Response to comments by referee #1 on the manuscript egusphere-2024-2348

We, the authors, thank the editor for handling the paper and appreciate the reviewer's feedback and recognize the concerns raised regarding the focus and structure of the manuscript. We have thoroughly revised the manuscript to address the reviewer's comments. We have also included an updated title and list of reviewed papers, which now encompasses papers from 2023 and 2024 as well, providing a more up-to-date list.

However, we believe the paper does address the role of fire emissions in the global carbon budget. Our review aims to explore not only the emissions themselves, but also the state of research into the underlying mechanisms that govern fire emissions in the Cerrado — specifically, how bioclimatic conditions and ecosystem functions contribute to the emissions profile. This is a critical component for understanding the Cerrado's role in the global carbon cycle.

The paper follows a call for a more integrated, interdisciplinary approach to fire science, as demonstrated by the "Fire Learning AcRoss the Earth System" (FLARE) white paper (Hamilton et al., 2024). This initiative, supported by a broad community of fire scientists, highlights the need for deeper, multi-disciplinary reviews of the carbon cycle and its drivers and clearly demonstrates that there is a demand for this type of review. Our review goes beyond simply cataloging the Cerrado's emissions; it provides a holistic exploration of their drivers and potential management strategies. We highlight key research gaps that, if addressed, could provide more comprehensive insights into how emissions change over time, what factors control them, and how fire management strategies could influence these dynamics.

We believe this broader, systems-level review is timely and valuable to the scientific community, particularly in light of the increasing recognition of the need for detailed, multi-scale assessments of fire emissions and their drivers. Additionally, this manuscript is authored primarily by Brazilian researchers, offering a perspective that is deeply embedded in local understanding and expertise.

We hope this clarification helps align the manuscript's objectives with the reviewer's expectations. We look forward to addressing the specific concerns raised and refining the paper accordingly. We provide a table with detailed responses to each separate comment in the following papers.

Sincerely,

Renata Moura da Veiga (on behalf of all co-authors)

Reviewer 1	
Comment	**Authors' response**
This literature review proposes to clarify the role of Cerrado's fire emissions in the global carbon budget through existing literature. To do so, the authors spend a large portion of the manuscript discussing papers that do not evaluate fire emissions but rather several aspects of fire behaviour and regime. Although knowledge on fire dynamics contribute to improved emission estimates, none of the papers listed do so	We appreciate the reviewer's feedback and acknowledge the need to maintain a strong focus on fire emissions. Our intent with this review is to assess the role of the Cerrado's fire emissions in the global carbon budget, but we also recognize that dedicated research on fire emissions in this region remains limited. Compared to other savanna ecosystems, such as Australia, where fire emissions are better quantified, the Cerrado, despite contributing significantly to global fire emissions, has received less research attention in this area. As a result, there are relatively few studies that directly estimate fire-driven carbon emissions, while many studies on fire dynamics in the Cerrado do not extend their analysis to emissions (and, in some cases, explicitly state this gap). Given this research landscape, our review takes an important step in bridging the gap between fire dynamics and emissions research. By examining how fire dynamics shape emissions and identifying where further integration of these fields could improve our understanding, we aim to encourage future studies that explicitly quantify emissions. We also highlight how insights from fire behavior and fire regimes are crucial for emissions estimation — providing necessary context on the drivers of emissions, their variability, and potential mitigation strategies. To clarify our focus, we have changed the title to better represent this broad analysis of fire

	emissions in the Cerrado. We have also refined our discussion to more clearly distinguish between studies that quantify emissions and those that provide essential context for emissions estimation. Additionally, we have made explicit recommendations on how fire dynamics research can better contribute to fire emissions assessments. We believe these refinements will strengthen the manuscript while ensuring that our review remains both focused and constructive for advancing research in this area.
The authors also put a lot of focus on fire management, while it is clear that there isn't enough research on fire emissions in the Cerrado to properly characterize the fire-driven carbon fluxes in the biome. I would advise the authors to focus on fire emissions and on attempting to answer the research question (which does not pertain to fire dynamics).	Fire management and policy emerged as key themes in our literature search because they play a crucial role in shaping fire regimes and, consequently, fire emissions in the Cerrado. While there is limited empirical research quantifying the direct impact of fire management on emissions in this region, we believe that discussing management strategies is essential to fully assessing the factors that influence fire-driven carbon fluxes. Understanding how management affects fire regimes provides a pathway to improving emissions estimates and identifying potential mitigation strategies. To ensure that fire management is framed in direct relation to emissions, we have thoroughly revised the section *The influence of fire management and policy in estimating fire emissions in the Cerrado*. These revisions clarify how fire management influences emission estimates and reinforce the section's relevance to our core research question. Additionally, we have streamlined discussions on fire dynamics to maintain a stronger focus on their implications for emissions estimation.

