investigated in this study (K, P, Mg, N, and S) were generally much lower (<2%).

We have clarified this point in the revised manuscript as follows: « *Samples were systematically analysed alongside certified standards, for which a maximum measurement deviation of 10% from the expected value was accepted. If one or more elements measured in these standards deviated beyond this threshold, the instrument was recalibrated and the affected analyses were repeated.* »

I suggest “leaf litterfall” rather than Leaf with the s subscript s. Ditto for Fruit. Everywhere possible, use language that will be familiar to your readers (that's how language works). How about "mast

production" for your fruits? Even "fruit litterfall" would be better than introducing a term that people will not recognize and have to go searching for a definition of. I think the subscript s is particularly bad because it looks like a plural. Also, "litterfall production" is redundant; choose between "litterfall" and "litter production."

Similarly, I'm not crazy about MY and NMY, as these are not common in the literature. I did manage to learn them, but I think you should consider writing them out at each occurrence. Ditto for CE, DD, all these acronyms that nobody knows. NCB is an important one, and having put your paper down, I have no idea what it means. Writing it out in figure and table captions would help, if you need the acronym at all.

We agree with the reviewer that excessive use of abbreviations may reduce readability, particularly for readers who are less familiar with the terminology. However, we believe that repeatedly writing out "Mast Year", "Non-Mast Year", and especially "Nutrient Content in annual aboveground biomass production" would make the manuscript unnecessarily cumbersome and reduce readability due to the length of these terms. Furthermore, none of the other reviewers indicated that the use of these abbreviations impaired the clarity or understanding of the manuscript.

Therefore, we have retained these abbreviations in the main text but have rewritten their full terms in the captions of all figures and tables to facilitate interpretation. In addition, the full terms are repeated at several key points in the Results, Discussion, and Conclusion sections to improve readability. More generally, apart from MY, NMY, and NCB, all other abbreviations are restricted to equations or specific figures, where they are used to avoid excessively long labels that would unnecessarily increase the complexity of the presentation. In the main text, including the Results and Discussion sections, the corresponding terms are written in full.

298 I don't think you can attribute your site differences to soils. Is this the term you call "ecosystem" in table 2? Please be consistent. I vote for "site."

We fully agree with the reviewer's comment and have therefore replaced the term "ecosystem" with "plot" throughout the revised manuscript, in order to use terminology that more accurately reflects the scale of our study

Figure 3: why bar graphs? And this is an average over many years? What is n, the number of years, using the average of all trees? The number of trees, using the average of years? If you are describing a population of all trees in all years, that's pseudoreplication (an exaggeration of your statistical power).

Figure 3 is intended as a descriptive overview of the average nutritional status of the study plots. The values presented were calculated using all foliar measurements collected throughout the monitoring period (i.e. all sampled trees across all years) in order to provide an overall representation of the nutritional status of each plot. Therefore, differences between plots were assessed using linear mixed-effects models, with tree included as a random effect (Table 2). Although this descriptive aggregation combines observations collected over multiple years, no significant differences among plots were detected in the statistical analyses.

The authors should use AI tools to clean up the writting. The manuscript is very understandable, but full of spelling, grammar, and punctuation that are not good English. I'm surprised that you don't have a spellcheck feature that would take care of this for you. There are many errors of the use of the definite article, I crossed a lot of them out, but I hope you will find a tool to automate your English checking. A reviewer shouldn't be doing this level of copy editing, but I couldn't resist. One general rule is that when a noun is used as an adjective to modify another noun, we use the singular. Use past tense consistently in the methods and results. Currently you have a mix of past and present tense.

The manuscript has been thoroughly edited to improve the English language, including grammar, spelling, punctuation, and sentence structure. We also carefully revised the manuscript to ensure consistent use of the past tense throughout the Methods and Results sections.