The authors did not clarify why they focus on "natural areas". I don't see the reason for making the distinction between natural and anthropogenic land covers in regards to fire emissions. Fire is use for a variety of purposes in the Cerrado, such as agriculture and pasture management. These occur in anthropic areas and also contribute to fire emissions. Given that around 50% of the Cerrado biome is anthropogenic land cover (Colman et al., 2024) and a considerable portion of burned areas occur in these lands (Silva et al., 2021), I would argue that, by excluding fires in anthropogenic land covers, this review will inevitably yield erroneous results as to the role of fire emissions of the Cerrado in the global carbon budget. Moreover, even if the authors proceed with this criteria of fire emissions in "natural areas", as I stated in the previous round of revisions, a keyword should be provided as all biome-wide and global studies will consider anthropogenic land use.	We appreciate the reviewer's comments and understand the concern regarding the distinction between natural and anthropogenic land covers in relation to fire emissions. Our focus on natural areas is not intended to downplay the role of agricultural and pastoral fires but to provide a clearer understanding of how fire in these landscapes interacts with biophysical and ecological processes that shape the Cerrado's carbon cycle. There are several reasons for this approach: • **Fire as a Biophysical Process in the Carbon Cycle** – Fires in natural Cerrado ecosystems are closely linked to climate, vegetation structure, and ecosystem dynamics. Fires in natural areas influence long-term carbon fluxes by affecting biomass accumulation, decomposition, and post-fire recovery. A focus on natural areas allows for a clearer evaluation of how fire interacts with ecosystem function, rather than being confounded by human-driven fire use. • **Knowledge Gaps in Fire Regimes and Emissions** – While agricultural burning is better accounted for in emission inventories, natural fire regimes in the Cerrado remain understudied, particularly in terms of their contribution to the global carbon budget. Identifying the key drivers of fire emissions in natural landscapes provides a stronger basis for improving emissions estimates, understanding fire-climate feedbacks, and assessing long-term ecosystem resilience. • **Management and Co-benefits** – Fires in natural areas play a central role in shaping

	vegetation dynamics, biodiversity, and carbon storage. Understanding these processes is essential for evaluating fire management strategies and the potential co-benefits of this practice. Maintaining fire-adapted ecosystems can support carbon sequestration while also preserving biodiversity and water resources, contributing to broader climate mitigation efforts. • **Maintaining a Focused Scope** – Expanding the review to include anthropogenic fire use would require a fundamental restructuring of the paper. Agricultural burning introduces additional complexities related to land tenure, policy, and socio-economic drivers. While these aspects are critical, they fall outside the intended scope of this review. By focusing on natural areas, we aim to provide a clearer ecological perspective on fire emissions in the Cerrado and their implications for the global carbon budget. We recognize the need for clarity in how we define our scope. To address this, we have refined the manuscript to explicitly state that our focus is on fire emissions from natural areas, while acknowledging the role of anthropogenic fires and the importance of further research integrating both systems. We hope this clarification aligns with the reviewer's expectations. The paragraph now reads (lines 122-132): "We applied four inclusionary criteria to identify relevant literature: papers had to be (1) published in peer-reviewed journals with an impact factor greater than 1; (2) encompass

	the Cerrado biome; (3) be published after 2003; and (4) be conducted in areas that do not explicitly include anthropogenic land uses. Anthropogenic burning, as agricultural and pastoral, is better documented and accounted for, while natural fire regimes in the Cerrado remain understudied, particularly in terms of their contribution to the global carbon budget. Although we acknowledge the role of anthropogenic fires and the importance of further research to integrate fires in natural and anthropogenic areas to fully assess fire emissions in the Cerrado, we focus on non-anthropogenic areas, or natural areas, to provide a clearer ecological perspective on fire emissions in the Cerrado and their implications for the global carbon budget. Thus, identifying the key drivers of fire emissions in natural landscapes provides a strong basis for improving emissions estimates, understanding fire-climate feedback, and assessing long-term ecosystem resilience in the Cerrado. Because papers found by this review often do not specify the land use of their study area, we have not included papers that explicitly document fire occurring in anthropized areas."
The authors state that they aim to understand how measurements are performed, how to use different non-standardized measurements, and the available products. I would argue that this goal was not met, as it is not explained anywhere how measurements of emission factors and carbon emissions are obtained, much less a discussion on which methods/measurements are best and limitations.	We have excluded this item from the aims list. While our review does provide information on how measurements are done to estimate fire emissions in the Cerrado, we appreciate the reviewer's comment and understand that this is not one of the main goals of the paper. The paragraph was reformulated: "This systematic literature review aims to gain a comprehensive understanding of the Cerrado's fire emissions within the global carbon budget by evaluating how fire

The authors do not list available products and/or explore in the Discussion other methods that were not found in the Cerrado literature.	parameters can inform emission estimates and mitigation strategies. Particularly, we aim to: (a) outline current emissions estimates, specially carbon, in regions that encompass the Cerrado or are limited to it; (b) describe fire dynamic factors that support these estimates; (c) understand how these estimates fit the carbon budget; (d) identify mitigation strategies in the biome and their link to fire-driven carbon fluxes; and (e) identify research gaps. This will support improvements for future fire emission estimation, provide insights into the placement of the Cerrado in the global carbon balance and assist fire policies." We show what are the main methods used to estimate emissions in the Cerrado documented in literature, and how these are performed. By synthesizing literature, we find that the main methodological techniques used in the Cerrado are models, satellite and in situ observations, with results from literature reviews also being the source of input data in studies. We provide examples of studies that measure fire dynamics and emissions and their methodologies throughout the manuscript. To improve this analysis, we have included additional information found in the reviewed papers, such as lines 508-513: "Two global emissions datasets were often used in the papers reviewed to develop and evaluate models of fire occurrence and effects, and these are GFED and Global Fire Assimilation System (GFAS). Both rely on MODIS products to estimate emissions. GFED fire emissions estimates are based on MODIS burned area products and on the Carnegie–

	Ames–Stanford Approach (CASA) model (Van Der Werf et al., 2017). GFAS estimates fire emissions globally by using a conversion factor that links MODIS-derived FRP observations to combustion rates, resulting in the fuel consumption, which is then combined with emissions factors to estimate fire emissions (Kaiser et al., 2012)."
It is still unclear to the reader, in the Results section, if the papers mentioned are included in the review or not. For instance, which paper gave information on how burned area and fire intensity contribute to emission estimates in lines 319-328? Only three papers are mentioned in the beginning of this paragraph: one of them is not in the literature review and the two others do not discuss or evaluate fire emissions. If none of the papers discuss this, then this information should not be in the Results section.	• We have updated Table S1, which now includes a column to contemplate the subsection of Results of each paper, entitled 'Results' subsection', to simplify the understanding of the papers that are included in the Results section, and to which subsection they are under. • Lines 319-328 were moved to Discussion (now lines 685-694). • The paragraphs that introduce the section 3.2 Fire dynamics parameters to estimate fire emissions were modified and now read (lines 318-327): "Papers under 'fire dynamic parameters' encompass 46% of the studies reviewed, underscoring the importance of variables like burned area, fuel characteristics, combustion completeness, combustion efficiency and emission factor in fire emissions research. These parameters directly influence emission estimates, with their combination playing key roles in determining carbon emissions from fires. By examining these variables within the specific ecological and climatic context of the Cerrado, we gain insights into how fire behavior and emissions in this biome interact. The prevalence of studies on fire dynamics parameters reflects the accessibility of these

	variables and indicates the importance of linking fire dynamics directly to emission, with studies often highlighting the potential applicability of their research in fire emission estimation (e.g. Libonati et al., 2015; Pereira Junior et al., 2014). This focus on fire dynamics provides some of the most current information available, yet it suggests a need for more research to correlate fire drivers to emissions. We further discuss the fire dynamics parameters found in the literature review process."
There are several more instances where papers that were not found in the literature review (and thus not listed in the Supplementary Material) are cited in the Results section: for example, Haas et al. (2022) - line 357; Bistinas et al. (2014) - line 368; Ichoku et al. (2018) - line 418; several in lines 484-485; Bustamante et al. (2018) - line 558. Conversely, there are many papers found in the literature review that are not mentioned in the text and their contributions to the subject remain undiscussed.	We have revised the manuscript to make sure the Results section only includes papers found in the literature review process, except when it refers to concepts, and these were published before the time period covered by this review (Carvalho Jr. et al. (1998), line 371; Ward and Hardy (1991), lines 373 and 499; DeBano et al. (1998), line 422; Wooster (2002), lines 428, 429 and 434). While we acknowledge the value of all papers found in the literature review, not all could be included in the main manuscript. The papers referenced in the Results section highlight the main findings and key themes from the literature review process (fire dynamics, emissions, management and policy in the Cerrado). However, the full list of reviewed papers remains available for transparency and further reference in the Supplementary Material.
Several sections of the Results belong in Discussion as they are not stating what was found but rather an interpretation of the authors (e.g. lines 220-226, 274-277, 344-	We have reviewed the mentioned sentences and have moved them accordingly, when appropriate.

354, 501-504, 552-559, 594-607). Likewise, information that would be relevant in Methods is still stated in the Results section (e.g. lines 227-229, 239-243).	Lines 220-226: Moved to Discussion (lines 646-653) Lines 274-277: Moved to Discussion (lines 657-660) Lines 344-354: Deleted. Lines 501-504: Deleted. Lines 552-559: Moved to Discussion (lines 661-669) Lines 594-607: Moved to Discussion (lines 707-721) Lines 227-229: Moved to Methods (lines 135-137) Lines 239-243: Moved to Methods (lines 192-197)
Lastly, it would help a lot to know which papers are being analysed and belong to each subsection of Results.	The supplementary Table S1 provides a column entitled 'topics', which indicates the topics under which the papers were classified. We have updated Table S1, which now includes a column to contemplate the subsection of Results of each paper, entitled 'Results' subsection'.
The authors could easily employ simple statistical methods that would add significance to their results. Indeed, in the previous version of the manuscript there was a trend line in Figure 2 that, albeit lacking information on how it was computed and its parameters, added statistical significance to the clear upward trend in papers over the last 2 decades. However, the authors removed this analysis but still state in the text that: "There is an increasing tendency in the number of papers (...)" (lines 218-219).	We have included again the trendline in Figure 2, together with its p-value (p=0.005). The trendline indicates an increase in papers published throughout the time series. Lines 218-219 (now 229-230) now reads: "There is a statistically significant increasing trend ($p \leq 0.005$) in the number of papers published throughout the time series, with a sharp drop in publications in the year 2022".

Please use en dashes for ranges (e.g. lines 381, 411, 519, 591, 592)	En dashes added to all ranges throughout the manuscript.
Line 50: this is incorrect. Neither Gomes et al. (2020b) nor Hofmann et al. (2021) show that fires are increasing in the Cerrado. Recent papers suggest otherwise (e.g. Andela et al., 2017).	The sentence was reformulated and now reads (lines 69-70): Fire events are also becoming more frequent and intense (Gomes et al., 2024; Oliveira et al., 2022; Pivello et al., 2021)".
Line 222: please see Pereira et al. (2024) "Changes, trends, and gaps in research dynamics after the megafires in the Pantanal". They do refer to a shift in the academic community's attention pre and post the 2020 megafires.	Thank you for the suggestion. We believe referencing the indicated paper strengthens our argument of a shifted focus away from the Cerrado studies and towards other regions of Brazil. We included the following sentence in Lines 649-650: "Pereira et al. (2024) indicate an increase in papers published about fires in the Pantanal after the 2020 megafire in the biome."
Lines 329-330: the prevalence of studies in fire dynamics do not show a "gap in linking fire dynamics directly to emissions" as they do not propose to do so.	The sentence was improved and now reads (lines 323-325): "The prevalence of studies on fire dynamics parameters reflects the accessibility of these variables and indicates the importance of linking fire dynamics directly to emission, with studies often highlighting the potential applicability of their research in fire emission estimation (e.g. Libonati et al., 2015; Pereira Junior et al., 2014)."
Line 336: Libonati et al. (2015) do not consider plant complexity. They do discuss that regional products better reflect different vegetation types.	The sentence was reworded and now reads (lines 338-339): "Libonati et al. (2015) developed a regional algorithm using MODIS data to increase the accuracy of estimations of burned area in the Cerrado, demonstrating that regional products more accurately capture vegetation diversity."

Line 338: Silva et al. (2021) do not propose to divide Cerrado into 19 ecoregions based on fire parameters. They do use the ecoregional framework and evaluate fire.	The sentence was reworded and now reads (lines 339-342): “Also, to capture the variety of fire dynamics throughout the biome, Silva et al. (2021) map fire characteristics for the 19 ecoregions of the Cerrado, including the patterns and trends of burned area using MODIS data. Results show a great variation of size of burned area in the Cerrado, with large areas detected in the boundaries with other biomes (Silva et al., 2021).”
Lines 340-343: this is incorrect. Looking into INPE's Queimadas website (https://terrabrasilis.dpi.inpe.br/queimadas/aq1km/) the value for 2020 is 138,540 km2 and 74,085 km2 for 2009, different from the values presented by the authors. 2020 was also not a critical term in terms of wildfire in Brazil, as easily confirmed in INPE's Queimadas website, either using active fires or burned area. It was, however, a critical year for Pantanal.	INPE Queimadas is constantly being updated and validated, and changes in the values may occur over time. This is advised on the website (https://terrabrasilis.dpi.inpe.br/queimadas/aq1km/): “The product is constantly updated and validated, so changes may occur as new versions are released. For this reason, we do not have the data available for download or other forms of analysis. If necessary, contact the INPE Queimadas team to facilitate access to the data.” This means that, between the writing and the revision of the manuscript, INPE Queimadas was updated, and the values were slightly changed. We have updated the values in the manuscript to match the most recent values shown on the website: 2009 now presents the updated value of 74,085 km2. 2020 was replaced for 2007, the second largest year in terms of total burned area in Brazil between 2003-2024.
Lines 344-345: Pivello et al. (2021) do not show that 2020 was a significant year in terms of burned area in the Cerrado. They do	This paragraph was deleted.

say that it was an extreme year for Amazon and Pantanal	
Lines 345-347: this is incorrect. Neither Libonati et al. (2022) nor Hofmann et al. (2021) show that 2020 was a drought year in the Cerrado, as none of the studies even consider 2020 in their historical time series. And dos Santos et al. (2024) does not discuss Cerrado.	This paragraph was deleted.
Lines 347-349: I'm fairly certain that the authors are confusing Cerrado with the Pantanal.	The authors' list includes Brazilian scientists with extensive experience working in the Cerrado and are well aware of the differences between the Cerrado and the Pantanal. The analysis and conclusions presented in the manuscript are specific to the Cerrado and based on a thorough understanding of its distinct characteristics and dynamics. We have changed the year that represents the critical year in terms of wildfires in Brazil: 2020 was replaced by 2007, since 2007 presents the second largest total burned area in the country between 2003-2024, according to INPE Queimadas database (https://terrabrasilis.dpi.inpe.br/queimadas/aq1km/). 2009 was maintained as an example of a year with low overall rate of burned area in Brazil: from INPE Queimadas database, 2009 was the second year with least total burned area in the time series (2003-2024).
Lines 366-367: reference? Lines 409-410: reference? Lines 412-414: reference? Lines 548-551: reference?	• Lines 366-367 (now lines 362-367): paragraph reformulated, and new references added. • Lines 409-410, 412-414 (now lines 419-425): paragraph edited, and references

	included. Now reads: “Fire behavior is limited by fuel characteristics and availability, and microclimate conditions. Fire behavior is often analyzed in terms of fire intensity (Gomes et al., 2020a; Silva et al., 2021), fire spread (Gomes et al., 2020a), heat released (Gomes et al., 2020a), fuel consumption (Andela et al., 2016), and fire return interval (Gomes et al., 2020b; Pereira Junior et al., 2014). For the Cerrado, this means that fire intensity follows a seasonal pattern, increasing in the dry months (Silva et al., 2021), and that it is also highly influenced by the vegetation type, increasing from forests to savannas and grasslands, where fine fuel consumption is higher (Gomes et al., 2020a). Silva et al. (2021) indicates higher values of fire intensity at the end of the dry season in the Cerrado,when fuel moisture is lower and fuel availability for burning is higher.” • Lines 548-551: Paragraph deleted.
Lines 382-383: these acronyms were already defined in the Introduction (e.g. line 47 for LDS).	LDS acronym removed from the parentheses. EDS appears for the first time in this sentence and, therefore, the acronym was not removed.
Lines 417-419: this is incorrect, as I mentioned in the previous round of revisions.	This paragraph was rewritten and now reads (lines 427-434): “Fire intensity can also be measured through the fire radiative power (FRP). FRP is the instantaneous amount of energy released by fire in the combustion process (Wooster, 2002). FRP often derives from MODIS data, and it relates to the intensity of fire and to the amount of biomass being consumed (Wooster, 2002). Although FRP has been used to provide estimates of fire

	intensity, Sperling et al. (2020) states that FRP from MODIS is underestimated for the Cerrado. Through FRP, Silva et al. (2021) estimates fire intensity in the Cerrado, with high values (FRP > 63.7 MW) found in the border with other biomes. Continuous observations of FRP can be integrated over time, resulting in the Fire Radiative Energy (FRE) (Van der Werf et al., 2017). FRE represents the total amount of energy released by fire during the combustion process, and it relates to the total amount of biomass consumed by fire, being directly related to fire emissions (Wooster, 2002)."
Figure 5: very confusing figure. It doesn't help in understanding how each of these parameters contribute to the end goal of estimating fire emissions. At best, this figure should be discussed in section 3.3.	This figure is essential for illustrating the key controls on fire emissions in the Cerrado and should remain in its current placement. The figure visually synthesizes how various factors—such as fuel availability, vegetation characteristics, and meteorology—interact to shape fire properties (burnt area and fire intensity) and ultimately determine emissions. Given that our review focuses on fire emissions, this conceptual framework provides necessary context by clarifying where emissions originate and what drives their variability.
Line 511: this is incorrect. Gomes et al. (2020a) does not use the BEFIRE model. And these are not estimations of carbon emissions from fires in Cerrado. These parameters only show that the amount of carbon released depends on land cover type. The study does not quantify emissions.	Gomes et al. (2020a) models fire-associated emissions, more specifically carbon emissions associated with fine fuel consumption, as stated in page 2 of their research "In this study, we compiled literature data from 65 prescribed fire experiments in the grasslands, savannas, and forests of the Brazilian Cerrado to determine (1) how aspects of fire behaviour (fire spread rate, fire intensity, and heat released) and fire-associated emissions (fine

	fuel consumption, combustion factor, and carbon emissions associated with fine fuel consumption) vary according to the vegetation type (grassland, savanna, and forest) and (2) the relative importance of vegetation and microclimatic factors in determining the fire behaviour and fire- associated emissions." They use the same methods and equations as the BEFIRE model (Gomes et al., 2020b) to estimate fire-associated emissions, as described in Gomes et al. (2020b) and in the Supplementary Materials (Table S2) of Gomes et al. (2020a). The paragraph in Line 511 was rewritten to provide a clearer explanation, and now reads (lines 546-554): "Gomes et al. (2020a) modelled carbon emissions associated with fine fuel consumption, finding 0.230 kg m^{-2} for grassland, 0.210 kg m^{-2} for savanna, and 0.053 kg m^{-2} for forests, and concluding that fine fuel load was the main predictor of the amount of carbon released through fire. When considering different scenarios (moderate, medium, and extreme) for fine fuel available for burning, wind speed, and vapor pressure deficit using the BEFIRE (Behavior and Effect of Fire) model, Gomes et al. (2020b) showed that carbon emissions from fine fuel consumption increased with the intensity of the scenario (0.19 kg m^{-2} for moderate, 0.23 kg m^{-2} for medium, and 0.26 kg m^{-2} for extreme). Because the model only considers fine fuel load, which is more abundant in grasslands due to the presence of grasses, carbon emissions decrease with the increase of woody biomass. These simulations confirm

	that fire-associated emissions depend on the vegetation type (Gomes et al., 2020a, 2020b).”
Line 570: "That makes sense" is not adequate scientific writing.	Sentence replaced by (lines 592-593): “This complexity emphasizes all factors that need to be considered beyond quantifying the amount of carbon emitted to the atmosphere.”
Line 583: "Despite the relevance of fire management to fire emission", reference?	We have included papers from 2023 and 2024, to provide an up-to-date systematic review. This sentence and paragraph was changed and now reads (lines 610-618): “ Despite the increasing recognition of fire’s importance to the Cerrado and the subsequent expansion of fire management operations, as well as the global relevance of fire management in reducing emissions (Moura et al., 2019), this review identified only one study that quantifies the reduction in fire carbon emissions achieved through fire management in the Cerrado. Franke et al. (2024) show an emission abatement of 26,677 $tCO_2e\ year^{-1}$ (2014 – 2019) in specific protected areas, and a reduction potential of more than 1,085 $tCO_2e\ year^{-1}$ (2014 – 2019) when the result is scaled-up to all protected areas in the Cerrado. The reduction in emissions from prescribed burning is due to lower fuel consumption and combustion factors of early dry season fires when compared to mid/late dry season fires (Franke et al., 2024). These values are considered conservative due to analyzing mainly fine fuels, and Franke et al. (2024) argue that estimations could be improved by using high-resolution data that would allow the identification of small-scala fires.”

Lines 610-611: it would be interesting to see how many papers actually evaluate emissions and their trends throughout the study period.	We have included in the Results section, 'Systematic literature review process' subsection, a paragraph showing the number of papers that evaluate fire emissions and their trends (lines 293-298): "Of the 43 papers that report fire emissions, 23 focus only on fire emissions, while 18 analyze fire emissions and fire dynamics parameters, 1 focuses on fire emissions and fire management, and 1 on the three topics. From the 23 papers exclusive to fire emissions, only 2 are restricted to the Cerrado, one focusing on net CO_2 (Gomes et al., 2024), and the other on fine particulate matter (Mataveli et al., 2019). The remaining papers include the Cerrado region but are not limited to it (9 provide a global analysis, 5 relate to the Tropical region, 4 to South America and 3 to Brazil). These numbers demonstrate the potential to expand the study of emissions from fire in the Cerrado."
Figure 6: this should be results, as it is characterizations of the papers found in the review process.	Figure 6, now Figure 5, was moved to the Results section, 'Systematic literature review process' subsection.
Line 653: remove the "Therefore".	'Therefore' deleted and sentence edited (now line 669).
Lines 658-659: again, how are fire dynamics a sink of CO2?	Paragraph replaced by (lines 670-677): "Examining fire carbon emissions reveals that local emissions reflect the global carbon budget. A key factor in carbon balance analysis is vegetation regrowth, since a significant portion of the CO_2 emitted by fire is sequestered during post-fire biomass recovery (Andreae, 2019; Van Der Werf et al., 2017; Gomes et al., 2024). This literature review identified only one study that quantifies the net CO_2 emissions from the

	Cerrado fires from 1985–2020 (Gomes et al., 2024). Vegetation regrowth removed 63.5% of the CO_2 emitted, indicating that fire in the Cerrado has been a source of carbon to the atmosphere in recent decades (Gomes et al., 2024). For a shorter time series (2015–2018), Oliveira et al. (2021) also found the Cerrado fires to be a net emitter of CO_2. Further research is needed to enhance the understanding of the long-term carbon balance of Cerrado fires. This literature review contributes by providing an overview of published studies on fire emissions in the region.”
Table 3: please clarify what is "Fire culture" and how it relates to burned area.	More details on “fire culture” are now provided on lines 680-685: “This indicates that estimating fire emissions requires a holistic approach. For example, including the perspectives of fire culture, ecology and policy within emissions is essential given the importance of fire to the biome. Fire culture refers to the interaction between humans and fire, encompassing the factors that drive societies to use it (see Pivello et al., 2021). The use of fire, shaped by cultural traditions and socioeconomic conditions, can influence the extent of burned areas and the resulting fire emissions. Traditional communities, for instance, may occasionally use fire on a small scale (Pivello et al., 2021).”
Lines 680-684: repetition. Same information in lines 498-504.	Lines 680-684 deleted.
Line 710: replace on-site with in-situ.	On-site replaced with in situ throughout the text.

Line 711: "incorporating non-carbon aspects of fire in fire emissions", please clarify.	The non-carbon aspects of fire are those cited in the end of that same sentence “such as the ecological, social and cultural aspects”. To improve the understanding, we have rephrased the sentence, which now reads (lines 733-737): “Examples of how these can be achieved are by valuing prescribed burning emissions and including these in fire modeling, representing fire management in land surface models, using in situ observations to assess models’ utility and as input data to modeling, and incorporating the ecological, social and cultural aspects of fire in fire emission estimates. These could address uncertainty and improve models' accuracy, thus providing better accounting of fire emissions in the Cerrado and worldwide.”